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ENGINEERING SERVICES REPORT

PROPOSED STRATEGIC HOUSING DEVELOPMENT,
BLACKGLEN ROAD, SANDYFORD,DUBLIN 18

Zolbury Limited

Project No. Z040

19th July 2022

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DOCUMENT CONTROL & HISTORY

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ENGINEERING SERVICES REPORT

TABLE OF CONTENTS PAGE

APPENDICES

1 INTRODUCTION

1.1 Appointment

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by *Zolbury Ltd.* to carry out the design of the Civil Engineering services (surface water, wastewater drainage, watermain and site-specific flood risk assessment) associated with the Strategic Housing Development for 360 no. residential units, associated resident amenity facilities and a childcare facility at Blackglen road, Sandyford.

1.2 Administrative Jurisdiction

The proposed development is located in the jurisdiction of Dun Laoghaire Rathdown County Council (DLRCC), and therefore the engineering services design was carried out with reference to the following:

- Dun Laoghaire Rathdown County Council Development Plan (2012 – 2028);
- Greater Dublin Strategic Drainage Study (GDSDS);
- The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government and the Office of Public Works).

1.3 Site Location

The subject site is located at lands at Blackglen Road in Sandyford, Co. Dublin as shown in *Figure 1.1 – Site Location*. The proposed development site is immediately bound by:

- Residential properties to the east & west,
- Blackglen Road to the north,
- Woodside Road to the south.
- Diswellstown Road, to the east;

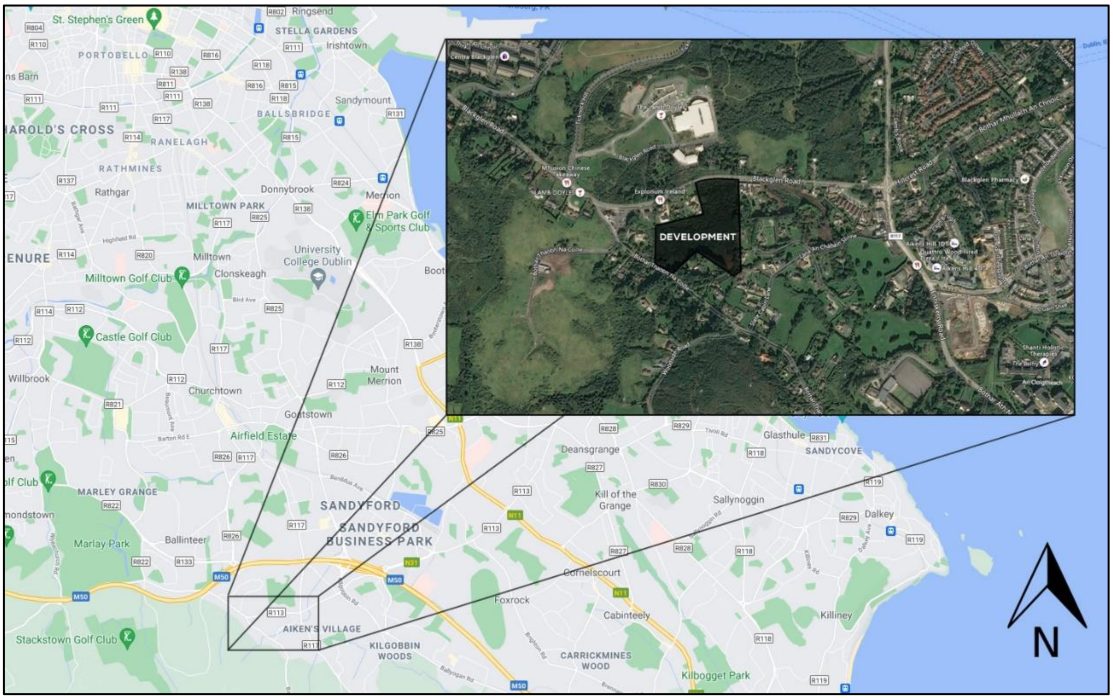


Figure 1.1 - Site Location

1.4 Existing Site Overview

The overall development site area is **c. 3.7 -hectares.** The site is currently greenfield in nature. The Site is generally graded towards north of the site with the highest point of the site being located at the south-west boundary and is approximately +160.12m AOD with lowest the point being located at the north-east boundary of the site and is approximately +138.72m AOD. This gives a typical gradient of approximately 8.2% across the site.

1.5 Proposed Development Context

We, Zolbury Limited intend to apply to An Bord Pleanála for planning permission for a Strategic Housing Development on a site of c. 3.7 ha at Blackglen Road and Woodside Road, Sandyford, Dublin 18. The development shall consist of a new residential scheme comprising 360 no. residential units, associated resident amenity facilities and a childcare facility in the form of 9 no. new apartment buildings (A1 – C3) as follows:

- Block A1 (4 storeys) comprising 18 no. apartments (3 no. 1 bed units and 15 no. 2 bed units); a crèche facility of approx. 401 sq. m with associated outdoor play space of approx. 20 sq. m; and resident amenity facilities of approx. 30 sq. m.
- Block A2 (3-4 storeys) comprising 24 no. apartments (2 no. 1 bed units and 22 no. 2 bed units) and resident amenity facilities of approx. 390m2.
- Blocks B1 and B2 (2-6 storeys) comprising 69 no. apartments (30 no. 1 bed units, 34 no. 2 bed units, 5 no. 3 bed units).
- Blocks B3 and B4 (2-6 storeys) comprising 62 no. apartments (30 no. 1 bed units, 27 no. 2 bed units and 5 no. 3 bed units).
- Blocks C1, C2 and C3 (3-6 storeys) comprising 187 no. apartments (58 no. 1 bed units, 126 no. 2 bed units and 3 n0. 3 bed units); and resident amenity facilities of approx. 187.5 sq. m.

Each residential unit is afforded with associated private open space in the form of a terrace / balcony.

Total Open space (approx. 22,033 sq. m) is proposed in the form of public open space (approx. 17,025 sq. m), and residential communal open space (approx.5,008 sq. m).

Podium level / basement level areas are proposed adjacent to / below Blocks A2, B1, B2, B3, B4, C1, C2 and C3 (approx. 12,733 sq. m GFA). A total of 419 no. car parking spaces (319 no. at podium/basement level and 100 no. at surface level); to include 80 no. electric power points and 26 no. accessible parking spaces); and 970 no. bicycle spaces (740 no. long term and 230 no. short term), and 19 no. Motorcycle spaces are proposed. 10 no. car spaces for creche use are proposed at surface level.

Vehicular/pedestrian and cyclist access to the development will be provided via Blackglen Road to tie in with the Blackglen Road Improvement Scheme. A second access is also proposed via Woodside Road for emergency vehicles, pedestrian and cyclist access only.

The proposal also provides for Bin Storage areas and 4 No. ESBN substations to supply the development. 3 no. sub-stations shall be integrated within the building structures of Blocks B and Blocks C. In addition, one Sub-station shall be classed as a unit sub-station mounted externally on a dedicated plinth.

The associated site and infrastructural works include provision for water services; foul and surface water drainage and connections; attenuation proposals; permeable paving; all landscaping works; green roofs; boundary treatment; internal roads and footpaths; electrical services; and all associated site development works.

Figure 1.2 – Proposed site layout

1.6 Development access

The development will be accessed via Blackglen Road. One main access to the development will be provided, with a second access just east of this as noted on Figure 1.2. The second access will be minor and will provide access to a portion of car parking only, for the site.

The reason why this second access is required is due to the topography of the site. Drawing a line through the site from north to south, on the eastern side yields the following topography:

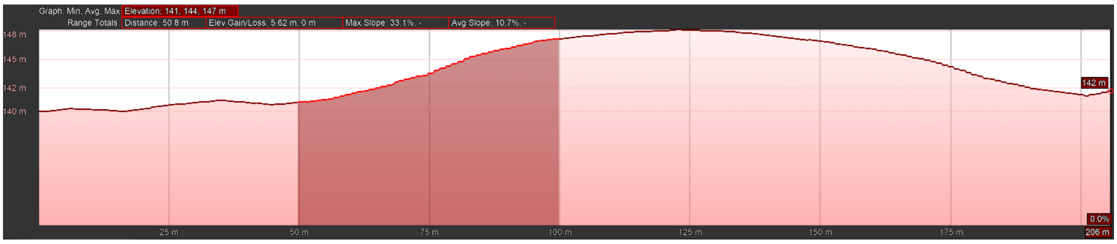


Figure 16: Topography of Site from North to South

From this topography, it is evident that there is a gradual slope (avg 4.0%) from Blackglen Road (left side) for approximately 50m, after which the slop increases significantly. From 50m to 100m the slope increases to an average of 10.7%.

Should this area be accessed from the site, the resultant ramp which would be required to get down from the top to the bottom would render this portion of the site unusable, as most of the space would be required for the access ramp. This means that parking spaces would need to be further reduced. Access via Blackglen Road will result in a much more gradual slope, which means the majority of the space in question can be utilised for car parking, rather than access.

2 SCOPE OF SERVICES REPORT

This Engineering Services Report was prepared by reviewing the available data from the Local Authority sources and national bodies *i.e.* Dun Laoghaire Rathdown County Council, Irish Water, The OPW, and the wider Design Team.

The following services are addressed within this report, with respect to the proposed development:

- Surface Water Drainage;
- Wastewater Drainage;
- Potable Water Supply;
- Flood Risk Assessment;

The proposed design, for the aforementioned services, have been carried out in accordance with the following technical guidelines and information:

- Dun Laoghaire Rathdown County Council Development Plan (2022 – 2028);
- Greater Dublin Strategic Drainage Study (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works (GDRCOP);
- Irish Water Code of Practice for Wastewater, IW-CDS-5030-03 (Revision 2);
- Irish Water Code of Practice for Water Supply, IW-CDS-5020-03 (Revision 2);
- The Building Regulations – Technical Guidance Document Part H;
- BE EN 752 – Drainage Outside Buildings;
- BS 7533-13 – Guide for Design of Permeable Pavements;
- The Office of Public Works, the Planning System and Flood Risk Management;
- OPW website www.floodinfo.ie & www.floodmaps.ie;
- DECLG website www.myplan.ie;
- EPA website http://gis.epa.ie/EPAMaps;
- Geological Survey of Ireland Maps;
- Architectural drawings;
- Topographical survey of the proposed site;

Members of the wider design team cover all other elements of the application pertaining to traffic, sustainability, landscaping, planning, ecological, and architectural detail.

This report should be read in conjunction with the set of OCSC Civil Engineering design drawings that accompany this submission.

3 SURFACE WATER DRAINAGE

3.1 Design Guidelines Overview

Any planning permission sought on the subject lands are required to adhere to the Local Authority requirements *i.e.* the Dun Laoghaire Rathdown County Council Development Plan (2022 – 2028);, and as such, the Greater Dublin Strategic Drainage Study (Dublin City Council, 2005).

New development must ensure that a comprehensive Sustainable Drainage System (SuDS), is incorporated into the development. SuDS requires that post development run-off rates be maintained at equivalent, or lower, levels than pre-development levels. Thus, the development must be able to retain, within its boundaries, surface water volumes from extreme rainfall events up to a 1 in 100-year rainfall event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability), *while also allowing for an additional climate change factor of **20%** increase in rainfall intensity* in accordance with the Dun Laoghaire Rathdown County Council Development (2022 - 2028).

Any new development must also have the physical capacity to retain surface water volumes as directed under the Greater Dublin Strategic Drainage Strategy (GDSDS) and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate, not greater than the greenfield runoff equivalent.

A further component of the SuDS protocol is to increase the overall water quality of surface water runoff before it enters a natural watercourse or a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of surface water quality.

SuDS are designed in accordance with best practice and the CIRIA C753 (The SuDS Manual) guidance material.

3.2 Surface Water Design Strategy Overview

The proposed development is to be served by a gravity surface water network comprising a single catchment as a result of the natural topography, with attenuated surface water runoff generated within the new development site boundary to be discharged to the new surface water sewer on Blackglen Rd. , which bounds the site to the north of the site.

Sustainable Drainage Systems are to be provided, wherever practicable, and these are discussed in more detail in *Section 3.5*, with discharge rates from site being restricted to the greenfield equivalent runoff rate, for design rainfall events up to, and including, the 1% AEP, in accordance with the Dun Laoghaire Rathdown County Council Development Plan and the GDSDS.

The proposed surface water drainage strategy and detailed design has been subject to a SuDS Audit, carried out by JBA Consulting. A copy of the SuDS Audit is provided in **Appendix F**.

3.3 Existing Site Drainage

3.3.1 Existing Site Catchment Area

As detailed in *Section 1.4*, the existing c.3.7-hectare site is greenfield in nature and is graded from south-west towards north-east. The site in its current condition drains naturally as there is no surface water infrastructure within the site.

3.3.2 Existing Surface Water Drainage Infrastructure

Existing services records indicate that no surface water sewer is present in the vicinity of the proposed development. A new surface water sewer is proposed as part of the upgrades works on Blackglen Rd.

Refer to *Figure 3.1* for an excerpt from the public drainage records, which are also provided in **Appendix A**, for indicative locations of existing infrastructure.

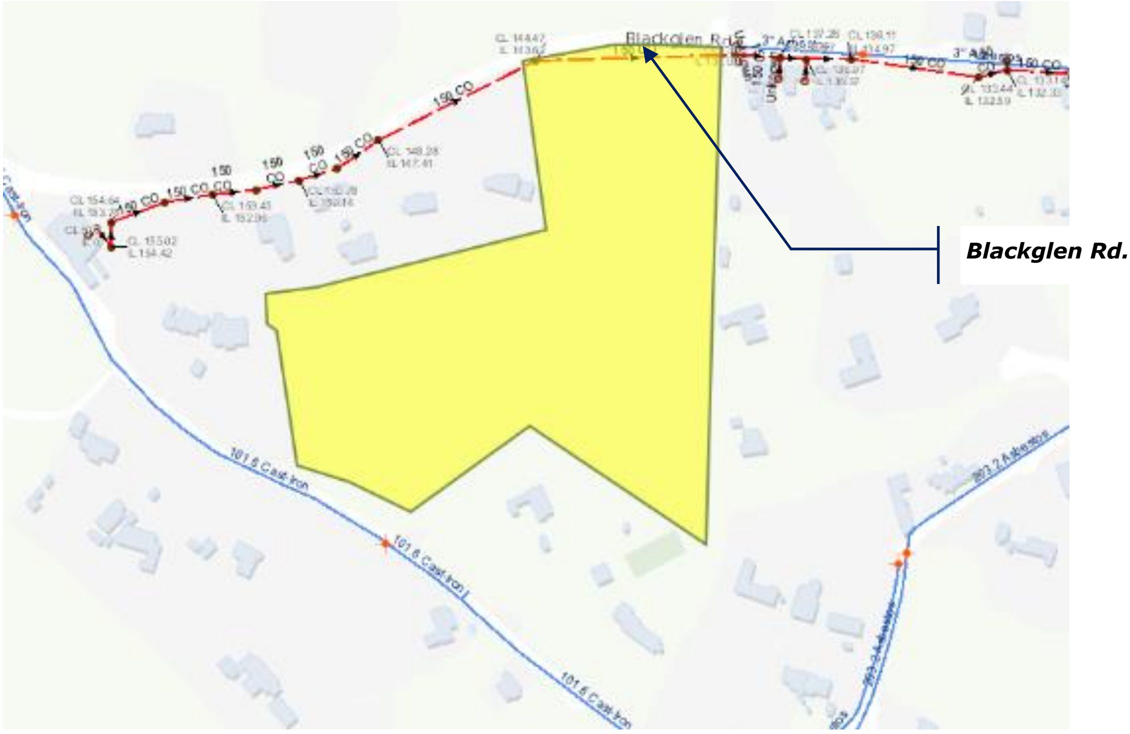


Figure 3.1 – Existing Drainage Infrastructure Records

3.3.3 Existing Site Rainfall Runoff

Runoff from the site is allowed to infiltrate naturally.

The soil value can be calculated from *Figure 1.4.18 (institute of Hydrology, 1978)* which shows the various soil types. The soil classifications are also available from the *Wallingford Procedure, Volume 3, Maps, "Winter rain acceptance potential"*. The equation was first published in FSSR 16, 1985. Refer to *Figure 3.2* for the "Soil" value in MicroDrainage that consider the SPR value and it can be obtained at *Greater Dublin Strategic Drainage Study – Regional Drainage Policies Volume 2 – New Development at section 6.7.2*.

SOIL	SPR value (% runoff)
1	0.1
2	0.3
3	0.37
4	0.47
5	0.53

Figure 3.2 – SPR Values for Soil (Excerpt from GDSDS: Table 6.7)

From the aforementioned mapping and Ground investigation report (refer to **Appendix I**), a **Soil Type 3** was used in design calculations along with the local Standard Annual Average Rainfall (SAAR) equivalent of **986mm**, as received from Met Éireann, was used to determine the rainfall runoff rate. Refer to the **Appendix B** for the Return Period Rainfall Depths for Sliding Durations from Met Éireann.

Results from three soakaway tests indicated infiltration at all three of the test locations varying from 1.599E-05 m/s to 4.151E-06 m/s across the site. Refer to **Appendix I** for the locations of the soakaways)

Using the ICPSuDS Input, {Flood Studies Report (FSR)} Method, the rainfall runoff discharging from the total brownfield site area that is to be developed (i.e. 3.7 ha), in its existing condition, has been estimated at **$QBAR_{RURAL}$ = 4.3 l/s/ha**. Refer to *Figure 3.3* for an excerpt of the results from the MicroDrainage Runoff Calculator, which also provides the calculated QBAR runoff rate along with the discharge rate for varying Annual Recurrence Intervals (ARI). Refer to the **Appendix C** for the QBAR runoff calculations.

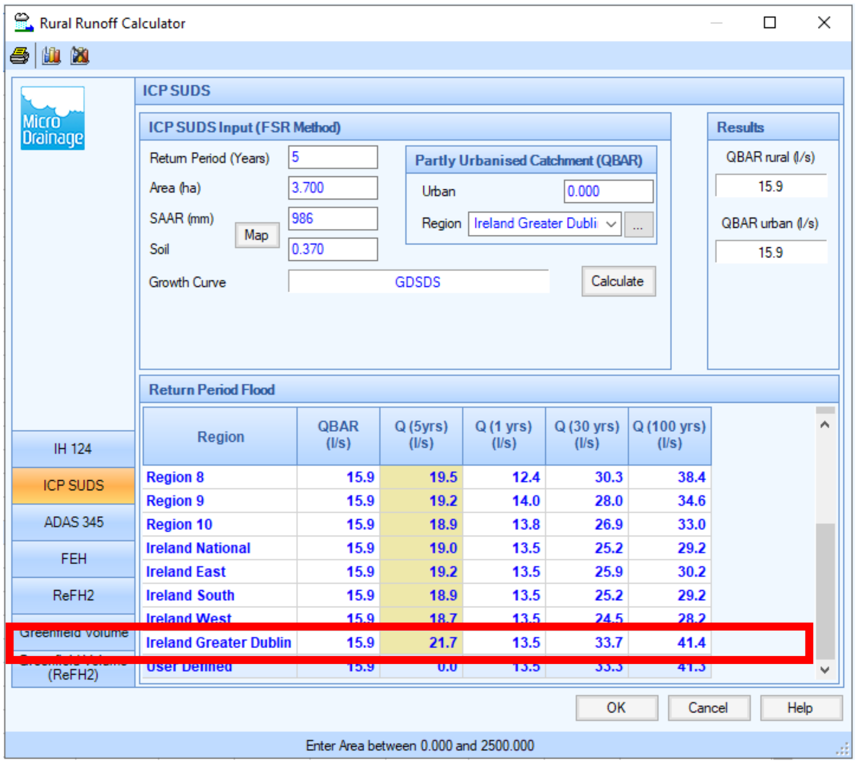


Figure 3.3 - Existing Site Runoff Calculator Results (MicroDrainage Excerpt)

3.4 Proposed Surface Water Drainage Design Strategy

3.4.1 Proposed Surface Water Strategy

It is proposed to separate the surface water and wastewater drainage networks, which will serve the proposed development, and provide independent connections to the surface water sewer and local wastewater sewer networks, respectively.

Refer to *Section 4* for details of the proposed wastewater drainage design.

Refer to detailed drawing **B986-OCSC-XX-XX-DR-C-0500 & 0501** for the proposed drainage network layout, which is to serve the proposed development.

3.4.2 Proposed Surface Water Network Strategy

The proposed surface water network is to be split into two main surface water drainage catchments, replicating the natural site catchments i.e.:

1. Main Development catchment (**Catchment 1**) discharging controlled and restricted flow rates of the treated rainfall runoff to the new stormwater sewer that is to be provided as part of upgrade work on Blackglen Rd. This is split into six sub-catchments, **catchments 1A, 1B, 1C, 1D, 1E and 1F**;
2. Access road to blocks B3 and B4 (**Catchment 2**) draining to the proposed infiltration soakaway.

Due to its size and layout, Catchment 1 will be divided into a number of sub-catchments, in order to best integrate Sustainable Drainage Systems. Each sub-catchment area will look to provide interception and treatment to the rainfall runoff, either at source or through site design. Refer to Section 3.5.3 and Figure 3.1 for overview of proposed catchment areas.

Infiltration systems will be provided in off podium areas where applicable as the soakaway testing carried out on site resulted in good infiltration rates across the site.

The proposed surface water networks are to typically comprise a gravity pipe network, with significant Sustainable Drainage Systems e.g., bioretention areas, infiltration trench, green roofs, podium drainage, pervious paving, filter drains, trapped road gullies, flow control devices, attenuation storages implemented and integrated, wherever practicable.

Interim attenuation benefits are to be provided at roof level, through the provision of green roofs (>60% total roof area), and throughout the external drainage network: within the landscape features, the podium build-up and pervious paving base course. However, in order to reduce development flow rates to the Greenfield Equivalent Runoff Rate (QBAR), further attenuation is to be provided; before discharging from the site and for sub-catchment 1D.

The typical traditional and Sustainable Drainage Systems (SuDS) to be provided, all of which will be designed in accordance with CIRIA C753, the SuDS Manual, and the design guidance material listed in Section 2 of this report, are listed and detailed in order of general sequence within the drainage network, as follows:

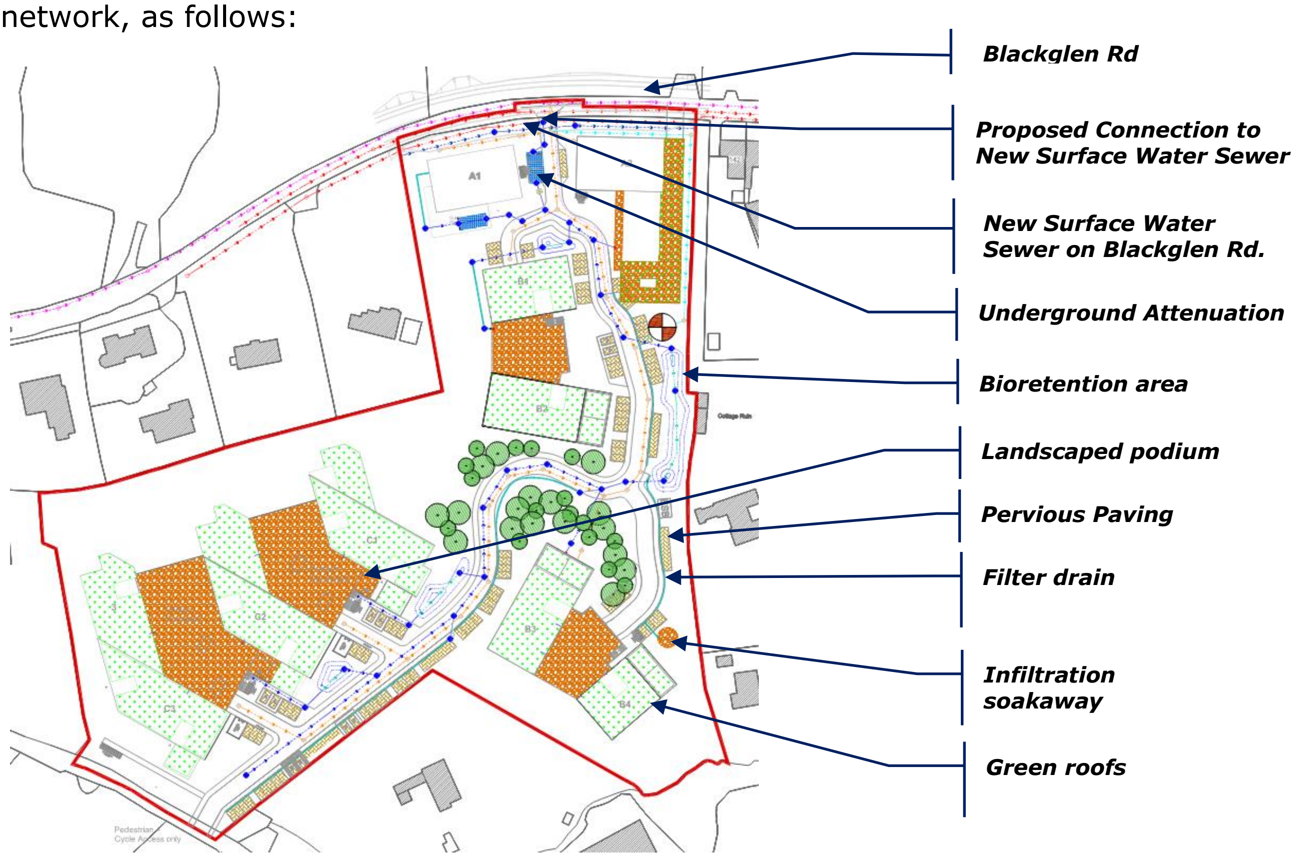


Figure 3.4 - Proposed Surface Water Drainage Strategy

3.4.2.1 Pervious Paving

Pervious pavements provide a pavement finish suitable for both pedestrian and vehicular traffic, while also allowing rainwater to infiltrate the surface layer and into the underlying pervious structural layers. Here, the rainwater is temporarily stored beneath the overlying finished surface before either infiltration to the ground or / and discharge to the main surface water drainage network.

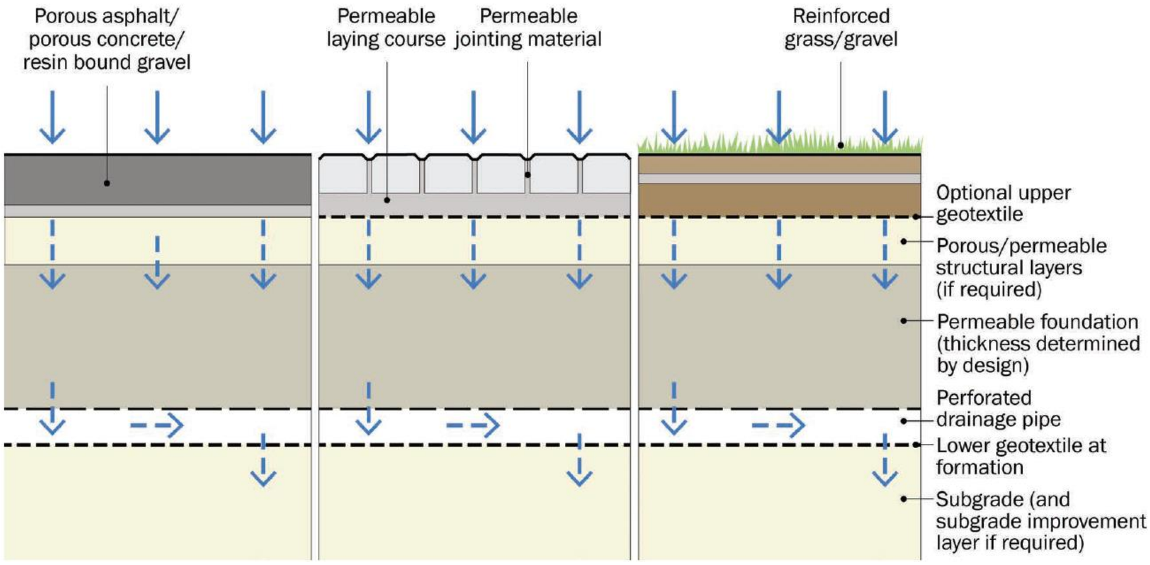


Figure 3.5 - Detail of Type B Pervious Paving (CIRIA C753)

Pervious paving systems are an efficient means of treating the rainwater at source by providing initial interception of the rainwater, reducing the volume and frequency of the runoff and improving the surface water quality by providing at source treatment of the rainfall runoff leaving the site. This is achieved by helping remove and retain pollutants prior to discharge to the drainage system and / or groundwater system.

A **Type B** pervious paving, with a 300mm (typical) depth of open graded crushed rock as base course, is to be provided in all car parking spaces, within the proposed development. An overflow pipe, from the base-course, will be provided to the drainage network, which will allow for interception of initial rainfall, groundwater discharge, with an attenuated outflow to the main network in extreme rainfall events.

3.4.2.2 Bioretention Areas

Bioretention area is to act as the development's primary attenuation, providing 162m^3 temporally storage inside the filter medium as well as to provide treatment and interception through the use of engineering soils in the filter medium. Runoff collected by the system ponds temporarily on the surface and then filters trough the vegetation and underlying soils. The filtered runoff is then collected using underdrain pipes and partially infiltrated into the surrounding soil.

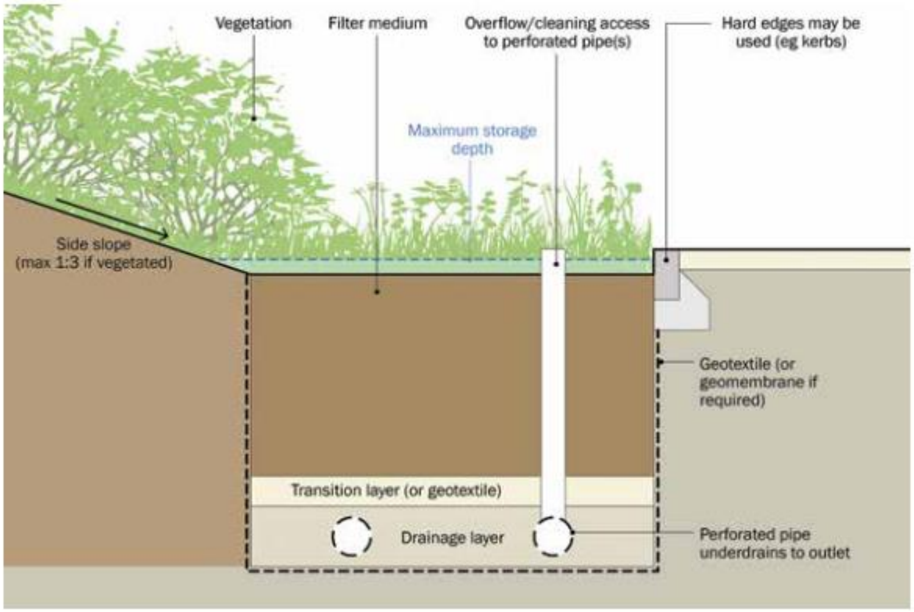


Figure 3.5 - Detail of Bioretention area (CIRIA C753)

Following consultation with Irish Water, refer to Section 4.3, it was requested to provide a temporary wastewater pumping station on site to limit the foul water discharge rate to 5l/s. The pumping station is to be decommissioned once upgrade works to the public sewer on Blackglen Road are completed. The pumping station is proposed north of the main bioretention area and once decommissioned the bioretention will be extended and thus provide additional treatment and storage capacity.

3.4.2.3 Green Roofs

It is proposed to provide green roofs on the buildings within the development. This increases the time of entry for rain water falling on the roof area of the development while providing at source treatment prior to entering the surface water network. The overall area of green roof has been maximised but with consideration to the extensive PV panels also proposed at roof level as a sustainability measure but which are generally considered to be incompatible with green roofs. Green roofs are to be provided across the development with greater than 60% coverage, as required by DLR's planning policy.

3.4.2.4 Trapped Road Gullies

All road gullies serving the proposed development are to be trapped, to help prevent sediment and gross pollutants from entering the surface water network, and thus improving the water quality discharging from site.

The grated covers are to have a minimum load classification of D400, for frequent vehicular traffic.

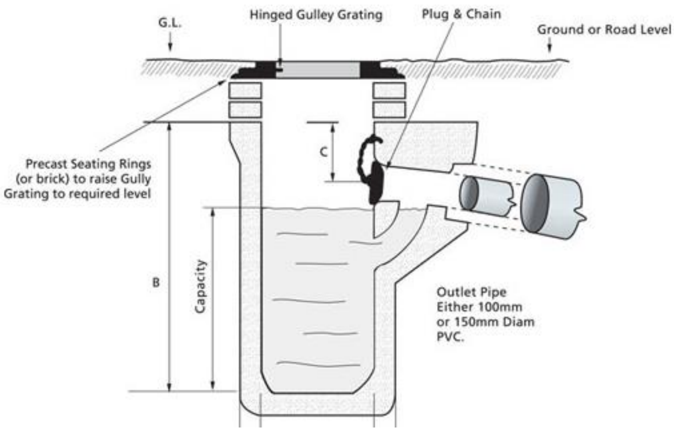


Figure 3.6 - Trapped Road Gully (Typical Detail)

3.4.2.5 Underground Pipe Network

A traditional gravity pipe and manhole network will be provided, to convey the collected rainfall runoff as far as the development's outfall. Manholes, compliant with the GDSDS and GDRCOP, are provided for maintenance access at branched connections, change in pipe size and gradient, and at intervals no greater than 90m distance.

3.4.2.6 Silt Traps

A manhole upstream of attenuation system is to contain a 600mm sump, below invert level of outlet pipe, in order to trap sediment and other gross pollutants, and prevent from entering the downstream watercourse; thus improving the water quality discharging from site.

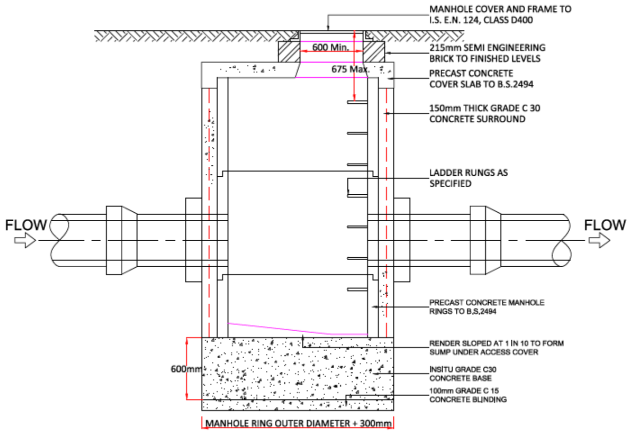


Figure 3.7 - Typical Detail of Silt Trap Manhole

3.4.2.7 Geocellular Storage Systems

Unlined proprietary geocellular storage units are to be provided for the attenuation of rainfall runoff for the catchment area.

These systems are to provide sufficient temporary storage volume for rainfall events up to, and including, the design 1% AEP rainfall event (including climate change). Typical geocellular storage systems comprise plastic cellular units of high porosity (typically >95%), structurally arranged in rows and layers, with a perforated distribution pipe through the centre.

These systems also allow for interception of initial rainfall to be provided at the base of the system, by elevating the outlet relative to the systems base.

Access chambers for inspection and maintenance are also to be provided.

Refer to **Appendix H** for the copy of the Cellular Attenuation System details.

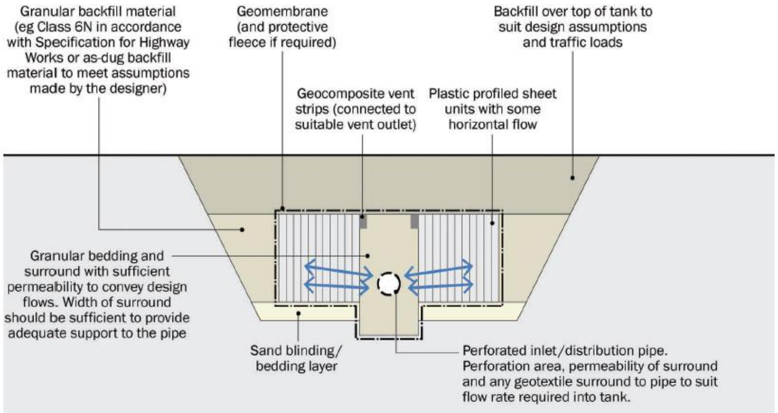


Figure 3.8 - Typical Section of Geocellular System (CIRIA C753)

3.4.2.8 Interception Storage

Interception storage is to be provided below the development's primary attenuation. This will temporarily store and treat the first 5mm rainfall on the development. The interception storage is to be allowed to drain naturally, which will reduce the volume of discharging to the existing network while increasing the quality of the water infiltrating to the ground.

The interception storage volume was calculated based on the hardstanding area on each individual sub-catchment area.

Catchment 1:

Sub-Catchment 1A

Total area = 4038m^2

Interception required = 20.19m^3

Total interception provided = 22.42 m^3

System	Area (m^2)	Interception provided (m^3)
Green roof	1680	8.4
Podium area (base course -300mm depth x 30% porosity)	1402	14.02

Sub-Catchment 1B

Total area = 2928m^2

Interception required = 14.64m^3

Total interception provided = 17.69 m^3

System	Area (m^2)	Interception provided (m^3)
Green roof	1260	6.3
Podium area (base course -300mm depth x 30% porosity)	1139.33	11.39

Sub-Catchment 1C

Total area = 2023m^2

Interception required = 10.11m^3

Total interception provided = 13.54 m^3

System	Area (m^2)	Interception provided (m^3)
Green roof	1260	6.3
Filter drain (150mm depth x 1m width x 30% porosity)	18.55	1.67
Podium area (base course -300mm depth x 30% porosity)	557	5.57

Sub-Catchment 1D

Total area = 858m^2

Interception required = 4.29m^3

Total interception provided = 4.38m^3

System	Area (m^2)	Interception provided (m^3)
Filter drain (150mm depth x 1m width x 30% porosity)	24.7	2.22
Base of underground attenuation (150mm depth x 30% porosity)	48	2.16

Sub-Catchment 1E

Total area = 2257m^2

Interception required = 11.28m^3

Total interception provided = 12.12 m^3

System	Area (m^2)	Interception provided (m^3)
Green roof	1260	6.3
Podium area (base course -300mm depth x 30% porosity)	582	5.82

Sub-Catchment 1F

Total area = 1688m^2

Interception required = 8.44m^3

Total interception provided = 10.425 m^3

System	Area (m^2)	Interception provided (m^3)
Green roof	643	3.215
Podium area (base course -300mm depth x 30% porosity)	721	7.21

Catchment 1 (Road) – to be intercepted by filter drains and pervious pavement along the road and additional interception provided at primary attenuations.

Total area = 4077.81m^2

Interception required = 20.39m^3

Total interception provided = 30.45 m^3

System	Area (m^2)	Interception provided (m^3)
Filter drain (150mm depth x 1m width x 30% porosity)	253.96	11.43
Base of underground attenuation (150mm depth x 30% porosity	90	4.05

Bioretention area	529	5.29
Pervious pavement (300mm depth with 30% porosity)	968	9.68

Catchment 2 (Access road to block B3 and B4) - to be intercepted by filter drains and pervious pavement along the road

Total area = 761m^2

Interception required = 3.81m^3

Total interception provided = 4.4 m^3

System	Area (m^2)	Interception provided (m^3)
Filter drain (150mm depth x 1m width x 30% porosity)	59.8	2.7
Pervious pavement (300mm depth with 30% porosity)	170.05	1.7

3.4.2.9 Filter Drains

Filter drains (perforated pipe with cl505 surround) to be provided along roads where possible to intercept and treat polluted water.

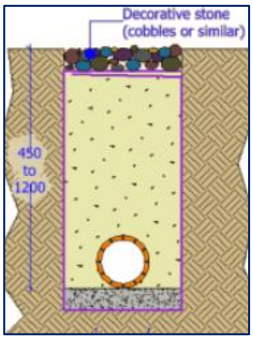


Figure 3.1 - Filter Drain under pavement (left)

Filter drains allow for interception of rainfall, while also acting as storage and conveying the excess rainfall runoff to the network outfall. Further benefits allow for filtration of surface water and infiltration to groundwater.

3.4.2.10 Flow Control Device

Flow Control device is to be provided immediately downstream of attenuation system, in order to restrict the surface water discharge from site to a flow rate equivalent, or below, the natural greenfield runoff rate.

The flow rate for the proposed development would be no greater than **15.9 l/s**, which is the greenfield runoff equivalent, as described in *Section 3.3.3*.

It is proposed to provide the Hydro-brake optimum vortex flow control unit (or similar approved by DLRCC) at the strategic locations, downstream of the attenuation systems.

Further, it is noted that the required aperture of the proposed Hydro-Brake outlet has been designed to be **greater than 50mm diameter**, to mitigate the risk of blockage. Any outlets lesser then 50mm to have a protective orifice plate.

The flow control chamber is to be fitted with a penstock valve at the inlet and a bypass lever at the outlet (if required), to allow for easy access and maintenance.

Figure 3.9 - Vortex Hydro-Brake Flow Control Unit (Hydro International)

3.4.2.11 Oil Separator

Oil separators are designed to separate gross amounts of oil and large (>250μm) suspended solids from the surface water, mainly through sedimentation process.

A Class 1 bypass fuel separator is to be provided immediately downstream of the last attenuation system, as an additional and final mitigation measure, prior to surface water discharge from each unit sub-catchment to the surface water network.

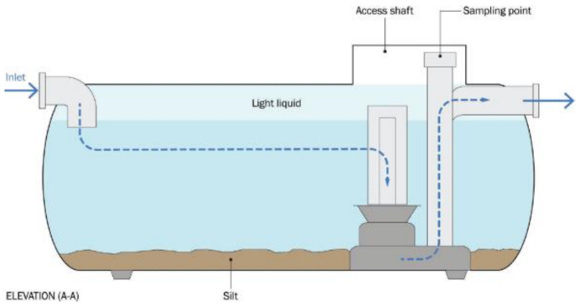


Figure 3.10 - Typical Section Detail of Fuel Separator (CIRIA C753)

3.5 Proposed Surface Water Network Detailed Design

3.5.1 Software Design Criteria

The proposed surface water network has been designed in accordance with the regulations and guidelines outlined in *Section 2*, using MicroDrainage Network Design package, by Innovyze Inc., which simulates the performance of the integrated drainage network for varying rainfall return periods and storm durations.

The MicroDrainage Network Design software applies the Flood Studies Report (FSR) methodology for analysis of the rainfall profiles. However, the input design parameters that were used, as part of this design, were based on the available Flood Studies Update (FSU) data, *i.e.* the return period rainfall depths for sliding durations, which determine the $\mathbf{M_{5\text{-}60}}$ and **R** values, and the standard annual average rainfall (SAAR); as sourced from Met Éireann.

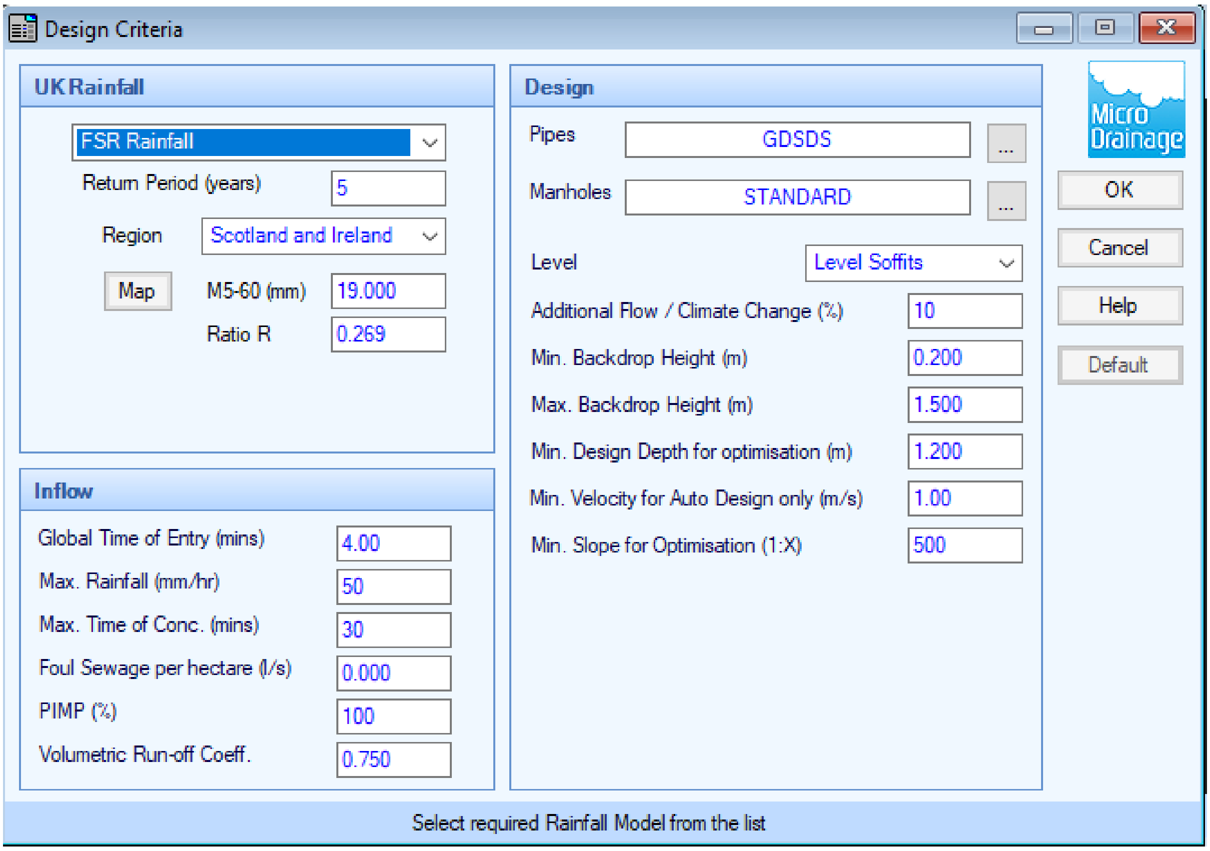


Figure 3.11 - Surface Water Network Design Criteria (MicroDrainage Excerpt)

3.5.2 Climate Change Allowance

As indicated in **Section 3.2**, the proposed network is to be designed to allow for an additional 20% increase in rainfall intensity, to allow for Climate Change projections, in accordance with the Dún Laoghaire Rathdown County Council Development Plan and the GDSDS.

All discussion within this report, with regards to surface water network design calculation and results, include for the allowance of an increase of <u>20%</u> in rainfall intensity, as required.

3.5.3 Proposed Surface Water Catchment Area

Due to the topography of the site and the proposed layout, the proposed surface water network is to be split into 2nr. main catchment areas, with catchment 1 divided into a number of sub-catchments; in order to best integrate Sustainable Drainage Systems. These catchments are best summarised as follows, with reference to **Figure 3.12:**

Catchment 1 – road and sub-catchments

Sub-Catchment 1A – Blocks C3 and C2 podium and roof catchment;

Sub-Catchment 1B – Blocks C1 and C2 Podium and roof catchment;

Sub-Catchment 1C – Blocks B1 and B2 Podium and roof catchment;

Sub-Catchment 1D – Block A1 and surround catchment ;

Sub-Catchment 1E – Blocks B3 and B4 Podium and roof catchment;

Sub-Catchment 1F – Block A2 Podium and roof catchment

Catchment 2 – Access road to blocks B3 and B4

Attenuated runoff from Catchment 1 is to be discharge to the new stormwater sewer that is to be provided as part of upgrade work on Blackglen Rd. Catchment 2 is to discharge to a infiltration soakaway.

Each sub-catchment area will look to provide interception and treatment of the rainfall runoff, either at source or through site.

Figure 3.12 - Surface Water Catchment areas

Refer to catchment drawing **Z040-OCSC-XX-XX-DR-C-0505** for information.

3.5.4 Proposed Development Rainfall Runoff

It is proposed to reduce and restrict the rainfall runoff, discharging from the proposed development to the greenfield equivalent, $QBAR_{RURAL}$, runoff rate, as per the FSR ICP SuDS method, which is based on the IH124 method for catchments smaller than 25km^2 in area.

This is to be achieved with the provision of a flow restrictor (Hydro-Brake Optimum by Hydro-International, or similar approved) prior to discharging to the existing surface water network to the north of the site, with the appropriate measures of attenuation provided. Sub-catchment flow-control devices and associated attenuation are also to be strategically provided, in order to maximise SuDS benefits and avail of the open space for preliminary attenuation.

Refer to *Figure 3.3*, in *Section 3.3.3*, for an excerpt from the results MicroDrainage Runoff Calculator for the development catchment area (c.3.7-hectares), which indicates the greenfield equivalent, $QBAR_{RURAL}$, value of **4.3 l/s/ha** along with the calculated runoff for varying Average Recurrence Intervals (ARI). Catchment 1 has a NET area of 1.81ha which equals to a runoff rate of **7.8 l/s**. Runoff from Catchment 2 will be completely infiltrated into the ground.

For the purpose of the surface water network design simulation, we have considered all external (roads, pavement, and roofs) areas as being 100% impermeable and taken a <u>*winter*</u> global runoff coefficient, C_v, of 1.00. The proposed car parking areas comprise pervious paving above a drainage layer base course.

3.5.5 Proposed Surface Water Pipe Network Design

The overall surface water drainage system, serving the proposed development, is to consist of a gravity sewer network that will convey runoff from the roofs and paved areas to the outfall manhole. The new gravity networks will discharge a controlled attenuated flow rate to the existing public network to the new surface water sewer to the north of the site, as outlined in *Section 3.3.2*.

The proposed piped-network has been designed in accordance with BS EN 752 and all new infrastructure is to be compliant with the requirements of the GDSDS and the GDRCOP for Drainage Works, with minimum full bore velocities of 1.0 m/s achieved throughout.

All main surface water carrier pipes have been sized to ensure no surcharging of the proposed drainage network for rainfall events up to, and including, the 1 in 5-year ARI event.

Refer to drawing **Z040-OCSC-XX-XX-DR-C-0500** for the proposed drainage infrastructure layout.

3.6 Proposed Surface Water Attenuation Storage

Attenuation systems are to be provided at strategic locations within the development in order to temporarily store excessive rainfall runoff, during significant rainfall events, due to the restricted discharge rates (to less than greenfield equivalent runoff rates) from the development outfalls.

This will be provided initially through integration with the landscape proposals around the development, with further provision of pervious paving for car parking areas.

The development is to combine a number of sustainable drainage features along with elements of a traditional drainage system. The developments main attenuation will be provided on podium level within 300mm layer of open graded crushed rock (for sub-catchments 1A, 1B, 1C, 1E), bellow the bioretention area inside 1000mm deep filter medium and underground attenuation in the form of a proprietary, modular system (such as the geocellular Y-ESS Pluval Cube, or similar approved).

Pervious paving to be provided within all car parking spaces within the development. This will provide at source treatment of runoff from the roads while also providing interim storage within the base course. A minimum of 300mm stone with a minimum porosity of 30% is to be provided below the pervious paving. Runoff temporarily stored within the base course will be allowed to infiltrate naturally to ground water, an overflow from this is to be provided for events where infiltration is not achieved.

3.7 Surface Water Outfall Location

The surface water drainage is to discharge attenuated flows to the public surface water network, which is to be provided as part of upgrade works on Blackglen Rd.

The discharge rate at the outfall location is to be restricted to a maximum flow rate of **4.30 l/s/ha** (7.8 l/s), which is less than the current greenfield equivalent runoff rate, as discussed in *Section 3.3.3*.

The above is to ensure that there is no increase in flow rates and volumes, from the development site, being discharged to the receiving infrastructure; thus, causing no adverse impact on adjoining and other downstream properties.

3.8 Water Quality

The quality of the surface water discharging from site is to be improved through the following provisions, each of which is discussed in greater detail in *Section 3.4.3*:

- Pervious Paving in all car parking areas;
- Green roofs;
- Intensive landscaping, where practical;
- Interception storage;
- Trapped road gullies on the road carriageway, to trap silt and gross pollutants;
- Silt trap to be provided on manhole immediately upstream of attenuation system, as a further preventative measure to trap silt and other gross pollutants;
- Class 1 bypass fuel separator to be provided prior to discharging from site.

3.9 Maintenance

The proposed surface water drainage network has been carefully designed to minimise risk of blockage throughout the network, mainly through the following provisions that limit and restrict the size of pollutants entering the network:

- Pervious paving;
- Trapped road gullies;
- Silt trap manhole;
- Flow control greater than 150mm diameter.

All devices, including road gullies, silt trap, flow control device and the attenuation system, should be inspected regularly and maintained, as appropriate and in accordance with manufacturer's recommendations and guidelines.

Items such as the flow controls and fuel separators have been located so as to provide easy vehicular access for inspection and maintenance.

3.10 SuDS Audit

A SuDS Quality Audit was carried out by JBA Consulting, with all inital comments having been addressed. Refer to **Appendix F** for a copy of the completed SuDS AUdit form.

3.11 Taking in Charge

It is proposed that all new surface water infrastructure associated within the redline boundary **is not** to be offered to be taken in charge by Dun Laoghaire Rathdown County Council.

3.12 Surface Water Impact Assessment

The design criteria for the drainage system are established in *GDSDS-RDP Volume 2*, *Section 6.3.4* and explained further in *GDSDS-RDP Volume 2, Appendix E*. There are four design criteria, each of which has been considered for the subject site:

- River Water Quality Protection;

- River Regime Protection;
- Level of Service (flooding) for the site and;
- River Flood Protection.

3.13 Criterion 1 – River Water Quality Protection

It is proposed that the overall drainage system, serving this development, will contain a range of surface water treatment methods, as outlined previously in *Section 3.4,* which will improve the quality of surface water being discharged from the proposed development.

Gross pollutants, sediments, hydrocarbons, and other impurities, will be removed at source with the following provisions:

a) Pervious Paving to all car parking areas;
b) Intensive landscaping, where practicable;
c) Interception storage at attenuation systems;
d) All road gullies and linear channel drains are to be trapped;
e) Silt-trap prior to attenuation storage area;
f) Class 1 fuel separator prior to discharge from the development.

3.14 Criterion 2 – River Regime Protection

Surface water discharge from the overall development will be restricted to an equivalent rural runoff rate of **7.8 l/s**, as per GDSDS and Dun Laoghaire Rathdown County Council requirements. Refer to *Section 3.3.3* for further details of the proposed development rainfall runoff calculations.

This will be achieved with the provision of a flow control devices (Hydro-Brake Optimum, by Hydro-International, or similar approved) upstream of the outfall manhole. Refer to *Section 3.4.3.9* for further details.

3.15 Criterion 3 – Level of Service (Flooding) Site

There are four sub-criteria for the required level of service, for a new development; as set out in the *GDSDS Volume 2, Section 6.3.4 (Table 6.3).*

- No flooding on site except where planned (30-year high intensity rainfall event);

- No internal property flooding (100-year high intensity rainfall event);
- No internal property flooding (100-year river event and critical duration for site) and;
- No flood routing off site except where specifically planned. (100-year high intensity rainfall event).

3.15.1 Sub-Criterion 3.1

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 10% increase in rainfall intensity for climate change) without flooding. Therefore, the system has capacity for the 30-year return period rainfall event without flooding.

The performance of the proposed drainage system has been analysed for design rainfall events up to, and including, the 1% AEP event (including 20% climate change allowance) using the *MicroDrainage Network Design Software*, by Innovyze Inc. Refer to **Appendix D** for details of design criteria, calculations and results. The analyses indicate that no flooding will occur for design rainfall events up to, and including, the 1% AEP.

3.15.2 Sub-Criterion 3.2

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding.

The performance of the proposed drainage system in 100-year return period storm events (including 20% climate change allowance) has been analysed – Refer **Appendix D** for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

3.15.3 Sub-Criterion 3.3

Details of the flood risk assessment associated with the proposed development is outlined in *the Site Specific Flood Risk Assessment*. The assessment indicates that there is no apparent risk of internal property flooding for a design 100-year return period pluvial rainfall event (including 20% climate change allowance).

3.15.4 Sub-Criterion 3.4

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding, so no flood routing off site will be experienced for such a rainfall event.

The performance of the proposed drainage system in 100-year return period storm events (including 20% climate change allowance) has been analysed – Refer **Appendix D** for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

Details of the flood risk assessment associated with the proposed development is outlined in *Section 7* of this report. This assessment, along with the network design simulation results, from the MicroDrainage Network Analysis, indicates that no internal property flooding will occur in a 100-year return period fluvial flood event (including 20% climate change allowance).

3.16 Criterion 4 – River Flood Protection

As outlined in *Section 3.14* (Criterion 2), the surface water runoff from the development's catchment will be limited to a maximum of **7.8 l/s** (4.30 l/s/ha).

Refer to *Section 3.3.3* and *Section 3.5* of this report for further details on the limiting discharge rates. The *GDSDS Volume 2, Appendix E* states that this practice ensures *"that sufficient stormwater runoff retention is achieved to protect the river during extreme events".*

Attenuation storage is to be provided for the 100-year return period rainfall event (including an increased 20% rainfall intensity; to allow for climate change). Discharge from site is to be achieved through the use of a vortex flow control device (e.g. Hydro-Brake Optimum, by Hydro-International, or similar approved), which will reduce the risk of blockage present with other flow devices.

Refer to **Appendix D** for details of hydraulic modelling calculations of attenuation and flow control facilities, as carried out using MicroDrainage software by Innovyze Inc.

4 WASTEWATER DRAINAGE

4.1 Overview

The proposed gravity wastewater sewer design has been carried out in accordance with Irish Water's Code of Practice for Wastewater Infrastructure.

4.2 Existing Wastewater Drainage

Existing services records do not indicate the presence of any wastewater infrastructure within the proposed site. Records indicate that there is an existing 150mm Ø wastewater sewer on Blackglen Rd.. This sewer is to be upgraded as part of the planned upgrade works on Blackglen Rd.

Figure 4.1 contains an excerpt from the Irish Water service records. The existing sewers are shown below.

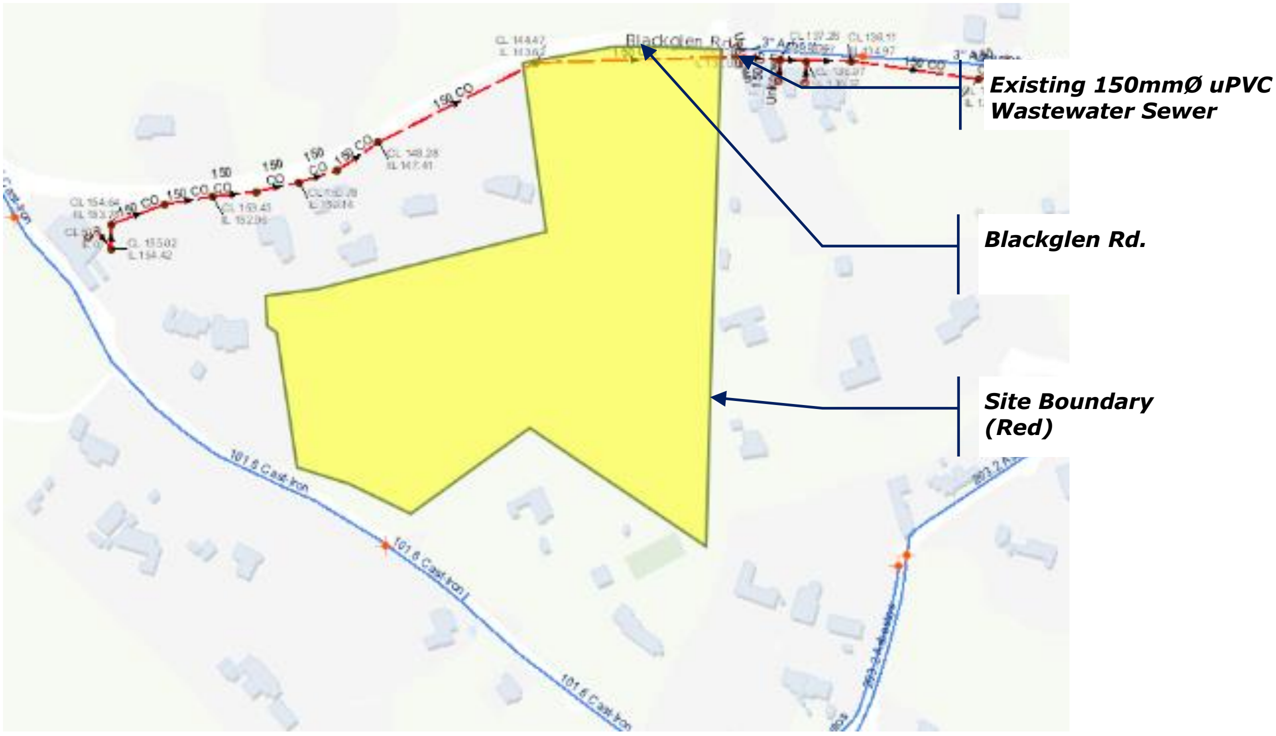


Figure 4.1 – Irish Water Public Records (Excerpt)

Refer to **Appendix A** for details of Irish Water existing wastewater infrastructure records.

4.3 Consultation

A Pre-Connection Enquiry Form ***(IW Ref Nr. CDS21001337)*** was submitted 26th February 2021 to Irish Water for a total of 450nr. residential units. Feedback on this enquiry has been received and states that the development is feasible subject upgrades to the existing network.

A new Pre-Connection Enquiry Form **(IW Ref Nr. CDS22002623)** was submitted 06th April 2022 to Irish Water for a total of 450nr. residential units. Feedback on this enquiry has been received and states that the development is feasible subject upgrades to the existing network.

Refer to **Appendix G** for Confirmation of Feasibility.

As noted in the CoF "*In order to accommodate the proposed connection, temporary flow controls from the site are required to limit the flows to 5l/s until Irish Water have increased capacity in the downstream network. The Irish Water capital upgrade project is currently at preliminary design stage. Installation of an on-site pumping station is usual flow control method. The pump station should be designed to be bypassed and decommissioned once upgrades are delivered in the catchment and permission is given by Irish Water*"

A subsequent Statement of Design Acceptance was issued by Irish Water on 14th July 2022. Refer to ***Appendix G*** *for a copy of this letter.*

4.4 Proposed Wastewater Drainage Strategy

It is proposed to separate the wastewater and surface water drainage networks, which will serve the proposed development, and provide independent connections to the public wastewater infrastructure.

Refer to *Section 3* for details of the proposed surface water drainage design strategy.

The overall development is to be drained by a gravity wastewater network, based on the natural topography of the development site. The buildings wastewater network is to connect to the new development's gravity wastewater network at the ground level. A single connection to the existing foul sewer on Blackglen Rd. is proposed once the required upgrade works are completed by Irish Water to serve the proposed development.

Until those upgrade works are completed, as suggested in the returned Confirmation of Feasibility Letter, it is proposed to provide a temporary Wastewater Pumping System (WWPS), within the confines of the proposed development which is to discharge into the existing 150mm sewer. This temporary WWPS will limit development flows to a maximum of 5 l/s, until such a stage that the planned upgrade works to the local infrastructure have been completed. On completion of the upgrade works, the connection to the temporary WWPS will be bypassed, to allow for it to be decommissioned and removed, with a gravity connection to the public network facilitated.

Refer to detailed drawing **Z040-OCSC-XX-XX-DR-C-0500 & 0551** for the proposed drainage network layout, which is to serve the proposed development.

4.5 Wastewater Network Design Calculations

It is proposed to separate the wastewater and surface water drainage networks, which will serve the proposed development, and provide independent connections to the adjacent watercourse and local wastewater sewer network, respectively.

Wastewater (volumetric) calculations have been compiled in accordance with *Irish Water's Code of Practice Wastewater Infrastructure, IW-CDS-5030-03* and are included in **Appendix E**. Pipe design calculations have been compiled using MicroDrainage software and are included in **Appendix E**. Design flow has been calculated using the Discharge Unit method described in *I.S. EN 752*. The calculations demonstrate that conveyance capacity is provided for all development of zoned lands within the catchment, that self-cleansing velocity will be achieved with the expected design flow rates and that the flow velocities will not exceed the upper limit of 3.0m/s.

4.6 Taking In Charge

It is proposed that all new wastewater drainage infrastructure installed to serve the proposed development within the redline boundary **is not** to be offered to Irish Water for to be taken-in-charge.

5 POTABLE WATER SUPPLY

5.1 Overview

All proposed potable water design has been carried out in accordance with *Irish Water’s Code of Practice for Water Infrastructure, IW-CDS-5020-03.*

A new 200mm-diameter HDPE watermain connection is to be provided from the existing 200mm Ø watermain on the Blackglen Rd. along the northern site boundary once operational.

5.2 Existing Watermain Infrastructure

The Irish Water public drainage records indicate that there is an existing public 3” asbestos watermain along on the Blackglen Rd. along the northern boundary of the site. That watermain is to be upgraded to a 200mm watermain as part of upgrades works to Blackglen Rd.

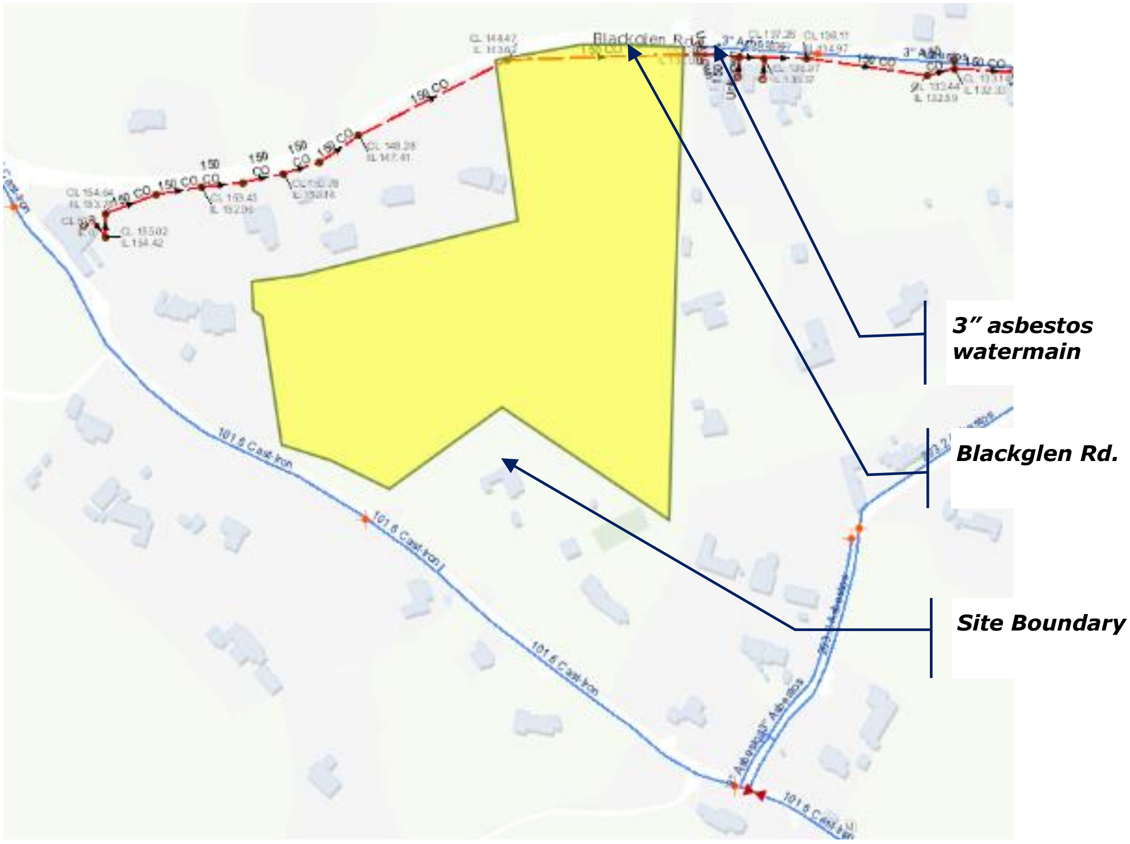


Figure 5.1 - Irish Water Public Records (Excerpt)

Refer to **Appendix A** for details of existing watermain infrastructure records.

5.3 Consultation

A Pre-Connection Enquiry Form (IW Ref Nr. CDS21001337) was submitted 26th February 2021 to Irish Water for a total of 450nr. residential units. Feedback on this enquiry has been received and states that the development is feasible subject upgrades to the existing network.

A new Pre-Connection Enquiry Form **(IW Ref Nr. CDS22002623)** was submitted 06th April 2022 to Irish Water for a total of 450nr. residential units. Feedback on this enquiry has been received and states that the development is feasible without infrastructure upgrade by Irish Water.

Refer to **Appendix G** for Confirmation of Feasibility.

As noted in the CoF "*Connection main should be a 150mm pipe connected to the newly laid 200mm ID main in Blackglen Road, with a bulk meter installed on the line. The new main must be operational before the connection. A PRV installation may be required for the connection"*

*A subsequent Statement of Design Acceptance was issued by Irish Water on 14th July 2022. Refer to **Appendix G** for a copy of this letter.*

5.4 Connection to the Existing Network

It is proposed to serve the proposed development by providing a new 200mm high density polyethylene (HDPE) connection to the new 200mm Ø watermain to be laid on Blackglen Rd. to the north of the site.

The proposed connection is to be carried out in accordance with *Irish Water's Code of Practice for Water Infrastructure*, following a New Connection agreement with Irish Water, with a bulk water meter to be provided at the development's entrance.

Refer to drawing **Z040-OCSC-XX-XX-DR-C-0550 and 0551** for the proposed watermain layout.

5.5 Water Saving Devices

Water saving devices are to be considered for use within the proposed development, in order to conserve the use of water, as part of the internal fit-out.

5.6 Water Meters

A bulk water meter is to be provided at the connection to the public watermain, at the development entrance, along with individual meters provided at the connection to each unit. All metering is to be provided in accordance with Irish Water's requirements.

5.7 Taking In Charge

All new watermain infrastructure, installed to serve the proposed development after the bulk meter **<u>is not</u>** to be offered to Irish Water for to be taken-in-charge.

For OCSC MULTIDISCIPLINARY CONSULTING ENGINEERS

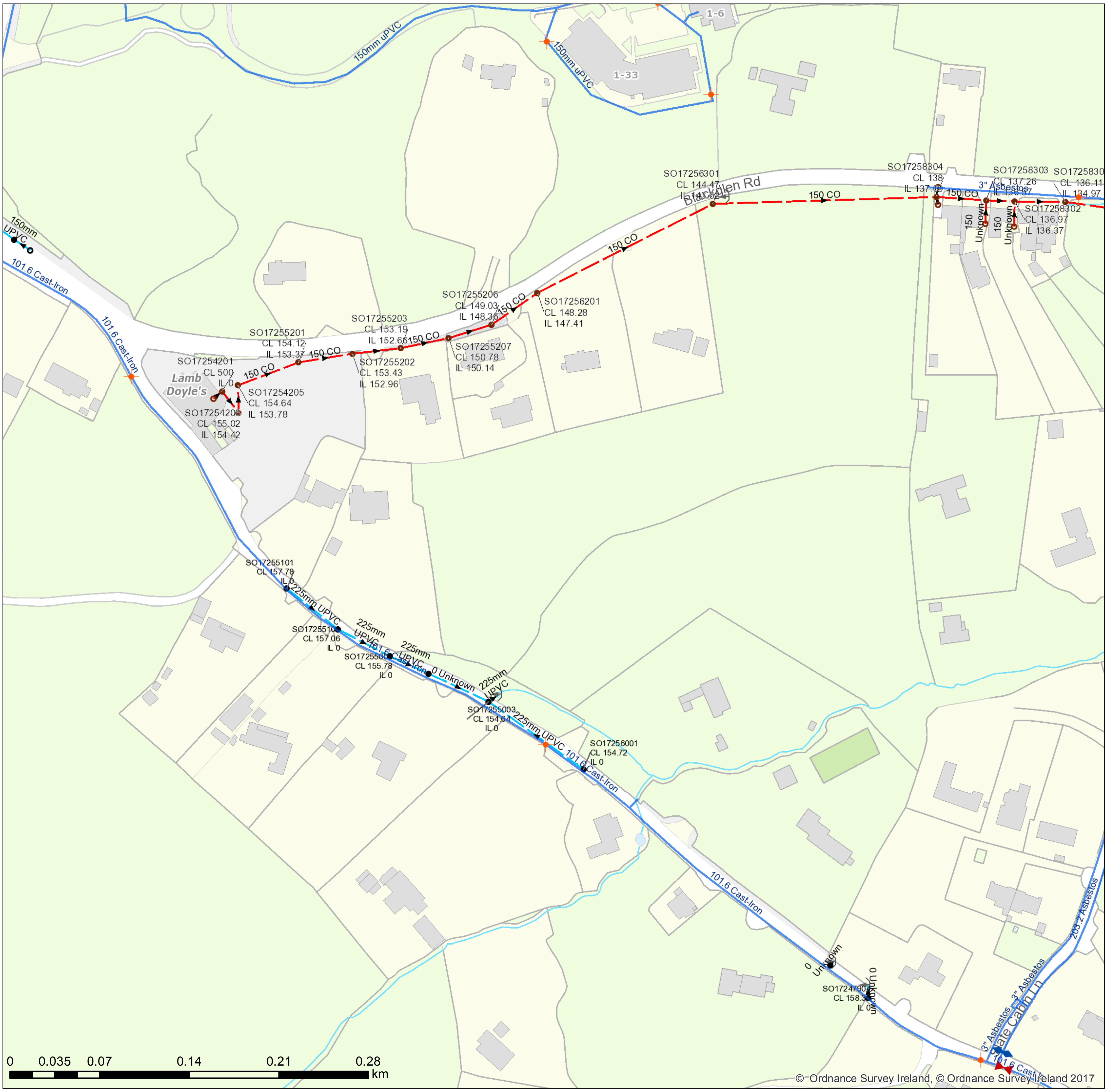
O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

APPENDIX A. EXISTING DRAINAGE INFRASTRUCTURE RECORDS

Appendix A

Existing Drainage Infrastructure Records

black glen road



Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

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Print Date: 09/03/2021

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Multidisciplinary Consulting Engineers

APPENDIX B. RETURN PERIOD RAINFALL DEPTHS

Appendix B

Return Period Rainfall Depths

for Sliding Durations from Met Éireann

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 317698, Northing: 225188,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.7,	3.9,	4.6,	5.7,	6.4,	7.0,	9.0,	11.2,	12.7,	14.9,	16.9,	18.4,	20.8,	22.7,	24.3,	N/A ,
10 mins	3.7,	5.5,	6.4,	7.9,	9.0,	9.8,	12.5,	15.6,	17.7,	20.8,	23.5,	25.7,	29.0,	31.6,	33.9,	N/A ,
15 mins	4.4,	6.4,	7.6,	9.3,	10.6,	11.5,	14.7,	18.4,	20.9,	24.4,	27.7,	30.2,	34.1,	37.2,	39.8,	N/A ,
30 mins	5.7,	8.4,	9.8,	12.1,	13.6,	14.8,	18.8,	23.4,	26.4,	30.8,	34.8,	37.9,	42.8,	46.5,	49.7,	N/A ,
1 hours	7.5,	10.9,	12.8,	15.6,	17.5,	19.0,	23.9,	29.7,	33.5,	38.9,	43.8,	47.6,	53.6,	58.2,	62.0,	N/A ,
2 hours	9.9,	14.2,	16.5,	20.1,	22.5,	24.4,	30.6,	37.7,	42.4,	49.1,	55.2,	59.8,	67.1,	72.7,	77.4,	N/A ,
3 hours	11.6,	16.6,	19.3,	23.3,	26.1,	28.2,	35.3,	43.4,	48.7,	56.3,	63.1,	68.4,	76.5,	82.9,	88.2,	N/A ,
4 hours	13.0,	18.5,	21.5,	25.9,	29.0,	31.3,	39.1,	47.9,	53.8,	62.0,	69.4,	75.2,	84.0,	90.9,	96.7,	N/A ,
6 hours	15.3,	21.6,	25.0,	30.1,	33.6,	36.3,	45.1,	55.1,	61.7,	71.1,	79.4,	85.9,	95.9,	103.6,	110.0,	N/A ,
9 hours	17.9,	25.2,	29.1,	34.9,	38.9,	42.0,	52.0,	63.4,	70.9,	81.5,	90.9,	98.1,	109.4,	118.1,	125.3,	N/A ,
12 hours	20.0,	28.1,	32.4,	38.8,	43.2,	46.6,	57.6,	70.0,	78.2,	89.7,	100.0,	107.9,	120.1,	129.5,	137.4,	N/A ,
18 hours	23.5,	32.8,	37.7,	45.1,	50.1,	53.9,	66.4,	80.6,	89.8,	102.8,	114.4,	123.3,	137.0,	147.6,	156.4,	N/A ,
24 hours	26.3,	36.6,	42.0,	50.1,	55.6,	59.8,	73.5,	89.0,	99.1,	113.3,	125.8,	135.5,	150.4,	161.9,	171.4,	204.7,
2 days	33.0,	44.7,	50.9,	59.9,	66.0,	70.6,	85.5,	102.0,	112.7,	127.6,	140.6,	150.6,	165.9,	177.6,	187.3,	220.7,
3 days	38.5,	51.4,	58.1,	67.9,	74.4,	79.4,	95.3,	112.7,	124.0,	139.5,	153.1,	163.5,	179.2,	191.3,	201.2,	235.3,
4 days	43.2,	57.2,	64.4,	74.9,	81.8,	87.0,	103.8,	122.1,	133.9,	150.0,	164.1,	174.8,	191.1,	203.5,	213.6,	248.5,
6 days	51.6,	67.4,	75.4,	87.0,	94.6,	100.3,	118.6,	138.4,	151.0,	168.3,	183.2,	194.6,	211.7,	224.7,	235.4,	271.7,
8 days	59.1,	76.3,	85.1,	97.6,	105.8,	112.0,	131.6,	152.6,	166.0,	184.2,	200.0,	211.8,	229.8,	243.4,	254.4,	292.1,
10 days	66.0,	84.5,	93.9,	107.3,	116.0,	122.6,	143.3,	165.5,	179.6,	198.6,	215.1,	227.5,	246.1,	260.2,	271.6,	310.6,
12 days	72.4,	92.2,	102.1,	116.3,	125.5,	132.5,	154.2,	177.4,	192.1,	212.0,	229.0,	241.9,	261.1,	275.7,	287.5,	327.6,
16 days	84.4,	106.4,	117.3,	132.9,	143.0,	150.6,	174.2,	199.2,	215.0,	236.2,	254.4,	268.1,	288.5,	303.9,	316.4,	358.6,
20 days	95.5,	119.5,	131.3,	148.2,	159.0,	167.1,	192.4,	219.1,	235.8,	258.3,	277.5,	291.9,	313.3,	329.5,	342.6,	386.6,
25 days	108.6,	134.8,	147.7,	165.9,	177.6,	186.3,	213.5,	242.0,	259.8,	283.7,	304.0,	319.2,	341.8,	358.8,	372.6,	418.6,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

APPENDIX C. Q_{BAR} RUNOFF CALCULATIONS

Appendix C

Q_{BAR} Runoff Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	5	Soil	0.370
Area (ha)	3.700	Urban	0.000
SAAR (mm)	986	Region Number	User Defined

User Defined Growth Curve

Filename GDSDS.gcfx Description GDSDS

Return Period (years)	**Growth Curve Factor**
1	0.850
2	0.000
5	0.000
10	0.000
20	0.000
25	0.000
30	2.100
50	0.000
100	2.600
200	0.000
500	0.000
1000	0.000

Results	**l/s**
QBAR Rural	15.9
QBAR Urban	15.9
Q5 years	0.0
Q1 year	13.5
Q30 years	33.3
Q100 years	41.3

APPENDIX D. SURFACE WATER DESIGN CALCULATIONS

- Design Criteria;
- Area Summary;
- Network Design & Results Table;
- Simulation Criteria;
- Hydrobrake / Controls & Storage Design;
- Summary of Results.

Appendix D

Surface Water Design Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes GDSDS Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	20
Ratio R	0.269	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	10.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	1.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm at outfall S (pipe S1.019)

Time (mins)	**Area (ha)**	**Time (mins)**	**Area (ha)**
0-4	0.405	4-8	0.601

Total Area Contributing (ha) = 1.007

Total Pipe Volume (m³) = 48.154

Time Area Diagram at outfall S86 (pipe S15.009)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.057	4-8	0.008

Total Area Contributing (ha) = 0.065

Total Pipe Volume (m³) = 1.120

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	59.239	2.576	23.0	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	20.311	0.119	170.7	0.014	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.36	152.622	0.000	0.0	0.0	0.0	2.74	108.9	0.0
S2.000	50.00	4.28	157.000	0.014	0.0	0.0	0.5	1.20	84.9	3.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	12.942	0.076	170.3	0.009	4.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	2.605	0.081	32.2	0.098	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.002	24.457	1.223	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.003	19.710	0.986	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.004	11.983	0.479	25.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	36.465	1.823	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	9.891	0.291	34.0	0.077	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	4.18	157.000	0.009	0.0	0.0	0.3	1.20	85.0	2.0
S2.001	50.00	4.30	156.881	0.120	0.0	0.0	4.3	2.32	92.1	26.1
S2.002	50.00	4.44	152.757	0.120	0.0	0.0	4.3	2.94	116.9	26.1
S2.003	50.00	4.55	151.534	0.120	0.0	0.0	4.3	2.94	116.9	26.1
S2.004	50.00	4.63	150.549	0.120	0.0	0.0	4.3	2.63	104.5	26.1
S1.001	50.00	4.83	150.046	0.120	0.0	0.0	4.3	2.94	116.9	26.1
S4.000	50.00	4.07	152.800	0.077	0.0	0.0	2.8	2.25	89.5	16.8

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S4.001	9.891	0.291	34.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.002	9.891	0.291	34.0	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.003	9.891	0.291	34.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.004	10.667	0.533	20.0	0.023	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.005	10.667	0.533	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.006	10.667	0.533	20.0	0.048	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.007	10.667	0.533	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.008	9.923	0.496	20.0	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.009	9.923	0.496	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.010	9.073	0.454	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S4.001	50.00	4.15	152.509	0.077	0.0	0.0	2.8	2.25	89.5	16.8
S4.002	50.00	4.22	152.218	0.086	0.0	0.0	3.1	2.25	89.5	18.6
S4.003	50.00	4.29	151.927	0.086	0.0	0.0	3.1	2.25	89.5	18.6
S4.004	50.00	4.35	151.636	0.109	0.0	0.0	3.9	2.94	116.9	23.7
S4.005	50.00	4.41	151.103	0.109	0.0	0.0	3.9	2.94	116.9	23.7
S4.006	50.00	4.47	150.570	0.158	0.0	0.0	5.7	2.94	116.9	34.1
S4.007	50.00	4.53	150.036	0.158	0.0	0.0	5.7	2.94	116.9	34.1
S4.008	50.00	4.59	149.503	0.194	0.0	0.0	7.0	2.94	116.9	42.0
S4.009	50.00	4.65	149.007	0.194	0.0	0.0	7.0	2.94	116.9	42.0
S4.010	50.00	4.70	148.511	0.194	0.0	0.0	7.0	2.94	116.9	42.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.002	14.879	0.595	25.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.000	32.037	0.120	267.0	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	17.741	0.104	170.6	0.014	4.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	2.439	0.030	81.3	0.080	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.002	23.845	0.145	164.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.003	26.216	0.749	35.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.004	8.631	0.432	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.002	50.00	4.93	148.057	0.314	0.0	0.0	11.3	2.63	104.5	68.1
S5.000	50.00	4.67	150.900	0.000	0.0	0.0	0.0	0.80	31.6	0.0
S6.000	50.00	4.30	150.900	0.014	0.0	0.0	0.5	1.00	39.7	3.1
S5.001	50.00	4.70	150.780	0.094	0.0	0.0	3.4	1.45	57.7	20.4
S5.002	50.00	5.09	149.000	0.094	0.0	0.0	3.4	1.02	40.4	20.4
S5.003	50.00	5.29	148.855	0.094	0.0	0.0	3.4	2.22	88.2	20.4
S5.004	50.00	5.34	148.106	0.094	0.0	0.0	3.4	2.94	116.9	20.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.003	26.552	1.328	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	16.025	0.801	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	14.605	0.730	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	21.557	1.078	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	8.812	0.052	169.5	0.005	4.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	2.937	0.017	172.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	10.874	0.064	169.9	0.006	4.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	3.625	0.021	172.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.003	50.00	5.49	147.462	0.408	0.0	0.0	14.7	2.94	116.9	88.4
S1.004	50.00	5.58	146.134	0.408	0.0	0.0	14.7	2.94	116.9	88.4
S1.005	50.00	5.66	145.333	0.408	0.0	0.0	14.7	2.94	116.9	88.4
S1.006	50.00	5.78	144.603	0.408	0.0	0.0	14.7	2.94	116.9	88.4
S7.000	50.00	4.15	144.575	0.005	0.0	0.0	0.2	1.00	39.8	1.1
S7.001	50.00	4.20	144.523	0.005	0.0	0.0	0.2	0.99	39.4	1.1
S8.000	50.00	4.18	144.575	0.006	0.0	0.0	0.2	1.00	39.8	1.2
S8.001	50.00	4.24	144.511	0.006	0.0	0.0	0.2	0.99	39.5	1.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S7.002	14.217	0.084	169.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.003	5.382	0.032	168.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.004	29.080	0.171	170.1	0.041	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.005	26.017	0.153	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.000	9.971	0.499	20.0	0.012	4.00	0.0	0.600	o	150	Pipe/Conduit	
S9.001	11.891	0.595	20.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.002	6.181	0.309	20.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.003	8.033	0.402	20.0	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.004	7.254	0.363	20.0	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.005	8.705	0.435	20.0	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.002	50.00	4.48	144.490	0.011	0.0	0.0	0.4	1.00	39.8	2.3
S7.003	50.00	4.57	144.406	0.011	0.0	0.0	0.4	1.01	40.0	2.3
S7.004	50.00	5.05	144.374	0.051	0.0	0.0	1.9	1.00	39.7	11.1
S7.005	50.00	5.49	144.203	0.051	0.0	0.0	1.9	1.00	39.8	11.1
S9.000	50.00	4.07	148.663	0.012	0.0	0.0	0.4	2.26	40.0	2.7
S9.001	50.00	4.16	148.164	0.027	0.0	0.0	1.0	2.26	40.0	5.8
S9.002	50.00	4.21	147.569	0.041	0.0	0.0	1.5	2.26	40.0	8.9
S9.003	50.00	4.27	147.260	0.047	0.0	0.0	1.7	2.26	40.0	10.2
S9.004	50.00	4.32	146.859	0.054	0.0	0.0	1.9	2.26	40.0	11.6
S9.005	50.00	4.38	146.496	0.062	0.0	0.0	2.2	2.26	40.0	13.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S9.006	5.885	0.294	20.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.007	12.314	0.616	20.0	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.008	14.946	0.747	20.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.009	7.848	0.032	245.0	0.007	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	9.084	0.454	20.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	10.582	0.529	20.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	13.767	0.688	20.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.010	37.692	1.905	19.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	17.735	0.071	251.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.012	17.356	0.071	246.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S9.006	50.00	4.43	146.061	0.071	0.0	0.0	2.6	2.26	40.0	15.3
S9.007	50.00	4.52	145.767	0.079	0.0	0.0	2.8	2.26	40.0	17.1
S9.008	50.00	4.63	145.151	0.096	0.0	0.0	3.5	2.26	40.0	20.8
S9.009	50.00	4.78	143.904	0.103	0.0	0.0	3.7	0.83	33.0	22.3
S1.007	50.00	5.83	143.450	0.562	0.0	0.0	20.3	3.53	249.6	121.8
S1.008	50.00	5.88	142.996	0.562	0.0	0.0	20.3	3.53	249.6	121.8
S1.009	50.00	5.94	141.253	0.562	0.0	0.0	20.3	3.53	249.6	121.8
S1.010	50.00	4.21	140.565	0.000	1.0	0.0	0.2	2.96	117.5	1.0
S1.011	50.00	4.51	138.585	0.000	1.0	0.0	0.2	0.99	69.7	1.2
S1.012	50.00	4.80	138.515	0.000	1.0	0.0	0.2	1.00	70.5	1.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S10.000	12.076	0.403	30.0	0.046	4.00	0.0	0.600	o	150	Pipe/Conduit	
S10.001	12.076	0.403	30.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S10.002	6.160	0.025	245.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S10.003	20.486	0.084	245.0	0.031	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.004	5.955	0.024	245.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.005	3.228	0.013	245.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.006	5.665	0.023	246.3	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.007	4.749	0.028	169.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.013	19.957	0.106	188.6	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.000	50.00	4.11	143.250	0.046	0.0	0.0	1.7	1.84	32.6	9.9
S10.001	50.00	4.22	142.848	0.046	0.0	0.0	1.7	1.84	32.6	9.9
S10.002	50.00	4.38	142.445	0.046	0.0	0.0	1.7	0.64	11.3	9.9
S10.003	50.00	4.79	142.345	0.077	0.0	0.0	2.8	0.83	33.0	16.7
S10.004	50.00	4.91	142.261	0.082	0.0	0.0	3.0	0.83	33.0	17.9
S10.005	50.00	4.97	142.237	0.082	0.0	0.0	3.0	0.83	33.0	17.9
S10.006	50.00	5.09	142.224	0.095	0.0	0.0	3.4	0.83	32.9	20.7
S10.007	50.00	5.17	141.601	0.095	0.0	0.0	3.4	1.00	39.8	20.7
S1.013	50.00	5.46	138.444	0.098	1.0	0.0	3.7	1.14	80.7	22.5

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S11.000	8.415	0.099	85.0	0.095	4.00	0.0	0.600	o	300	Pipe/Conduit	
S11.001	6.462	0.076	85.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.002	3.736	0.044	85.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.003	8.803	0.104	85.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	10.778	0.058	185.2	0.022	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.000	6.549	0.039	167.9	0.006	4.00	0.0	0.600	o	225	Pipe/Conduit	
S13.000	15.849	0.093	170.4	0.005	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S11.000	50.00	4.08	142.000	0.095	0.0	0.0	3.4	1.71	120.6	20.5
S11.001	50.00	4.15	141.901	0.095	0.0	0.0	3.4	1.71	120.6	20.5
S11.002	50.00	4.19	141.825	0.095	0.0	0.0	3.4	1.42	56.4	20.5
S11.003	50.00	4.29	141.400	0.095	0.0	0.0	3.4	1.42	56.4	20.5
S1.014	50.00	5.61	138.338	0.215	1.0	0.0	8.0	1.15	81.4	47.8
S12.000	50.00	4.11	143.225	0.006	0.0	0.0	0.2	1.01	40.0	1.2
S13.000	50.00	4.26	143.225	0.005	0.0	0.0	0.2	1.00	39.7	1.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S12.001	15.066	0.093	162.0	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.002	3.625	0.093	39.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.003	24.268	0.485	50.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.004	25.811	0.258	100.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.005	9.718	0.194	50.1	0.003	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.006	7.099	0.142	50.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.015	9.854	0.058	170.0	0.012	0.00	0.0	0.600	o	300	Pipe/Conduit	
S14.000	4.684	0.019	246.5	0.059	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S12.001	50.00	4.51	143.132	0.050	0.0	0.0	1.8	1.02	40.7	10.7
S12.002	50.00	4.54	143.039	0.050	0.0	0.0	1.8	2.10	83.6	10.7
S12.003	50.00	4.76	142.946	0.050	0.0	0.0	1.8	1.85	73.7	10.7
S12.004	50.00	5.09	141.660	0.055	0.0	0.0	2.0	1.31	52.0	11.9
S12.005	50.00	5.17	141.402	0.058	0.0	0.0	2.1	1.85	73.7	12.6
S12.006	50.00	5.24	141.208	0.058	0.0	0.0	2.1	1.85	73.7	12.6
S1.015	50.00	5.75	138.280	0.286	1.0	0.0	10.5	1.20	85.0	63.1
S14.000	50.00	4.09	141.500	0.059	0.0	0.0	2.1	0.83	32.9	12.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S14.001	19.494	0.080	245.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.002	12.123	0.049	245.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.003	10.017	0.041	244.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.004	8.327	0.333	25.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.005	5.311	0.212	25.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.006	9.140	0.366	25.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.016	10.208	0.060	170.0	0.086	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.017	10.582	0.026	407.0	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.018	5.030	0.030	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.019	8.083	0.048	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S14.001	50.00	4.49	141.481	0.059	0.0	0.0	2.1	0.83	33.0	12.9
S14.002	50.00	4.73	141.401	0.059	0.0	0.0	2.1	0.83	33.0	12.9
S14.003	50.00	4.93	141.352	0.059	0.0	0.0	2.1	0.83	33.1	12.9
S14.004	50.00	4.98	141.311	0.059	0.0	0.0	2.1	2.63	104.5	12.9
S14.005	50.00	5.02	140.978	0.059	0.0	0.0	2.1	2.63	104.5	12.9
S14.006	50.00	5.07	140.765	0.059	0.0	0.0	2.1	2.63	104.5	12.9
S1.016	50.00	4.17	138.222	0.000	15.6	0.0	2.6	1.00	39.8	15.6
S1.017	50.00	4.44	138.162	0.013	15.6	0.0	3.6	0.64	25.5	21.6
S1.018	50.00	4.53	138.136	0.013	15.6	0.0	3.6	1.00	39.8	21.6
S1.019	50.00	4.66	138.106	0.013	15.6	0.0	3.6	1.00	39.8	21.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S15.000	2.008	0.012	167.4	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
S15.001	5.496	0.137	40.0	0.035	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.002	8.690	0.217	40.0	0.011	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.003	10.997	0.233	47.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.004	9.527	0.451	21.1	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.005	7.602	0.253	30.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.006	6.599	0.220	30.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.007	4.241	0.141	30.1	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.008	6.118	0.227	27.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.009	2.125	0.009	236.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S15.000	50.00	4.04	142.924	0.000	0.0	0.0	0.0	0.77	13.7	0.0
S15.001	50.00	4.10	142.912	0.035	0.0	0.0	1.3	1.60	28.2	7.7
S15.002	50.00	4.19	142.775	0.047	0.0	0.0	1.7	1.60	28.2	10.1
S15.003	50.00	4.32	142.557	0.047	0.0	0.0	1.7	1.47	26.0	10.1
S15.004	50.00	4.39	142.324	0.052	0.0	0.0	1.9	2.20	38.9	11.3
S15.005	50.00	4.46	141.873	0.052	0.0	0.0	1.9	1.84	32.6	11.3
S15.006	50.00	4.52	141.619	0.057	0.0	0.0	2.1	1.84	32.6	12.3
S15.007	50.00	4.55	141.400	0.065	0.0	0.0	2.4	1.84	32.6	14.1
S15.008	50.00	4.61	140.000	0.065	0.0	0.0	2.4	1.95	34.4	14.1
S15.009	50.00	4.66	141.700	0.065	0.0	0.0	2.4	0.65	11.5«	14.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
2.000	As Zoned	Default	100	0.005	0.005	0.005
	As Zoned	Building	100	0.004	0.004	0.004
	As Zoned	Building	100	0.004	0.004	0.014
3.000	As Zoned	Building	100	0.005	0.005	0.005
	As Zoned	Building	100	0.004	0.004	0.009
2.001	As Zoned	Podium	70	0.140	0.098	0.098
2.002	-	-	100	0.000	0.000	0.000
2.003	-	-	100	0.000	0.000	0.000
2.004	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
4.000	As Zoned	Carparking	70	0.005	0.003	0.003
	As Zoned	Carparking	70	0.006	0.004	0.004
	As Zoned	Default	100	0.005	0.005	0.005
	As Zoned	Carparking	70	0.010	0.007	0.007
	As Zoned	Carparking	70	0.006	0.004	0.004
	As Zoned	Carparking	70	0.005	0.003	0.003
	As Zoned	Carparking	70	0.006	0.004	0.004
	As Zoned	Hardstanding	100	0.000	0.000	0.032
		Carparking	70	0.004	0.003	0.003
	As Zoned	Carparking	70	0.004	0.003	0.003
	As Zoned	Hardstanding	100	0.012	0.012	0.012
	As Zoned	Hardstanding	100	0.015	0.015	0.064
		Carparking	70	0.000	0.000	0.015
	As Zoned	Road	100	0.014	0.014	0.077
4.001	-	-	100	0.000	0.000	0.000
4.002	As Zoned	Road	100	0.009	0.009	0.009
4.003	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
4.004	As Zoned	Road	100	0.011	0.011	0.011
		Hardstanding	100	0.000	0.000	0.011
	As Zoned	Road	100	0.012	0.012	0.023
4.005	-	-	100	0.000	0.000	0.000
4.006	As Zoned	Road	100	0.014	0.014	0.014
		Hardstanding	100	0.000	0.000	0.015
	As Zoned	Hardstanding	100	0.034	0.034	0.048
4.007	-	-	100	0.000	0.000	0.000
4.008	As Zoned	Road	100	0.018	0.018	0.018
		Hardstanding	100	0.000	0.000	0.018
	As Zoned	Road	100	0.012	0.012	0.012
	As Zoned	Carparking	70	0.008	0.006	0.036
4.009	-	-	100	0.000	0.000	0.000
4.010	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.000	0.000	0.000
6.000	As Zoned	Default	100	0.005	0.005	0.005
	As Zoned	Default	100	0.004	0.004	0.004
	As Zoned	Default	100	0.005	0.005	0.014
5.001	As Zoned	Podium	70	0.114	0.080	0.080
5.002	-	-	100	0.000	0.000	0.000
5.003	-	-	100	0.000	0.000	0.000
5.004	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
7.000	As Zoned	Building	100	0.005	0.005	0.005

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
7.001	-	-	100	0.000	0.000	0.000
8.000	As Zoned	Building	100	0.006	0.006	0.006
8.001	-	-	100	0.000	0.000	0.000
7.002	-	-	100	0.000	0.000	0.000
7.003	-	-	100	0.000	0.000	0.000
7.004	As Zoned	Podium	70	0.058	0.041	0.041
7.005	-	-	100	0.000	0.000	0.000
9.000	As Zoned	Carparking	70	0.005	0.004	0.004
	As Zoned	Default	100	0.009	0.009	0.012
9.001	As Zoned	Carparking	70	0.005	0.003	0.003
	As Zoned	Road	100	0.011	0.011	0.014
		Hardstanding	100	0.000	0.000	0.014
		Carparking	70	0.000	0.000	0.014
9.002	As Zoned	Hardstanding	100	0.012	0.012	0.012
		Carparking	70	0.008	0.006	0.010
	As Zoned	Road	100	0.004	0.004	0.022
		Hardstanding	100	0.000	0.000	0.014
9.003	As Zoned	Carparking	70	0.006	0.004	0.004
	As Zoned	Road	100	0.002	0.002	0.006
		Hardstanding	100	0.000	0.000	0.006
9.004	As Zoned	Road	100	0.006	0.006	0.006
		Hardstanding	100	0.000	0.000	0.006
9.005	As Zoned	Default	100	0.001	0.001	0.001
		Hardstanding	100	0.008	0.008	0.008
9.006	As Zoned	Road	100	0.009	0.009	0.009
9.007	As Zoned	Road	100	0.008	0.008	0.008
9.008	As Zoned	Road	100	0.000	0.000	0.000
		Hardstanding	100	0.007	0.007	0.007

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	As Zoned	Road	100	0.011	0.011	0.017
9.009	As Zoned	Road	100	0.007	0.007	0.007
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.000	0.000	0.000
1.012	-	-	100	0.000	0.000	0.000
10.000	As Zoned	Hardstanding	100	0.000	0.000	0.000
		Carparking	70	0.004	0.003	0.003
	As Zoned	Carparking	70	0.006	0.004	0.004
	As Zoned	Carparking	70	0.006	0.004	0.004
	As Zoned	Road	100	0.027	0.027	0.038
		Hardstanding	100	0.001	0.001	0.028
	As Zoned	Road	100	0.000	0.000	0.038
		Hardstanding	100	0.007	0.007	0.045
		Carparking	70	0.000	0.000	0.046
10.001	-	-	100	0.000	0.000	0.000
10.002	-	-	100	0.000	0.000	0.000
10.003	As Zoned	Carparking	70	0.009	0.006	0.006
	As Zoned	Carparking	70	0.006	0.004	0.004
	As Zoned	Carparking	70	0.005	0.003	0.003
	As Zoned	Road	100	0.017	0.017	0.031
		Hardstanding	100	0.000	0.000	0.031
10.004	As Zoned	Hardstanding	100	0.005	0.005	0.005
		Carparking	70	0.000	0.000	0.005
10.005	-	-	100	0.000	0.000	0.000
10.006	As Zoned	Carparking	70	0.002	0.002	0.002

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	As Zoned	Carparking	70	0.002	0.002	0.002
	As Zoned	Road	100	0.007	0.007	0.010
		Hardstanding	100	0.000	0.000	0.007
	As Zoned	Hardstanding	100	0.003	0.003	0.013
10.007	-	-	100	0.000	0.000	0.000
1.013	As Zoned	Carparking	70	0.015	0.010	0.000
	As Zoned	Carparking	70	0.004	0.003	0.003
11.000	As Zoned	Building	100	0.095	0.095	0.095
11.001	-	-	100	0.000	0.000	0.000
11.002	-	-	100	0.000	0.000	0.000
11.003	-	-	100	0.000	0.000	0.000
1.014	As Zoned	Road	100	0.017	0.017	0.017
		Hardstanding	100	0.000	0.000	0.018
	As Zoned	Road	100	0.000	0.000	0.018
		Hardstanding	100	0.005	0.005	0.022
12.000	As Zoned	Building	100	0.006	0.006	0.006
13.000	As Zoned	Building	100	0.005	0.005	0.005
12.001	As Zoned	Podium	70	0.056	0.039	0.039
12.002	-	-	100	0.000	0.000	0.000
12.003	-	-	100	0.000	0.000	0.000
12.004	As Zoned	Default	100	0.004	0.004	0.004
	As Zoned	Carparking	70	0.002	0.002	0.005
12.005	As Zoned	Hardstanding	100	0.003	0.003	0.003
12.006	-	-	100	0.000	0.000	0.000
1.015	As Zoned	Road	100	0.012	0.012	0.012
		Hardstanding	100	0.000	0.000	0.012
14.000	As Zoned	Building	100	0.059	0.059	0.059
14.001	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
14.002	-	-	100	0.000	0.000	0.000
14.003	-	-	100	0.000	0.000	0.000
14.004	-	-	100	0.000	0.000	0.000
14.005	-	-	100	0.000	0.000	0.000
14.006	-	-	100	0.000	0.000	0.000
1.016	As Zoned	Hardstanding	100	0.032	0.032	0.032
	As Zoned	Hardstanding	100	0.002	0.002	0.002
	As Zoned	Road	100	0.000	0.000	0.034
		Hardstanding	100	0.034	0.034	0.034
	As Zoned	Road	100	0.014	0.014	0.014
	As Zoned	Road	100	0.000	0.000	0.082
		Hardstanding	100	0.004	0.004	0.086
1.017	As Zoned	Road	100	0.013	0.013	0.013
		Hardstanding	100	0.000	0.000	0.013
		Carparking	70	0.000	0.000	0.013
1.018	-	-	100	0.000	0.000	0.000
1.019	-	-	100	0.000	0.000	0.000
15.000	-	-	100	0.000	0.000	0.000
15.001	As Zoned	Road	100	0.035	0.035	0.035
		Hardstanding	100	0.000	0.000	0.035
15.002	As Zoned	Hardstanding	100	0.011	0.011	0.011
15.003	-	-	100	0.000	0.000	0.000
15.004	As Zoned	Default	100	0.006	0.006	0.006
		Hardstanding	100	0.000	0.000	0.006
15.005	-	-	100	0.000	0.000	0.000
15.006	As Zoned	Carparking	70	0.007	0.005	0.005
15.007	As Zoned	Carparking	70	0.005	0.003	0.003
	As Zoned	Hardstanding	100	0.019	0.019	0.008

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
15.008	-	-	100	0.000	0.000	0.000
15.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.258	1.072	1.072

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.019	S	140.609	138.059	0.000	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S15.009	S86	142.000	141.691	0.000	1200	0

Online Controls for Storm

Orifice Manhole: S5, DS/PN: S2.002, Volume (m^3): 0.1

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 156.800

Orifice Manhole: S7, DS/PN: S2.004, Volume (m^3): 1.8

Diameter (m) 0.037 Discharge Coefficient 0.600 Invert Level (m) 150.548

Orifice Manhole: S11, DS/PN: S4.002, Volume (m^3): 1.9

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 152.218

Orifice Manhole: S14, DS/PN: S4.005, Volume (m^3): 0.4

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 151.103

Orifice Manhole: S16, DS/PN: S4.007, Volume (m^3): 0.4

Diameter (m) 0.148 Discharge Coefficient 0.600 Invert Level (m) 150.036

Orifice Manhole: S19, DS/PN: S4.010, Volume (m^3): 1.9

Diameter (m) 0.148 Discharge Coefficient 0.600 Invert Level (m) 148.511

Orifice Manhole: S24, DS/PN: S5.002, Volume (m^3): 0.8

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 149.000

Orifice Manhole: S26, DS/PN: S5.004, Volume (m^3): 2.0

Diameter (m) 0.045 Discharge Coefficient 0.600 Invert Level (m) 148.106

Orifice Manhole: S36, DS/PN: S7.003, Volume (m^3): 0.6

Diameter (m) 0.035 Discharge Coefficient 0.600 Invert Level (m) 144.406

Orifice Manhole: S40, DS/PN: S9.001, Volume (m^3): 1.6

Diameter (m) 0.064 Discharge Coefficient 0.600 Invert Level (m) 148.164

Orifice Manhole: S41, DS/PN: S9.002, Volume (m^3): 1.7

Diameter (m) 0.064 Discharge Coefficient 0.600 Invert Level (m) 147.569

Orifice Manhole: S42, DS/PN: S9.003, Volume (m^3): 1.6

Diameter (m) 0.064 Discharge Coefficient 0.600 Invert Level (m) 147.260

Orifice Manhole: S43, DS/PN: S9.004, Volume (m^3): 1.7

Diameter (m) 0.064 Discharge Coefficient 0.600 Invert Level (m) 146.859

Orifice Manhole: S44, DS/PN: S9.005, Volume (m^3): 1.7

Diameter (m) 0.056 Discharge Coefficient 0.600 Invert Level (m) 146.496

Orifice Manhole: S45, DS/PN: S9.006, Volume (m^3): 1.7

Diameter (m) 0.056 Discharge Coefficient 0.600 Invert Level (m) 146.061

Orifice Manhole: S46, DS/PN: S9.007, Volume (m^3): 1.5

Diameter (m) 0.056 Discharge Coefficient 0.600 Invert Level (m) 145.767

Orifice Manhole: S47, DS/PN: S9.008, Volume (m^3): 1.4

Diameter (m) 0.070 Discharge Coefficient 0.600 Invert Level (m) 145.151

Orifice Manhole: S48, DS/PN: S9.009, Volume (m^3): 1.9

Diameter (m) 0.070 Discharge Coefficient 0.600 Invert Level (m) 143.904

Hydro-Brake® Optimum Manhole: S53, DS/PN: S1.011, Volume (m^3): 3.4

Unit Reference	MD-SHE-0032-5000-1000-5000	Sump Available	Yes
Design Head (m)	1.000	Diameter (mm)	32
Design Flow (l/s)	0.5	Invert Level (m)	138.660
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Hydro-Brake® Optimum Manhole: S53, DS/PN: S1.011, Volume (m³): 3.4

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.5	Kick-Flo®	0.288	0.3
Flush-Flo™	0.143	0.3	Mean Flow over Head Range	-	0.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	0.600	0.4	1.600	0.6	2.600	0.8	5.000	1.0	7.500	1.2
0.200	0.3	0.800	0.5	1.800	0.6	3.000	0.8	5.500	1.1	8.000	1.3
0.300	0.3	1.000	0.5	2.000	0.7	3.500	0.9	6.000	1.1	8.500	1.3
0.400	0.3	1.200	0.5	2.200	0.7	4.000	0.9	6.500	1.2	9.000	1.3
0.500	0.4	1.400	0.6	2.400	0.7	4.500	1.0	7.000	1.2	9.500	1.4

Orifice Manhole: S67, DS/PN: S11.003, Volume (m³): 1.5

Diameter (m) 0.055 Discharge Coefficient 0.600 Invert Level (m) 141.781

Orifice Manhole: S71, DS/PN: S12.001, Volume (m³): 0.9

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 143.132

Orifice Manhole: S76, DS/PN: S12.006, Volume (m³): 1.8

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 141.208

Hydro-Brake® Optimum Manhole: S82, DS/PN: S14.004, Volume (m³): 2.2

Unit Reference	MD-SHE-0021-2000-0700-2000	Sump Available	Yes
Design Head (m)	0.700	Diameter (mm)	21
Design Flow (l/s)	0.2	Invert Level (m)	141.311
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	0.2	Kick-Flo®	0.191	0.1
Flush-Flo™	0.094	0.1	Mean Flow over Head Range	-	0.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.1	0.600	0.2	1.600	0.3	2.600	0.3	5.000	0.5	7.500	0.6
0.200	0.1	0.800	0.2	1.800	0.3	3.000	0.4	5.500	0.5	8.000	0.6
0.300	0.1	1.000	0.2	2.000	0.3	3.500	0.4	6.000	0.5	8.500	0.6
0.400	0.2	1.200	0.3	2.200	0.3	4.000	0.4	6.500	0.5	9.000	0.6
0.500	0.2	1.400	0.3	2.400	0.3	4.500	0.4	7.000	0.5	9.500	0.6

Hydro-Brake® Optimum Manhole: S87, DS/PN: S1.018, Volume (m³): 3.5

Unit Reference	MD-SHE-0117-7800-1900-7800	Objective	Minimise upstream storage
Design Head (m)	1.900	Application	Surface
Design Flow (l/s)	7.8	Sump Available	Yes
Flush-Flo™	Calculated	Diameter (mm)	117

Hydro-Brake® Optimum Manhole: S87, DS/PN: S1.018, Volume (m³): 3.5

Invert Level (m) 138.136 Suggested Manhole Diameter (mm) 1200
Minimum Outlet Pipe Diameter (mm) 150

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	7.8	Kick-Flo®	1.040	5.9
Flush-Flo™	0.508	7.4	Mean Flow over Head Range	-	6.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.1	0.600	7.4	1.600	7.2	2.600	9.0	5.000	12.3	7.500	14.9
0.200	6.4	0.800	7.1	1.800	7.6	3.000	9.7	5.500	12.9	8.000	15.4
0.300	7.1	1.000	6.2	2.000	8.0	3.500	10.4	6.000	13.4	8.500	15.9
0.400	7.3	1.200	6.3	2.200	8.3	4.000	11.1	6.500	14.0	9.000	16.3
0.500	7.4	1.400	6.8	2.400	8.7	4.500	11.7	7.000	14.5	9.500	16.7

Orifice Manhole: S90, DS/PN: S15.001, Volume (m³): 1.6

Diameter (m) 0.059 Discharge Coefficient 0.600 Invert Level (m) 142.912

Orifice Manhole: S91, DS/PN: S15.002, Volume (m³): 1.9

Diameter (m) 0.059 Discharge Coefficient 0.600 Invert Level (m) 142.775

Orifice Manhole: S92, DS/PN: S15.003, Volume (m^3): 1.8

Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 142.557

Orifice Manhole: S93, DS/PN: S15.004, Volume (m^3): 1.5

Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 142.324

Orifice Manhole: S94, DS/PN: S15.005, Volume (m^3): 1.4

Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 141.873

Orifice Manhole: S95, DS/PN: S15.006, Volume (m^3): 1.4

Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 141.619

Orifice Manhole: S96, DS/PN: S15.007, Volume (m^3): 1.3

Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 141.400

Orifice Manhole: S97, DS/PN: S15.008, Volume (m^3): 2.7

Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 140.000

Storage Structures for Storm

Cellular Storage Manhole: S5, DS/PN: S2.002

Invert Level (m) 157.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	1410.0	0.0	0.300	1410.0	0.0	0.301	0.0	0.0

Bio-Retention Area Manhole: S7, DS/PN: S2.004

Invert Level (m) 150.549 Infiltration Coefficient Side (m/hr) 0.01494
Porosity 0.30 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.01494

Depth (m)	**Area (m²)**	**Perimeter (m)**	**Depth (m)**	**Area (m²)**	**Perimeter (m)**
0.000	10.3	14.000	0.500	95.0	38.000

Filter Drain Manhole: S9, DS/PN: S4.000

Infiltration Coefficient Base (m/hr) 0.01494 Trench Length (m) 10.0
Infiltration Coefficient Side (m/hr) 0.01494 Pipe Diameter (m) 0.225
Safety Factor 1.0 Pipe Depth above Invert (m) 0.100
Porosity 0.30 Number of Pipes 1
Invert Level (m) 153.200 Slope (1:X) 35.0
Trench Width (m) 1.0 Cap Volume Depth (m) 0.000

Filter Drain Manhole: S9, DS/PN: S4.000

Cap Infiltration Depth (m) 0.000

Filter Drain Manhole: S10, DS/PN: S4.001

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	35.0
Invert Level (m)	152.509	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	10.0		

Filter Drain Manhole: S11, DS/PN: S4.002

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	35.0
Invert Level (m)	152.635	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	10.0		

Filter Drain Manhole: S12, DS/PN: S4.003

Infiltration Coefficient Base (m/hr)	0.01494	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.01494	Trench Length (m)	10.0
Safety Factor	1.0	Pipe Diameter (m)	0.225
Porosity	0.30	Pipe Depth above Invert (m)	0.100
Invert Level (m)	151.927	Number of Pipes	1

Filter Drain Manhole: S12, DS/PN: S4.003

Slope (1:X)	35.0	Cap Infiltration Depth (m)	0.000
Cap Volume Depth (m)	0.000		

Filter Drain Manhole: S13, DS/PN: S4.004

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	25.0
Invert Level (m)	152.070	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	10.0		

Filter Drain Manhole: S14, DS/PN: S4.005

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	25.0
Invert Level (m)	151.103	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	10.0		

Filter Drain Manhole: S15, DS/PN: S4.006

Infiltration Coefficient Base (m/hr)	0.01494	Invert Level (m)	151.003
Infiltration Coefficient Side (m/hr)	0.01494	Trench Width (m)	1.0
Safety Factor	1.0	Trench Length (m)	10.0
Porosity	0.30	Pipe Diameter (m)	0.225

Filter Drain Manhole: S15, DS/PN: S4.006

Pipe Depth above Invert (m)	0.100	Cap Volume Depth (m)	0.000
Number of Pipes	1	Cap Infiltration Depth (m)	0.000
Slope (1:X)	20.0		

Filter Drain Manhole: S16, DS/PN: S4.007

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	150.036	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	10.0		

Filter Drain Manhole: S17, DS/PN: S4.008

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	149.937	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	10.0		

Filter Drain Manhole: S18, DS/PN: S4.009

Infiltration Coefficient Base (m/hr)	0.01494	Porosity	0.30
Infiltration Coefficient Side (m/hr)	0.01494	Invert Level (m)	149.007
Safety Factor	1.0	Trench Width (m)	1.0

Filter Drain Manhole: S18, DS/PN: S4.009

Trench Length (m)	10.0	Slope (1:X)	20.0
Pipe Diameter (m)	0.225	Cap Volume Depth (m)	0.000
Pipe Depth above Invert (m)	0.100	Cap Infiltration Depth (m)	0.000
Number of Pipes	1		

Cellular Storage Manhole: S24, DS/PN: S5.002

Invert Level (m)	149.000	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1140.0	0.0	0.300	1140.0	0.0	0.301	0.0	0.0

Bio-Retention Area Manhole: S26, DS/PN: S5.004

Invert Level (m)	148.106	Infiltration Coefficient Side (m/hr)	0.01494
Porosity	0.30	Safety Factor	1.0
Infiltration Coefficient Base (m/hr)	0.01494		

Depth (m)	Area (m²)	Perimeter (m)	Depth (m)	Area (m²)	Perimeter (m)
0.000	7.0	11.500	0.500	137.0	62.000

Cellular Storage Manhole: S36, DS/PN: S7.003

Invert Level (m)	144.406	Infiltration Coefficient Side (m/hr)	0.00000
Infiltration Coefficient Base (m/hr)	0.00000	Safety Factor	2.0

Cellular Storage Manhole: S36, DS/PN: S7.003

Porosity 0.30

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	580.0	0.0	0.300	580.0	0.0	0.301	0.0	0.0

Filter Drain Manhole: S39, DS/PN: S9.000

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	148.863	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	10.0		

Filter Drain Manhole: S40, DS/PN: S9.001

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	148.364	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	12.0		

Filter Drain Manhole: S41, DS/PN: S9.002

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	147.769	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	6.0		

Filter Drain Manhole: S42, DS/PN: S9.003

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	147.460	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	8.0		

Filter Drain Manhole: S43, DS/PN: S9.004

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	147.059	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	7.0		

Filter Drain Manhole: S44, DS/PN: S9.005

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	146.696	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	8.5		

Filter Drain Manhole: S45, DS/PN: S9.006

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	146.261	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	6.0		

Filter Drain Manhole: S46, DS/PN: S9.007

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	145.967	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	12.0		

Filter Drain Manhole: S47, DS/PN: S9.008

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	20.0
Invert Level (m)	145.351	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	9.8		

Bio-Retention Area Manhole: S53, DS/PN: S1.011

Invert Level (m)	138.585	Infiltration Coefficient Side (m/hr)	0.05983
Porosity	0.30	Safety Factor	1.0
Infiltration Coefficient Base (m/hr)	0.05983		

Depth (m)	Area (m²)	Perimeter (m)	Depth (m)	Area (m²)	Perimeter (m)	Depth (m)	Area (m²)	Perimeter (m)
0.000	380.0	145.200	0.500	490.7	150.000	1.000	615.6	154.630
0.300	444.7	147.000	0.700	539.0	152.000			

Filter Drain Manhole: S55, DS/PN: S10.000

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	30.0
Invert Level (m)	143.250	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	12.0		

Filter Drain Manhole: S56, DS/PN: S10.001

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	30.0
Invert Level (m)	142.848	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	12.0		

Filter Drain Manhole: S57, DS/PN: S10.002

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	245.0
Invert Level (m)	142.445	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	6.0		

Filter Drain Manhole: S58, DS/PN: S10.003

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	245.0
Invert Level (m)	142.345	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	20.0		

Filter Drain Manhole: S59, DS/PN: S10.004

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	245.0
Invert Level (m)	142.261	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	6.0		

Filter Drain Manhole: S60, DS/PN: S10.005

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	245.0
Invert Level (m)	142.237	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	3.0		

Filter Drain Manhole: S61, DS/PN: S10.006

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	245.0
Invert Level (m)	142.224	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	5.0		

Cellular Storage Manhole: S66, DS/PN: S11.002

Invert Level (m) 142.051 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	700.7	0.0	0.300	700.7	0.0	0.301	0.0	0.0

Cellular Storage Manhole: S71, DS/PN: S12.001

Invert Level (m) 143.132 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	556.0	0.0	0.300	556.0	0.0	0.301	0.0	0.0

Filter Drain Manhole: S73, DS/PN: S12.003

Infiltration Coefficient Base (m/hr)	0.01494	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.01494	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	50.0
Invert Level (m)	142.945	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000
Trench Length (m)	26.5		

Bio-Retention Area Manhole: S76, DS/PN: S12.006

Invert Level (m) 141.208 Infiltration Coefficient Side (m/hr) 0.01494
Porosity 0.30 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.01494

Depth (m)	Area (m^2)	Perimeter (m)	Depth (m)	Area (m^2)	Perimeter (m)
0.000	20.0	4.000	0.500	65.0	34.000

Filter Drain Manhole: S79, DS/PN: S14.001

Infiltration Coefficient Base (m/hr) 0.01494 Pipe Diameter (m) 0.150
Infiltration Coefficient Side (m/hr) 0.01494 Pipe Depth above Invert (m) 0.100
Safety Factor 1.0 Number of Pipes 1
Porosity 0.30 Slope (1:X) 245.0
Invert Level (m) 141.481 Cap Volume Depth (m) 0.000
Trench Width (m) 0.7 Cap Infiltration Depth (m) 0.000
Trench Length (m) 24.0

Cellular Storage Manhole: S82, DS/PN: S14.004

Invert Level (m) 141.311 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.01494

Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)
0.000	50.0	0.0	0.700	50.0	20.0	0.701	0.0	20.0

Cellular Storage Manhole: S87, DS/PN: S1.018

Invert Level (m)	138.136	Safety Factor	1.0
Infiltration Coefficient Base (m/hr)	0.01494	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.01494		

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	82.0	0.0	1.900	82.0	75.0	1.901	0.0	75.0

Filter Drain Manhole: S90, DS/PN: S15.001

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	30.0
Invert Level (m)	142.912	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	7.5		

Filter Drain Manhole: S91, DS/PN: S15.002

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	30.0
Invert Level (m)	142.775	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	8.7		

Filter Drain Manhole: S92, DS/PN: S15.003

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	30.0
Invert Level (m)	142.557	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	7.0		

Filter Drain Manhole: S93, DS/PN: S15.004

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	30.0
Invert Level (m)	142.324	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	13.5		

Filter Drain Manhole: S94, DS/PN: S15.005

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	30.0
Invert Level (m)	141.873	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	7.6		

Filter Drain Manhole: S95, DS/PN: S15.006

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	30.0
Invert Level (m)	141.619	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	6.6		

Filter Drain Manhole: S96, DS/PN: S15.007

Infiltration Coefficient Base (m/hr)	0.05983	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.05983	Pipe Depth above Invert (m)	0.100
Safety Factor	1.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	30.0
Invert Level (m)	141.400	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	4.2		

Infiltration Basin Manhole: S98, DS/PN: S15.009

Invert Level (m)	139.773	Safety Factor	1.0
Infiltration Coefficient Base (m/hr)	0.05983	Porosity	0.30
Infiltration Coefficient Side (m/hr)	0.05983		

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	40.0	1.500	40.0	1.501	0.0

Time Area Diagram for Green Roof at Pipe Number S2.000 (Storm)

Area (m³) 980 Depression Storage (mm) 5 Evaporation (mm/day) 1 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.017809	24	28	0.005364	48	52	0.001616	72	76	0.000487	96	100	0.000147
4	8	0.014580	28	32	0.004392	52	56	0.001323	76	80	0.000398	100	104	0.000120
8	12	0.011937	32	36	0.003595	56	60	0.001083	80	84	0.000326	104	108	0.000098
12	16	0.009774	36	40	0.002944	60	64	0.000887	84	88	0.000267	108	112	0.000080
16	20	0.008002	40	44	0.002410	64	68	0.000726	88	92	0.000219	112	116	0.000066
20	24	0.006551	44	48	0.001973	68	72	0.000594	92	96	0.000179	116	120	0.000054

Time Area Diagram for Green Roof at Pipe Number S3.000 (Storm)

Area (m³) 700 Depression Storage (mm) 5 Evaporation (mm/day) 1 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.012720	24	28	0.003831	48	52	0.001154	72	76	0.000348	96	100	0.000105
4	8	0.010415	28	32	0.003137	52	56	0.000945	76	80	0.000285	100	104	0.000086
8	12	0.008527	32	36	0.002568	56	60	0.000774	80	84	0.000233	104	108	0.000070
12	16	0.006981	36	40	0.002103	60	64	0.000633	84	88	0.000191	108	112	0.000057
16	20	0.005716	40	44	0.001722	64	68	0.000519	88	92	0.000156	112	116	0.000047
20	24	0.004680	44	48	0.001409	68	72	0.000425	92	96	0.000128	116	120	0.000039

Time Area Diagram for Green Roof at Pipe Number S5.000 (Storm)

Area (m³) 355 Depression Storage (mm) 5 Evaporation (mm/day) 1 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006451	24	28	0.001943	48	52	0.000585	72	76	0.000176	96	100	0.000053
4	8	0.005282	28	32	0.001591	52	56	0.000479	76	80	0.000144	100	104	0.000043
8	12	0.004324	32	36	0.001302	56	60	0.000392	80	84	0.000118	104	108	0.000036
12	16	0.003540	36	40	0.001066	60	64	0.000321	84	88	0.000097	108	112	0.000029
16	20	0.002899	40	44	0.000873	64	68	0.000263	88	92	0.000079	112	116	0.000024
20	24	0.002373	44	48	0.000715	68	72	0.000215	92	96	0.000065	116	120	0.000020

Time Area Diagram for Green Roof at Pipe Number S6.000 (Storm)

Area (m³) 900 Depression Storage (mm) 5 Evaporation (mm/day) 1 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.016355	24	28	0.004926	48	52	0.001484	72	76	0.000447	96	100	0.000135
4	8	0.013390	28	32	0.004033	52	56	0.001215	76	80	0.000366	100	104	0.000110
8	12	0.010963	32	36	0.003302	56	60	0.000995	80	84	0.000300	104	108	0.000090
12	16	0.008976	36	40	0.002703	60	64	0.000814	84	88	0.000245	108	112	0.000074
16	20	0.007349	40	44	0.002213	64	68	0.000667	88	92	0.000201	112	116	0.000060
20	24	0.006017	44	48	0.001812	68	72	0.000546	92	96	0.000164	116	120	0.000050

Time Area Diagram for Green Roof at Pipe Number S7.000 (Storm)

Area (m³) 760 Depression Storage (mm) 5 Evaporation (mm/day) 1 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.013811	24	28	0.004160	48	52	0.001253	72	76	0.000377	96	100	0.000114
4	8	0.011307	28	32	0.003406	52	56	0.001026	76	80	0.000309	100	104	0.000093
8	12	0.009258	32	36	0.002788	56	60	0.000840	80	84	0.000253	104	108	0.000076
12	16	0.007579	36	40	0.002283	60	64	0.000688	84	88	0.000207	108	112	0.000062
16	20	0.006206	40	44	0.001869	64	68	0.000563	88	92	0.000170	112	116	0.000051
20	24	0.005081	44	48	0.001530	68	72	0.000461	92	96	0.000139	116	120	0.000042

Time Area Diagram for Green Roof at Pipe Number S8.000 (Storm)

Area (m³) 500 Depression Storage (mm) 5 Evaporation (mm/day) 1 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.009086	24	28	0.002737	48	52	0.000824	72	76	0.000248	96	100	0.000075
4	8	0.007439	28	32	0.002241	52	56	0.000675	76	80	0.000203	100	104	0.000061
8	12	0.006091	32	36	0.001834	56	60	0.000553	80	84	0.000166	104	108	0.000050
12	16	0.004986	36	40	0.001502	60	64	0.000452	84	88	0.000136	108	112	0.000041
16	20	0.004083	40	44	0.001230	64	68	0.000370	88	92	0.000112	112	116	0.000034
20	24	0.003343	44	48	0.001007	68	72	0.000303	92	96	0.000091	116	120	0.000028

Time Area Diagram for Green Roof at Pipe Number S11.001 (Storm)

Area (m³) 700 Depression Storage (mm) 5 Evaporation (mm/day) 1 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.012720	24	28	0.003831	48	52	0.001154	72	76	0.000348	96	100	0.000105
4	8	0.010415	28	32	0.003137	52	56	0.000945	76	80	0.000285	100	104	0.000086
8	12	0.008527	32	36	0.002568	56	60	0.000774	80	84	0.000233	104	108	0.000070
12	16	0.006981	36	40	0.002103	60	64	0.000633	84	88	0.000191	108	112	0.000057
16	20	0.005716	40	44	0.001722	64	68	0.000519	88	92	0.000156	112	116	0.000047
20	24	0.004680	44	48	0.001409	68	72	0.000425	92	96	0.000128	116	120	0.000039

Time Area Diagram for Green Roof at Pipe Number S12.000 (Storm)

Area (m³) 495 Depression Storage (mm) 5 Evaporation (mm/day) 1 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.008995	24	28	0.002709	48	52	0.000816	72	76	0.000246	96	100	0.000074
4	8	0.007365	28	32	0.002218	52	56	0.000668	76	80	0.000201	100	104	0.000061
8	12	0.006030	32	36	0.001816	56	60	0.000547	80	84	0.000165	104	108	0.000050
12	16	0.004937	36	40	0.001487	60	64	0.000448	84	88	0.000135	108	112	0.000041
16	20	0.004042	40	44	0.001217	64	68	0.000367	88	92	0.000110	112	116	0.000033
20	24	0.003309	44	48	0.000997	68	72	0.000300	92	96	0.000090	116	120	0.000027

Time Area Diagram for Green Roof at Pipe Number S13.000 (Storm)

Area (m^3) 760 Depression Storage (mm) 5 Evaporation (mm/day) 1 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.013811	24	28	0.004160	48	52	0.001253	72	76	0.000377	96	100	0.000114
4	8	0.011307	28	32	0.003406	52	56	0.001026	76	80	0.000309	100	104	0.000093
8	12	0.009258	32	36	0.002788	56	60	0.000840	80	84	0.000253	104	108	0.000076
12	16	0.007579	36	40	0.002283	60	64	0.000688	84	88	0.000207	108	112	0.000062
16	20	0.006206	40	44	0.001869	64	68	0.000563	88	92	0.000170	112	116	0.000051
20	24	0.005081	44	48	0.001530	68	72	0.000461	92	96	0.000139	116	120	0.000042

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 9
Number of Online Controls 32 Number of Storage Structures 47 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.269 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 5, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1	15 minute 5 year Summer I+20%	154.047	152.622	-0.225	0.000		0.000	0.0	0.0	OK
S2.000	S2	15 minute 5 year Summer I+20%	158.150	157.300	0.000	0.000		0.518	0.1	6.1	SURCHARGED*
S3.000	S3	15 minute 5 year Summer I+20%	158.150	157.300	0.000	0.000		0.517	0.1	4.3	SURCHARGED*
S2.001	S4	15 minute 5 year Summer I+20%	158.150	157.224	0.118	0.000		2.987	1.0	20.9	SURCHARGED*
S2.002	S5	2160 minute 5 year Summer I+20%	158.150	157.730	4.748	0.000	0.000	102.182	1.0	1.2	SURCHARGED*
S2.003	S6	2160 minute 5 year Summer I+20%	153.011	151.547	-0.212	0.000		0.010	1.2	1.2	OK
S2.004	S7	2160 minute 5 year Summer I+20%	151.478	150.740	-0.034	0.000	10.678	1.435	0.9	1.2	OK
S1.001	S8	2160 minute 5 year Summer I+20%	151.465	150.058	-0.214	0.000		0.009	1.2	1.2	OK
S4.000	S9	15 minute 5 year Summer I+20%	154.003	152.918	-0.107	0.000	0.000	0.128	1.7	25.7	OK
S4.001	S10	15 minute 5 year Summer I+20%	153.804	152.892	0.158	0.000	0.030	1.581	1.4	17.1	SURCHARGED*
S4.002	S11	15 minute 5 year Summer I+20%	153.589	152.876	0.433	0.000	0.014	1.451	1.7	16.3	SURCHARGED
S4.003	S12	15 minute 5 year Summer I+20%	153.373	151.998	-0.155	0.000	0.008	0.107	1.5	16.2	OK*
S4.004	S13	30 minute 5 year Summer I+20%	152.976	151.837	-0.025	0.000	0.000	0.329	2.0	21.1	OK
S4.005	S14	30 minute 5 year Summer I+20%	152.440	151.812	0.484	0.000	0.087	2.908	2.1	17.0	SURCHARGED*
S4.006	S15	30 minute 5 year Summer I+20%	151.904	150.648	-0.146	0.000	0.000	0.093	2.1	25.6	OK
S4.007	S16	30 minute 5 year Summer I+20%	151.368	150.408	0.147	0.000	0.044	1.063	2.4	24.9	SURCHARGED*
S4.008	S17	30 minute 5 year Summer I+20%	150.831	149.593	-0.135	0.000	0.000	0.107	2.2	32.1	OK
S4.009	S18	30 minute 5 year Summer I+20%	150.341	149.113	-0.118	0.000	0.011	0.150	2.2	31.7	OK*
S4.010	S19	30 minute 5 year Summer I+20%	149.850	149.063	0.327	0.000		0.937	2.5	31.6	SURCHARGED
S1.002	S20	30 minute 5 year Summer I+20%	149.660	148.149	-0.133	0.000		0.109	2.1	32.0	OK
S5.000	S21	60 minute 5 year Summer I+20%	151.500	150.959	-0.166	0.000		0.054	0.5	3.4	OK*
S6.000	S22	60 minute 5 year Summer I+20%	151.500	150.974	-0.151	0.000		0.069	0.8	8.6	OK*
S5.001	S23	60 minute 5 year Summer I+20%	151.500	150.936	-0.069	0.000		0.922	0.8	24.5	OK*
S5.002	S24	1440 minute 5 year Summer I+20%	151.500	149.207	-0.018	0.000	0.000	70.783	0.5	2.2	OK
S5.003	S25	1440 minute 5 year Summer I+20%	150.420	148.880	-0.200	0.000		0.044	1.0	2.2	OK
S5.004	S26	1440 minute 5 year Summer I+20%	148.996	148.379	0.048	0.000	5.104	2.815	1.1	2.1	SURCHARGED

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.003	S27	30 minute 5 year Summer I+20%	148.901	147.545	-0.142	0.000		0.102	2.4	32.0	OK
S1.004	S28	30 minute 5 year Summer I+20%	147.533	146.220	-0.140	0.000		0.102	2.3	32.0	OK
S1.005	S29	30 minute 5 year Summer I+20%	146.766	145.419	-0.139	0.000		0.102	2.3	32.0	OK
S1.006	S30	30 minute 5 year Summer I+20%	146.074	144.687	-0.141	0.000		0.100	2.4	32.0	OK
S7.000	S31	1440 minute 5 year Summer I+20%	146.150	144.651	-0.149	0.000		0.071	0.5	2.4	OK*
S7.001	S32	1440 minute 5 year Summer I+20%	146.150	144.650	-0.098	0.000		0.266	0.5	2.4	OK*
S8.000	S33	1440 minute 5 year Summer I+20%	146.150	144.651	-0.149	0.000		0.071	0.5	1.6	OK*
S8.001	S34	1440 minute 5 year Summer I+20%	146.150	144.650	-0.086	0.000		0.326	0.4	1.5	OK*
S7.002	S35	1440 minute 5 year Summer I+20%	146.150	144.650	-0.065	0.000		0.303	0.6	3.9	OK*
S7.003	S36	1440 minute 5 year Summer I+20%	146.150	144.648	0.017	0.000	0.000	42.853	0.5	1.2	SURCHARGED*
S7.004	S37	15 minute 5 year Summer I+20%	146.150	144.454	-0.145	0.000		0.129	0.8	10.0	OK
S7.005	S38	15 minute 5 year Summer I+20%	146.036	144.283	-0.145	0.000		0.173	0.8	10.1	OK
S9.000	S39	15 minute 5 year Summer I+20%	149.937	148.697	-0.116	0.000	0.000	0.033	1.4	4.1	OK
S9.001	S40	15 minute 5 year Summer I+20%	149.447	148.594	0.280	0.000	0.006	0.718	1.5	5.4	SURCHARGED
S9.002	S41	30 minute 5 year Summer I+20%	148.875	148.225	0.505	0.000	0.028	1.430	1.5	5.6	SURCHARGED
S9.003	S42	60 minute 5 year Summer I+20%	148.607	147.843	0.433	0.000	0.040	1.146	1.6	5.2	SURCHARGED
S9.004	S43	60 minute 5 year Summer I+20%	148.296	147.546	0.537	0.000	0.068	1.502	1.3	4.6	SURCHARGED
S9.005	S44	60 minute 5 year Summer I+20%	147.941	147.281	0.635	0.000	0.111	1.857	1.5	4.4	SURCHARGED
S9.006	S45	120 minute 5 year Summer I+20%	147.409	146.834	0.623	0.000	0.120	1.698	1.4	4.6	SURCHARGED
S9.007	S46	120 minute 5 year Summer I+20%	147.040	146.343	0.426	0.000	0.105	1.117	1.5	4.8	SURCHARGED
S9.008	S47	30 minute 5 year Summer I+20%	146.239	145.639	0.338	0.000	0.022	0.895	1.7	6.9	SURCHARGED
S9.009	S48	60 minute 5 year Summer I+20%	145.412	144.493	0.364	0.000		0.669	0.7	7.6	SURCHARGED
S1.007	S49	30 minute 5 year Summer I+20%	145.010	143.558	-0.192	0.000		0.118	2.1	47.5	OK
S1.008	S50	30 minute 5 year Summer I+20%	144.516	143.100	-0.196	0.000		0.126	2.2	47.5	OK
S1.009	S51	30 minute 5 year Summer I+20%	143.000	141.350	-0.203	0.000		0.104	2.4	47.4	OK
S1.010	S52	30 minute 5 year Summer I+20%	142.100	140.664	-0.126	0.000		0.110	2.8	47.5	OK*

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Infil. Vol (m^3)	Maximum Vol (m^3)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.011	S53	720 minute 5 year Summer I+20%	140.300	139.154	0.269	0.000	413.011	76.341	0.2	0.3	SURCHARGED
S1.012	S54	600 minute 5 year Summer I+20%	143.314	138.861	0.047	0.000		1.506	0.2	0.7	SURCHARGED
S10.000	S55	15 minute 5 year Summer I+20%	144.175	143.326	-0.074	0.000	0.014	0.099	1.7	15.2	OK
S10.001	S56	15 minute 5 year Summer I+20%	143.624	142.925	-0.073	0.000	0.013	0.111	1.7	15.2	OK
S10.002	S57	15 minute 5 year Summer I+20%	143.406	142.627	0.032	0.000	0.085	0.496	0.8	14.9	SURCHARGED
S10.003	S58	15 minute 5 year Summer I+20%	143.371	142.488	-0.082	0.000	0.220	0.625	0.8	21.4	OK
S10.004	S59	15 minute 5 year Summer I+20%	143.269	142.431	-0.056	0.000	0.098	0.837	0.7	21.7	OK
S10.005	S60	15 minute 5 year Summer I+20%	143.366	142.412	-0.050	0.000	0.053	0.445	0.7	21.1	OK
S10.006	S61	15 minute 5 year Summer I+20%	143.347	142.399	-0.050	0.000	0.090	0.447	0.7	23.6	OK
S10.007	S62	15 minute 5 year Summer I+20%	143.317	141.758	-0.068	0.000		0.172	0.8	23.7	OK
S1.013	S63	600 minute 5 year Summer I+20%	143.230	138.861	0.117	0.000		1.608	0.6	4.6	SURCHARGED
S11.000	S64	240 minute 5 year Summer I+20%	142.650	142.165	-0.135	0.000		0.181	0.6	9.7	OK
S11.001	S65	240 minute 5 year Summer I+20%	142.650	142.164	-0.037	0.000		0.660	0.5	14.1	OK
S11.002	S66	240 minute 5 year Summer I+20%	142.650	142.162	0.112	0.000	0.000	24.116	0.4	4.6	SURCHARGED
S11.003	S67	240 minute 5 year Summer I+20%	142.650	142.208	0.583	0.000		1.009	0.8	3.8	SURCHARGED
S1.014	S68	600 minute 5 year Summer I+20%	142.718	138.860	0.222	0.000		1.911	0.6	8.7	SURCHARGED
S12.000	S69	10080 minute 5 year Summer I+20%	148.500	143.450	0.000	0.000		0.823	0.2	0.7	SURCHARGED*
S13.000	S70	10080 minute 5 year Summer I+20%	148.500	143.450	0.000	0.000		0.824	0.3	0.8	SURCHARGED*
S12.001	S71	10080 minute 5 year Summer I+20%	148.500	143.433	0.076	0.000	0.000	51.901	0.5	1.2	SURCHARGED*
S12.002	S72	1440 minute 5 year Summer I+20%	148.500	143.072	-0.192	0.000		0.062	0.6	2.2	OK
S12.003	S73	1440 minute 5 year Summer I+20%	144.295	142.972	-0.199	0.000	0.079	0.033	0.9	2.2	OK
S12.004	S74	1440 minute 5 year Summer I+20%	143.692	141.691	-0.194	0.000		0.030	0.7	2.3	OK
S12.005	S75	2160 minute 5 year Summer I+20%	142.623	141.578	-0.049	0.000		0.452	0.8	2.2	OK
S12.006	S76	2160 minute 5 year Summer I+20%	142.530	141.576	0.143	0.000	15.468	4.493	0.8	2.0	SURCHARGED
S1.015	S77	600 minute 5 year Summer I+20%	142.160	138.857	0.277	0.000		1.323	0.5	10.0	SURCHARGED
S14.000	S78	2160 minute 5 year Summer I+20%	142.500	141.768	0.043	0.000		0.297	0.3	1.4	SURCHARGED

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S14.001	S79	2160 minute 5 year Summer I+20%	143.000	141.767	0.061	0.000	10.567	1.915	0.4	1.2	SURCHARGED
S14.002	S80	2160 minute 5 year Summer I+20%	144.000	141.767	0.140	0.000		1.135	0.3	1.2	SURCHARGED
S14.003	S81	2160 minute 5 year Summer I+20%	143.100	141.766	0.190	0.000		0.897	0.2	1.1	SURCHARGED
S14.004	S82	2160 minute 5 year Summer I+20%	142.962	141.766	0.230	0.000	6.071	22.480	0.2	0.2	SURCHARGED
S14.005	S83	2160 minute 5 year Summer I+20%	142.210	140.981	-0.222	0.000		0.000	0.2	0.2	OK
S14.006	S84	2160 minute 5 year Summer I+20%	142.087	140.768	-0.223	0.000		0.000	0.2	0.2	OK
S1.016	S85	600 minute 5 year Summer I+20%	141.700	138.852	0.405	0.000		1.319	0.6	14.9	SURCHARGED
S1.017	S86	600 minute 5 year Summer I+20%	141.455	138.842	0.455	0.000		1.122	0.4	15.5	SURCHARGED
S1.018	S87	600 minute 5 year Summer I+20%	140.927	138.832	0.471	0.000	2.821	55.334	0.8	7.4	SURCHARGED
S1.019	S88	600 minute 5 year Summer I+20%	140.624	138.181	-0.151	0.000		0.111	0.6	7.4	OK
S15.000	S89	30 minute 5 year Summer I+20%	144.295	143.421	0.347	0.000		0.557	0.1	0.4	SURCHARGED
S15.001	S90	30 minute 5 year Summer I+20%	144.297	143.422	0.360	0.000	0.347	1.544	1.0	3.7	SURCHARGED
S15.002	S91	60 minute 5 year Summer I+20%	144.385	143.177	0.252	0.000	0.513	1.280	1.1	4.0	SURCHARGED
S15.003	S92	60 minute 5 year Summer I+20%	144.052	142.936	0.229	0.000	0.506	1.179	1.0	3.1	SURCHARGED
S15.004	S93	60 minute 5 year Summer I+20%	143.516	142.635	0.161	0.000	0.595	0.991	1.3	3.0	SURCHARGED
S15.005	S94	120 minute 5 year Summer I+20%	143.013	142.145	0.122	0.000	0.645	0.732	1.1	2.7	SURCHARGED
S15.006	S95	180 minute 5 year Summer I+20%	142.727	141.907	0.138	0.000	0.780	0.806	1.0	2.7	SURCHARGED
S15.007	S96	60 minute 5 year Summer I+20%	142.492	141.700	0.150	0.000	0.440	0.756	1.1	3.0	SURCHARGED
S15.008	S97	360 minute 5 year Summer I+20%	142.373	140.688	0.538	0.000		0.772	0.1	2.6	SURCHARGED
S15.009	S98	360 minute 5 year Summer I+20%	142.000	140.553	-1.297	0.000	23.507	10.325	0.0	0.0	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 9
Number of Online Controls 32 Number of Storage Structures 47 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.269 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 5, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1	15 minute 30 year Summer I+20%	154.047	152.622	-0.225	0.000		0.000	0.0	0.0	OK
S2.000	S2	15 minute 30 year Summer I+20%	158.150	157.300	0.000	0.000		0.560	0.2	10.7	SURCHARGED*
S3.000	S3	15 minute 30 year Summer I+20%	158.150	157.300	0.000	0.000		0.561	0.1	7.7	SURCHARGED*
S2.001	S4	15 minute 30 year Summer I+20%	158.150	157.224	0.118	0.000		3.032	1.0	30.9	SURCHARGED*
S2.002	S5	5760 minute 30 year Summer I+20%	158.150	157.801	4.819	0.000	0.000	132.602	1.0	1.5	SURCHARGED*
S2.003	S6	2160 minute 30 year Summer I+20%	153.011	151.555	-0.204	0.000		0.020	1.4	2.1	OK
S2.004	S7	2160 minute 30 year Summer I+20%	151.478	150.980	0.206	0.000	14.349	5.753	1.0	1.8	SURCHARGED
S1.001	S8	2160 minute 30 year Summer I+20%	151.465	150.064	-0.207	0.000		0.018	1.4	1.8	OK
S4.000	S9	30 minute 30 year Summer I+20%	154.003	153.188	0.163	0.000	0.000	0.434	1.7	30.4	SURCHARGED
S4.001	S10	30 minute 30 year Summer I+20%	153.804	153.163	0.429	0.000	0.071	2.832	1.4	22.3	SURCHARGED*
S4.002	S11	30 minute 30 year Summer I+20%	153.589	153.143	0.700	0.000	0.048	2.766	1.8	19.5	SURCHARGED
S4.003	S12	30 minute 30 year Summer I+20%	153.373	152.091	-0.061	0.000	0.024	0.383	1.6	18.6	OK*
S4.004	S13	30 minute 30 year Summer I+20%	152.976	152.072	0.210	0.000	0.000	0.834	2.1	24.1	SURCHARGED
S4.005	S14	30 minute 30 year Summer I+20%	152.440	152.044	0.716	0.000	0.140	3.837	2.2	19.7	SURCHARGED*
S4.006	S15	15 minute 30 year Summer I+20%	151.904	150.703	-0.092	0.000	0.000	0.174	2.3	38.3	OK
S4.007	S16	15 minute 30 year Summer I+20%	151.368	150.632	0.371	0.000	0.053	2.199	2.5	33.0	SURCHARGED*
S4.008	S17	15 minute 30 year Summer I+20%	150.831	149.616	-0.112	0.000	0.000	0.141	2.4	47.2	OK
S4.009	S18	30 minute 30 year Summer I+20%	150.341	149.473	0.241	0.000	0.034	1.514	2.2	41.1	SURCHARGED*
S4.010	S19	30 minute 30 year Summer I+20%	149.850	149.387	0.652	0.000		1.357	2.7	40.9	SURCHARGED
S1.002	S20	30 minute 30 year Summer I+20%	149.660	148.163	-0.119	0.000		0.127	2.3	41.5	OK
S5.000	S21	60 minute 30 year Summer I+20%	151.500	151.048	-0.077	0.000		0.143	0.5	5.4	OK*
S6.000	S22	60 minute 30 year Summer I+20%	151.500	151.057	-0.068	0.000		0.152	0.9	13.2	OK*
S5.001	S23	60 minute 30 year Summer I+20%	151.500	151.021	0.016	0.000		1.856	0.9	37.5	SURCHARGED*
S5.002	S24	960 minute 30 year Summer I+20%	151.500	149.294	0.069	0.000	0.000	100.717	0.6	2.7	SURCHARGED
S5.003	S25	960 minute 30 year Summer I+20%	150.420	148.882	-0.198	0.000		0.049	1.0	2.7	OK
S5.004	S26	1440 minute 30 year Summer I+20%	148.996	148.481	0.150	0.000	7.222	5.292	1.2	2.5	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.003	S27	30 minute 30 year Summer I+20%	148.901	147.558	-0.129	0.000		0.119	2.6	41.6	OK
S1.004	S28	30 minute 30 year Summer I+20%	147.533	146.233	-0.126	0.000		0.119	2.5	41.6	OK
S1.005	S29	30 minute 30 year Summer I+20%	146.766	145.433	-0.125	0.000		0.120	2.5	41.6	OK
S1.006	S30	30 minute 30 year Summer I+20%	146.074	144.700	-0.128	0.000		0.117	2.5	41.6	OK
S7.000	S31	960 minute 30 year Winter I+20%	146.150	144.800	0.000	0.000		0.746	0.5	2.8	SURCHARGED*
S7.001	S32	2160 minute 30 year Summer I+20%	146.150	144.748	0.000	0.000		1.071	0.4	2.4	SURCHARGED*
S8.000	S33	960 minute 30 year Winter I+20%	146.150	144.800	0.000	0.000		0.746	0.5	1.8	SURCHARGED*
S8.001	S34	2160 minute 30 year Summer I+20%	146.150	144.736	0.000	0.000		1.164	0.4	1.6	SURCHARGED*
S7.002	S35	2160 minute 30 year Summer I+20%	146.150	144.731	0.016	0.000		1.014	0.5	3.9	SURCHARGED*
S7.003	S36	2880 minute 30 year Summer I+20%	146.150	144.707	0.076	0.000	0.000	53.471	0.5	1.8	SURCHARGED*
S7.004	S37	15 minute 30 year Summer I+20%	146.150	144.492	-0.107	0.000		0.199	0.9	19.7	OK
S7.005	S38	15 minute 30 year Summer I+20%	146.036	144.320	-0.108	0.000		0.300	0.9	19.6	OK
S9.000	S39	30 minute 30 year Summer I+20%	149.937	148.873	0.060	0.000	0.000	0.232	1.5	5.0	SURCHARGED
S9.001	S40	30 minute 30 year Summer I+20%	149.447	148.863	0.549	0.000	0.037	1.624	1.5	6.0	SURCHARGED
S9.002	S41	30 minute 30 year Summer I+20%	148.875	148.532	0.813	0.000	0.070	2.213	1.5	6.4	SURCHARGED
S9.003	S42	60 minute 30 year Summer I+20%	148.607	148.153	0.743	0.000	0.124	2.143	1.5	5.2	SURCHARGED
S9.004	S43	60 minute 30 year Summer I+20%	148.296	147.853	0.844	0.000	0.157	2.345	1.3	4.7	SURCHARGED
S9.005	S44	120 minute 30 year Summer I+20%	147.941	147.572	0.926	0.000	0.273	2.738	1.5	4.7	SURCHARGED
S9.006	S45	120 minute 30 year Summer I+20%	147.409	147.056	0.846	0.000	0.227	2.233	1.4	5.0	SURCHARGED
S9.007	S46	60 minute 30 year Summer I+20%	147.040	146.476	0.560	0.000	0.178	1.590	1.6	5.4	SURCHARGED
S9.008	S47	30 minute 30 year Summer I+20%	146.239	145.851	0.550	0.000	0.055	1.664	1.8	8.3	SURCHARGED
S9.009	S48	30 minute 30 year Summer I+20%	145.412	144.756	0.627	0.000		1.046	0.7	9.2	SURCHARGED
S1.007	S49	15 minute 30 year Summer I+20%	145.010	143.579	-0.171	0.000		0.146	2.2	65.0	OK
S1.008	S50	15 minute 30 year Summer I+20%	144.516	143.119	-0.177	0.000		0.160	2.4	64.9	OK
S1.009	S51	15 minute 30 year Summer I+20%	143.000	141.368	-0.185	0.000		0.124	2.6	64.7	OK
S1.010	S52	15 minute 30 year Summer I+20%	142.100	140.685	-0.105	0.000		0.141	3.0	64.4	OK*

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.011	S53	960 minute 30 year Summer I+20%	140.300	139.492	0.607	0.000	653.805	132.667	0.2	0.4	SURCHARGED
S1.012	S54	720 minute 30 year Summer I+20%	143.314	139.564	0.749	0.000		2.350	0.2	0.7	SURCHARGED
S10.000	S55	15 minute 30 year Summer I+20%	144.175	143.349	-0.051	0.000	0.019	0.137	1.8	22.5	OK
S10.001	S56	15 minute 30 year Summer I+20%	143.624	142.947	-0.050	0.000	0.018	0.152	1.8	22.6	OK
S10.002	S57	15 minute 30 year Summer I+20%	143.406	142.708	0.113	0.000	0.096	0.768	1.2	20.9	SURCHARGED
S10.003	S58	15 minute 30 year Summer I+20%	143.371	142.609	0.039	0.000	0.271	1.520	0.9	28.6	SURCHARGED
S10.004	S59	15 minute 30 year Summer I+20%	143.269	142.530	0.043	0.000	0.111	1.390	0.7	29.7	SURCHARGED
S10.005	S60	15 minute 30 year Summer I+20%	143.366	142.495	0.033	0.000	0.060	0.657	0.8	29.5	SURCHARGED
S10.006	S61	15 minute 30 year Summer I+20%	143.347	142.471	0.022	0.000	0.101	0.655	0.8	32.7	SURCHARGED
S10.007	S62	15 minute 30 year Summer I+20%	143.317	141.843	0.017	0.000		0.268	0.8	32.5	SURCHARGED
S1.013	S63	720 minute 30 year Summer I+20%	143.230	139.564	0.820	0.000		2.403	0.5	6.2	SURCHARGED
S11.000	S64	240 minute 30 year Summer I+20%	142.650	142.250	-0.050	0.000		0.277	0.6	13.8	OK
S11.001	S65	240 minute 30 year Summer I+20%	142.650	142.249	0.048	0.000		0.863	0.5	20.0	SURCHARGED
S11.002	S66	240 minute 30 year Summer I+20%	142.650	142.247	0.197	0.000	0.000	41.968	0.4	4.8	SURCHARGED
S11.003	S67	360 minute 30 year Winter I+20%	142.650	142.281	0.656	0.000		1.092	0.8	4.1	SURCHARGED
S1.014	S68	720 minute 30 year Summer I+20%	142.718	139.564	0.926	0.000		2.707	0.5	11.1	SURCHARGED
S12.000	S69	10080 minute 30 year Summer I+20%	148.500	143.450	0.000	0.000		1.887	0.2	0.9	SURCHARGED*
S13.000	S70	10080 minute 30 year Summer I+20%	148.500	143.450	0.000	0.000		1.885	0.3	1.1	SURCHARGED*
S12.001	S71	10080 minute 30 year Summer I+20%	148.500	143.433	0.076	0.000	0.000	52.970	0.5	1.8	SURCHARGED*
S12.002	S72	960 minute 30 year Summer I+20%	148.500	143.081	-0.183	0.000		0.084	0.7	3.5	OK
S12.003	S73	960 minute 30 year Summer I+20%	144.295	142.978	-0.193	0.000	0.102	0.043	1.0	3.4	OK
S12.004	S74	1440 minute 30 year Summer I+20%	143.692	141.953	0.068	0.000		0.325	0.7	3.5	SURCHARGED
S12.005	S75	1440 minute 30 year Summer I+20%	142.623	141.946	0.319	0.000		1.588	0.8	3.5	SURCHARGED
S12.006	S76	1440 minute 30 year Summer I+20%	142.530	141.942	0.509	0.000	13.558	11.776	0.9	2.8	SURCHARGED
S1.015	S77	720 minute 30 year Summer I+20%	142.160	139.562	0.982	0.000		2.121	0.5	12.8	SURCHARGED
S14.000	S78	2160 minute 30 year Summer I+20%	142.500	141.950	0.225	0.000		0.503	0.3	1.9	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S14.001	S79	2160 minute 30 year Summer I+20%	143.000	141.949	0.243	0.000	16.765	3.072	0.4	1.6	SURCHARGED
S14.002	S80	2160 minute 30 year Summer I+20%	144.000	141.949	0.322	0.000		1.341	0.3	1.5	SURCHARGED
S14.003	S81	2160 minute 30 year Summer I+20%	143.100	141.948	0.371	0.000		1.103	0.2	1.5	SURCHARGED
S14.004	S82	2160 minute 30 year Summer I+20%	142.962	141.948	0.412	0.000	9.082	31.317	0.2	0.2	SURCHARGED
S14.005	S83	2160 minute 30 year Summer I+20%	142.210	140.981	-0.222	0.000		0.000	0.2	0.2	OK
S14.006	S84	2160 minute 30 year Summer I+20%	142.087	140.768	-0.223	0.000		0.000	0.2	0.2	OK
S1.016	S85	720 minute 30 year Summer I+20%	141.700	139.557	1.110	0.000		2.116	0.5	18.7	SURCHARGED
S1.017	S86	720 minute 30 year Summer I+20%	141.455	139.548	1.161	0.000		1.920	0.5	19.4	SURCHARGED
S1.018	S87	720 minute 30 year Summer I+20%	140.927	139.538	1.177	0.000	7.963	111.134	0.8	7.4	SURCHARGED
S1.019	S88	2160 minute 30 year Winter I+20%	140.624	138.181	-0.151	0.000		0.111	0.6	7.4	OK
S15.000	S89	30 minute 30 year Summer I+20%	144.295	143.805	0.731	0.000		0.991	0.1	0.7	SURCHARGED
S15.001	S90	30 minute 30 year Summer I+20%	144.297	143.806	0.744	0.000	0.628	2.844	1.0	4.9	SURCHARGED
S15.002	S91	60 minute 30 year Summer I+20%	144.385	143.436	0.511	0.000	0.885	2.272	1.1	4.7	SURCHARGED
S15.003	S92	60 minute 30 year Summer I+20%	144.052	143.117	0.409	0.000	0.795	1.777	0.9	3.6	SURCHARGED
S15.004	S93	60 minute 30 year Summer I+20%	143.516	142.717	0.243	0.000	0.981	1.389	1.4	3.4	SURCHARGED
S15.005	S94	120 minute 30 year Summer I+20%	143.013	142.309	0.286	0.000	1.068	1.397	1.0	3.1	SURCHARGED
S15.006	S95	120 minute 30 year Summer I+20%	142.727	142.013	0.243	0.000	1.046	1.189	0.9	3.0	SURCHARGED
S15.007	S96	60 minute 30 year Summer I+20%	142.492	141.814	0.264	0.000	0.619	1.043	1.2	3.5	SURCHARGED
S15.008	S97	360 minute 30 year Winter I+20%	142.373	141.115	0.965	0.000		1.255	0.2	2.8	SURCHARGED
S15.009	S98	360 minute 30 year Winter I+20%	142.000	140.974	-0.876	0.000	32.529	15.845	0.0	0.0	OK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 9
Number of Online Controls 32 Number of Storage Structures 47 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.269 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 5, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1	15 minute 100 year Summer I+20%	154.047	152.622	-0.225	0.000		0.000	0.0	0.0	OK
S2.000	S2	15 minute 100 year Summer I+20%	158.150	157.300	0.000	0.000		0.638	0.2	14.8	SURCHARGED*
S3.000	S3	15 minute 100 year Summer I+20%	158.150	157.300	0.000	0.000		0.640	0.2	10.8	SURCHARGED*
S2.001	S4	15 minute 100 year Summer I+20%	158.150	157.224	0.118	0.000		3.113	1.3	50.8	SURCHARGED*
S2.002	S5	10080 minute 100 year Summer I+20%	158.150	157.801	4.819	0.000	0.000	133.367	1.1	1.9	SURCHARGED*
S2.003	S6	1440 minute 100 year Summer I+20%	153.011	151.559	-0.200	0.000		0.026	1.4	3.1	OK
S2.004	S7	1440 minute 100 year Winter I+20%	151.478	151.364	0.590	0.000	13.125	17.235	1.1	2.6	FLOOD RISK
S1.001	S8	1440 minute 100 year Winter I+20%	151.465	150.070	-0.202	0.000		0.025	1.4	2.6	OK
S4.000	S9	30 minute 100 year Summer I+20%	154.003	153.467	0.442	0.000	0.017	1.181	1.7	37.6	SURCHARGED
S4.001	S10	30 minute 100 year Summer I+20%	153.804	153.436	0.702	0.000	0.108	3.924	1.4	26.6	SURCHARGED*
S4.002	S11	30 minute 100 year Summer I+20%	153.589	153.413	0.970	0.000	0.082	3.898	1.9	22.4	FLOOD RISK
S4.003	S12	30 minute 100 year Summer I+20%	153.373	152.278	0.126	0.000	0.064	1.389	1.6	20.3	SURCHARGED*
S4.004	S13	30 minute 100 year Summer I+20%	152.976	152.257	0.395	0.000	0.017	1.205	2.1	26.2	SURCHARGED
S4.005	S14	30 minute 100 year Summer I+20%	152.440	152.226	0.898	0.000	0.193	4.566	2.3	21.6	FLOOD RISK*
S4.006	S15	30 minute 100 year Summer I+20%	151.904	150.894	0.099	0.000	0.000	0.516	2.3	41.5	SURCHARGED
S4.007	S16	30 minute 100 year Summer I+20%	151.368	150.804	0.542	0.000	0.101	2.991	2.6	38.1	SURCHARGED*
S4.008	S17	30 minute 100 year Summer I+20%	150.831	149.812	0.084	0.000	0.000	0.487	2.5	53.1	SURCHARGED
S4.009	S18	30 minute 100 year Summer I+20%	150.341	149.698	0.466	0.000	0.063	2.633	2.2	46.0	SURCHARGED*
S4.010	S19	30 minute 100 year Summer I+20%	149.850	149.592	0.856	0.000		1.587	2.8	45.8	FLOOD RISK
S1.002	S20	30 minute 100 year Summer I+20%	149.660	148.170	-0.112	0.000		0.139	2.3	46.5	OK
S5.000	S21	480 minute 100 year Summer I+20%	151.500	151.125	0.000	0.000		0.221	0.5	3.5	SURCHARGED*
S6.000	S22	30 minute 100 year Summer I+20%	151.500	151.125	0.000	0.000		0.226	0.9	17.3	SURCHARGED*
S5.001	S23	15 minute 100 year Summer I+20%	151.500	151.021	0.016	0.000		2.047	1.1	42.1	SURCHARGED*
S5.002	S24	720 minute 100 year Summer I+20%	151.500	151.362	2.137	0.000	0.000	103.465	0.8	7.6	FLOOD RISK
S5.003	S25	960 minute 100 year Summer I+20%	150.420	148.952	-0.128	0.000		0.210	1.3	7.5	OK
S5.004	S26	960 minute 100 year Summer I+20%	148.996	148.943	0.612	0.000	7.943	24.474	1.4	3.8	FLOOD RISK

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PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.003	S27	30 minute 100 year Summer I+20%	148.901	147.565	-0.122	0.000		0.127	2.6	46.8	OK
S1.004	S28	30 minute 100 year Summer I+20%	147.533	146.240	-0.119	0.000		0.128	2.5	46.7	OK
S1.005	S29	30 minute 100 year Summer I+20%	146.766	145.440	-0.118	0.000		0.129	2.5	46.8	OK
S1.006	S30	30 minute 100 year Summer I+20%	146.074	144.707	-0.121	0.000		0.125	2.6	46.8	OK
S7.000	S31	2160 minute 100 year Summer I+20%	146.150	144.800	0.000	0.000		1.435	0.5	3.0	SURCHARGED*
S7.001	S32	2160 minute 100 year Summer I+20%	146.150	144.748	0.000	0.000		1.836	0.4	2.9	SURCHARGED*
S8.000	S33	2160 minute 100 year Summer I+20%	146.150	144.800	0.000	0.000		1.435	0.5	1.9	SURCHARGED*
S8.001	S34	2160 minute 100 year Summer I+20%	146.150	144.736	0.000	0.000		1.929	0.4	1.9	SURCHARGED*
S7.002	S35	2880 minute 100 year Summer I+20%	146.150	144.731	0.016	0.000		1.488	0.5	3.9	SURCHARGED*
S7.003	S36	2880 minute 100 year Summer I+20%	146.150	144.707	0.076	0.000	0.000	54.130	0.6	2.7	SURCHARGED*
S7.004	S37	15 minute 100 year Summer I+20%	146.150	144.513	-0.086	0.000		0.245	1.0	25.6	OK
S7.005	S38	15 minute 100 year Summer I+20%	146.036	144.342	-0.086	0.000		0.421	1.0	25.5	OK
S9.000	S39	30 minute 100 year Summer I+20%	149.937	149.093	0.280	0.000	0.011	0.606	1.5	5.2	SURCHARGED
S9.001	S40	30 minute 100 year Summer I+20%	149.447	149.085	0.771	0.000	0.089	2.534	1.5	6.0	SURCHARGED
S9.002	S41	60 minute 100 year Summer I+20%	148.875	148.802	1.083	0.000	0.164	2.858	1.5	6.6	FLOOD RISK
S9.003	S42	60 minute 100 year Summer I+20%	148.607	148.441	1.031	0.000	0.225	2.953	1.5	5.2	FLOOD RISK
S9.004	S43	60 minute 100 year Winter I+20%	148.296	148.146	1.137	0.000	0.264	3.106	1.2	4.7	FLOOD RISK
S9.005	S44	60 minute 100 year Winter I+20%	147.941	147.845	1.199	0.000	0.365	3.536	1.4	5.0	FLOOD RISK
S9.006	S45	120 minute 100 year Summer I+20%	147.409	147.277	1.066	0.000	0.335	2.760	1.3	5.4	FLOOD RISK
S9.007	S46	60 minute 100 year Summer I+20%	147.040	146.656	0.739	0.000	0.290	2.328	1.6	6.0	SURCHARGED
S9.008	S47	30 minute 100 year Summer I+20%	146.239	146.012	0.711	0.000	0.089	2.268	1.8	9.3	FLOOD RISK
S9.009	S48	60 minute 100 year Summer I+20%	145.412	144.975	0.846	0.000		1.366	0.7	10.4	SURCHARGED
S1.007	S49	15 minute 100 year Summer I+20%	145.010	143.591	-0.159	0.000		0.162	2.3	75.5	OK
S1.008	S50	15 minute 100 year Summer I+20%	144.516	143.130	-0.165	0.000		0.179	2.5	75.5	OK
S1.009	S51	30 minute 100 year Summer I+20%	143.000	141.378	-0.175	0.000		0.136	2.7	75.1	OK
S1.010	S52	15 minute 100 year Summer I+20%	142.100	140.696	-0.094	0.000		0.160	3.1	75.1	OK*

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.011	S53	960 minute 100 year Summer I+20%	140.300	139.947	1.062	0.000	820.492	217.246	0.3	0.5	SURCHARGED
S1.012	S54	960 minute 100 year Summer I+20%	143.314	140.137	1.323	0.000		2.999	0.3	0.8	SURCHARGED
S10.000	S55	15 minute 100 year Summer I+20%	144.175	143.410	0.010	0.000	0.025	0.260	1.9	27.7	SURCHARGED
S10.001	S56	15 minute 100 year Summer I+20%	143.624	143.104	0.107	0.000	0.037	0.607	1.8	25.0	SURCHARGED
S10.002	S57	15 minute 100 year Summer I+20%	143.406	142.853	0.258	0.000	0.111	1.186	1.3	22.5	SURCHARGED
S10.003	S58	15 minute 100 year Summer I+20%	143.371	142.715	0.146	0.000	0.325	2.133	0.8	32.9	SURCHARGED
S10.004	S59	15 minute 100 year Summer I+20%	143.269	142.611	0.125	0.000	0.126	1.656	0.9	34.5	SURCHARGED
S10.005	S60	15 minute 100 year Summer I+20%	143.366	142.551	0.089	0.000	0.067	0.770	0.9	34.4	SURCHARGED
S10.006	S61	15 minute 100 year Summer I+20%	143.347	142.494	0.045	0.000	0.110	0.711	1.0	38.6	SURCHARGED
S10.007	S62	30 minute 100 year Summer I+20%	143.317	141.863	0.037	0.000		0.291	1.0	38.6	SURCHARGED
S1.013	S63	960 minute 100 year Summer I+20%	143.230	140.138	1.394	0.000		3.052	0.5	6.5	SURCHARGED
S11.000	S64	240 minute 100 year Summer I+20%	142.650	142.331	0.031	0.000		0.369	0.6	17.4	SURCHARGED
S11.001	S65	240 minute 100 year Summer I+20%	142.650	142.330	0.129	0.000		0.990	0.5	25.3	SURCHARGED
S11.002	S66	240 minute 100 year Summer I+20%	142.650	142.328	0.278	0.000	0.000	59.157	0.4	5.2	SURCHARGED
S11.003	S67	240 minute 100 year Summer I+20%	142.650	142.347	0.722	0.000		1.167	0.9	4.6	SURCHARGED
S1.014	S68	960 minute 100 year Summer I+20%	142.718	140.138	1.500	0.000		3.356	0.5	11.7	SURCHARGED
S12.000	S69	10080 minute 100 year Summer I+20%	148.500	143.450	0.000	0.000		2.634	0.2	1.2	SURCHARGED*
S13.000	S70	10080 minute 100 year Summer I+20%	148.500	143.450	0.000	0.000		2.635	0.3	1.5	SURCHARGED*
S12.001	S71	10080 minute 100 year Summer I+20%	148.500	143.433	0.076	0.000	0.000	53.712	0.5	2.2	SURCHARGED*
S12.002	S72	960 minute 100 year Summer I+20%	148.500	143.087	-0.177	0.000		0.096	0.7	4.4	OK
S12.003	S73	960 minute 100 year Summer I+20%	144.295	142.983	-0.188	0.000	0.135	0.051	1.0	4.4	OK
S12.004	S74	1440 minute 100 year Summer I+20%	143.692	142.296	0.411	0.000		0.714	0.7	4.3	SURCHARGED
S12.005	S75	1440 minute 100 year Summer I+20%	142.623	142.288	0.661	0.000		1.975	0.8	4.3	SURCHARGED
S12.006	S76	1440 minute 100 year Summer I+20%	142.530	142.283	0.850	0.000	15.374	18.817	1.0	3.4	FLOOD RISK
S1.015	S77	960 minute 100 year Summer I+20%	142.160	140.135	1.555	0.000		2.770	0.5	14.0	SURCHARGED
S14.000	S78	2160 minute 100 year Summer I+20%	142.500	142.413	0.688	0.000		1.027	0.3	2.3	FLOOD RISK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Infil. Vol (m³)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S14.001	S79	2160 minute 100 year Summer I+20%	143.000	142.412	0.706	0.000	22.973	5.930	0.4	2.0	SURCHARGED
S14.002	S80	2160 minute 100 year Summer I+20%	144.000	142.412	0.785	0.000		1.864	0.3	1.9	SURCHARGED
S14.003	S81	2160 minute 100 year Summer I+20%	143.100	142.411	0.834	0.000		1.627	0.2	1.9	SURCHARGED
S14.004	S82	2160 minute 100 year Summer I+20%	142.962	142.411	0.875	0.000	11.091	34.855	0.2	0.2	SURCHARGED
S14.005	S83	2160 minute 100 year Summer I+20%	142.210	140.982	-0.221	0.000		0.000	0.2	0.2	OK
S14.006	S84	2160 minute 100 year Summer I+20%	142.087	140.768	-0.222	0.000		0.000	0.2	0.2	OK
S1.016	S85	960 minute 100 year Summer I+20%	141.700	140.131	1.684	0.000		2.765	0.5	20.0	SURCHARGED
S1.017	S86	960 minute 100 year Summer I+20%	141.455	140.120	1.733	0.000		2.567	0.5	20.8	SURCHARGED
S1.018	S87	960 minute 100 year Summer I+20%	140.927	140.108	1.747	0.000	13.931	150.634	0.8	7.8	SURCHARGED
S1.019	S88	960 minute 100 year Summer I+20%	140.624	138.183	-0.148	0.000		0.115	0.7	7.8	OK
S15.000	S89	30 minute 100 year Summer I+20%	144.295	144.154	1.080	0.000		1.385	0.1	0.8	FLOOD RISK
S15.001	S90	30 minute 100 year Summer I+20%	144.297	144.154	1.092	0.000	0.933	4.020	1.0	5.6	FLOOD RISK
S15.002	S91	60 minute 100 year Summer I+20%	144.385	143.687	0.762	0.000	1.288	3.211	1.1	5.2	SURCHARGED
S15.003	S92	60 minute 100 year Summer I+20%	144.052	143.288	0.581	0.000	1.098	2.331	0.9	4.0	SURCHARGED
S15.004	S93	120 minute 100 year Summer I+20%	143.516	142.814	0.340	0.000	1.784	1.913	1.4	3.7	SURCHARGED
S15.005	S94	120 minute 100 year Summer I+20%	143.013	142.431	0.408	0.000	1.462	1.844	1.0	3.2	SURCHARGED
S15.006	S95	120 minute 100 year Winter I+20%	142.727	142.114	0.345	0.000	1.381	1.511	1.0	3.2	SURCHARGED
S15.007	S96	60 minute 100 year Summer I+20%	142.492	141.915	0.365	0.000	0.776	1.286	1.2	3.9	SURCHARGED
S15.008	S97	360 minute 100 year Winter I+20%	142.373	141.499	1.349	0.000		1.728	0.2	3.1	SURCHARGED
S15.009	S98	360 minute 100 year Winter I+20%	142.000	141.374	-0.476	0.000	39.167	19.896	0.0	0.0	OK

APPENDIX E. WASTEWATER DESIGN CALCULATIONS

- As per Irish Water Code of Practice for Wastewater Infrastructure, IW-CDS-5030-03
- Network Design Tables

Appendix E

Wastewater Design Calculations

FOUL SEWERAGE DESIGN

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	25.886	0.647	40.0	0.000	100	0.0	1.500	o	225	Pipe/Conduit	
F1.001	47.341	2.367	20.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F2.000	25.474	0.127	200.0	0.000	100	0.0	1.500	o	225	Pipe/Conduit	
F1.002	26.051	0.521	50.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.003	16.102	0.805	20.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.004	27.180	1.359	20.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.005	12.804	0.640	20.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	152.485	0.000	0.0	100	0.3	32	0.90	1.82	72.3	3.1
F1.001	151.838	0.000	0.0	100	0.3	27	1.14	2.57	102.3	3.1
F2.000	148.847	0.000	0.0	100	0.3	47	0.51	0.81	32.2	3.1
F1.002	148.720	0.000	0.0	200	0.6	47	1.02	1.63	64.6	6.2
F1.003	148.199	0.000	0.0	200	0.6	38	1.42	2.57	102.3	6.2
F1.004	147.394	0.000	0.0	200	0.6	38	1.42	2.57	102.3	6.2
F1.005	146.035	0.000	0.0	200	0.6	38	1.42	2.57	102.3	6.2

FOUL SEWERAGE DESIGN

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.006	12.860	0.643	20.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.007	24.023	1.201	20.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F3.000	24.160	0.121	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.008	8.683	0.043	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.009	8.330	0.042	200.0	0.000	80	0.0	1.500	o	225	Pipe/Conduit	
F1.010	26.022	0.130	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.011	19.333	0.097	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.006	145.394	0.000	0.0	200	0.6	38	1.42	2.57	102.3	6.2
F1.007	144.251	0.000	0.0	200	0.6	38	1.42	2.57	102.3	6.2
F3.000	142.217	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.008	142.096	0.000	0.0	200	0.6	67	0.63	0.81	32.2	6.2
F1.009	142.053	0.000	0.0	280	0.8	80	0.69	0.81	32.2	8.7
F1.010	142.011	0.000	0.0	280	0.8	80	0.69	0.81	32.2	8.7
F1.011	141.881	0.000	0.0	280	0.8	80	0.69	0.81	32.2	8.7

FOUL SEWERAGE DESIGN

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.012	20.861	0.104	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.013	23.413	0.117	200.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.014	16.537	0.413	40.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F4.000	10.066	0.201	50.0	0.000	69	0.0	1.500	o	225	Pipe/Conduit	
F4.001	17.771	0.444	40.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.015	28.164	1.280	22.0	0.000	0	0.0	1.500	o	300	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.012	141.784	0.000	0.0	280	0.8	80	0.69	0.81	32.2	8.7
F1.013	140.880	0.000	0.0	280	0.8	80	0.69	0.81	32.2	8.7
F1.014	140.763	0.000	0.0	280	0.8	53	1.22	1.82	72.3	8.7
F4.000	141.080	0.000	0.0	69	0.2	28	0.74	1.63	64.6	2.1
F4.001	140.879	0.000	0.0	69	0.2	27	0.80	1.82	72.3	2.1
F1.015	140.275	0.000	0.0	349	1.0	46	1.56	2.96	209.4	10.8

FOUL SEWERAGE DESIGN

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F5.000	8.882	0.044	201.9	0.000	21	0.0	1.500	o	225	Pipe/Conduit	
F6.000	29.457	0.147	200.0	0.000	21	0.0	1.500	o	225	Pipe/Conduit	
F6.001	11.356	0.189	60.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.016	10.401	0.052	200.0	0.000	0	0.0	1.500	o	300	Pipe/Conduit	
F7.000	50.505	1.263	40.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F7.001	66.834	0.334	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F5.000	138.875	0.000	0.0	21	0.1	22	0.31	0.81	32.1	0.6
F6.000	140.575	0.000	0.0	21	0.1	22	0.32	0.81	32.2	0.6
F6.001	139.428	0.000	0.0	21	0.1	17	0.48	1.48	59.0	0.6
F1.016	138.756	0.000	0.0	391	1.1	85	0.74	0.98	69.2	12.1
F7.000	139.200	0.000	0.0	0	0.0	0	0.00	1.82	72.3	0.0
F7.001	137.937	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0

FOUL SEWERAGE DESIGN

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F7.002	3.242	0.016	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F7.002	137.603	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.016	F	140.505	138.704	0.000	0	0

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F7.002	F	139.300	137.587	0.000	0	0

O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

APPENDIX F. STAGE 1 STORMWATER AUDIT

Appendix F

Stage 1 Stormwater Audit

STORMWATER AUDIT (STAGE 1)

JBA Project Code	2022s0519
Contract	Residential Development, Woodside Road
Client	Zolbury Ltd.
Prepared by	David Micks
Subject	Stormwater Audit Stage 1 Report

Revision History

Issue	Date	Status	Issued to
S3-P01	03/05/2022	First issue	Zolbury Ltd.
S3-P02	19/07/2022	Second issue	Zolbury Ltd.

1 Introduction

JBA Consulting have been contracted to undertake a Stage 1 SW Audit of the surface water drainage design prepared by O'Connor Sutton Cronin & Associates for the proposed residential development at Woodside Road, Sandyford. The audit has been completed in accordance with Dún Laoghaire Rathdown County Council's (DLRCC) Stormwater Audit Procedure (Rev 0, Jan 2012) as set out below.

The subject of this Stage 1 stormwater audit is to review the proposed surface water drainage design and sustainable urban drainage system (SuDS) proposals for the proposed development.

Stage 1 – Pre-Planning Stage: *A Stage 1 audit shall be carried out of the Stormwater Impact Assessment (SIA) prepared by the applicant. The audit will focus on the SUDS management train and whether the applicant has carefully considered all known SUDS techniques and applied the most appropriate type(s) for the site that will ensure improved water quality, biodiversity and volume control.*

1.1 Report Structure

The Feedback Form in Appendix A identifies queries raised in this report which are to be answered by the Design Engineers. Once an 'Acceptable' status is achieved for each query the audit is deemed to be closed out.

The results of the audit are set out hereunder, where items raised in the feedback form are shown in **bold** within this report.

Updated report and drawings received on 14 June 2022 as part of revised stormwater design. Queries regarding the revised design will be highlighted in red.

1.2 Relevant Studies and Documents

The following documents were considered as part of this surface water audit:

- Greater Dublin Strategic Drainage Strategy (GDSDS);
- Dun Laoghaire Rathdown County Council Development Plan (2022 – 2028)
- Greater Dublin Regional Code of Practice for Drainage Works;
- The SUDs Manual (CIRIA C753).
- BRE Digest 365
- Current Development Plan

1.3 Key Considerations and Benefits of SuDS

The key benefits and objectives of SuDS considered as part of this audit and listed below include:

- Water Quantity
- Water Quality
- Amenity
- Biodiversity

Which can be achieved by;

- Storing runoff and releasing it slowly (attenuation)
- Harvesting and using the rain close to where it falls
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- Filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

1.3.1 SuDs Management Train

A SuDs Management Train is a robust pollutant removal strategy. The treatment train can comprise four stages:

1. *Prevention*
2. *Source Control*
3. *Site Control*
4. *Regional control*

2 Proposed Development at Woodside Road, Co. Dublin

The proposed site is located at lands at Woodside Road in Sandyford, Co. Dublin and has an area of c. 3.7ha. It is bounded to the north by the Blackglen Road, to the east by the Diswelltown Road, to the south by the Woodside Road, and to the west by existing residential properties. The location of the site is shown in Figure 1 below.

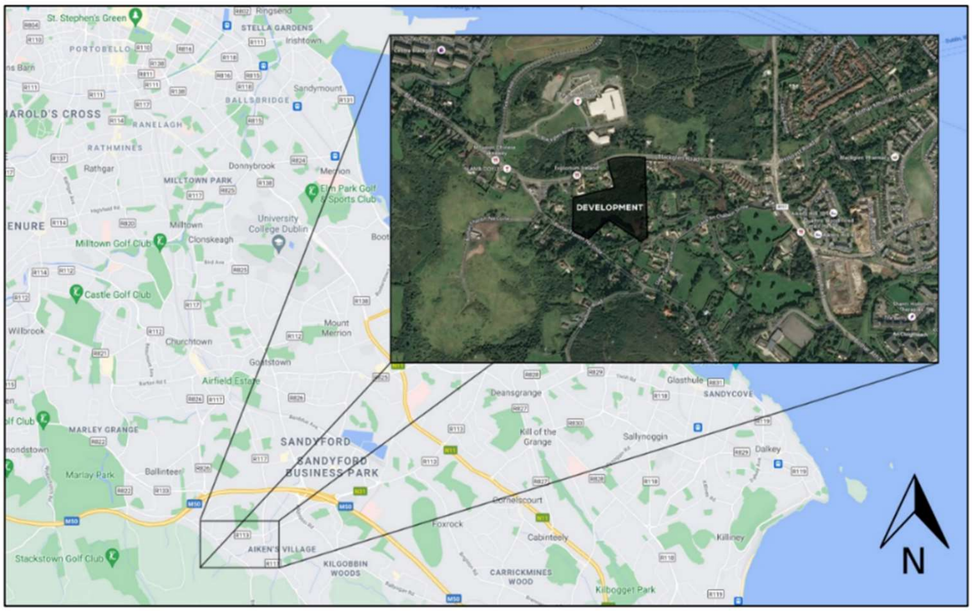


Figure 1- Site Location

The proposed development involves the construction of 9no. apartment buildings providing a total of 360 units. The development will also consist of associated resident amenity facilities and a childcare facility. The site is divided into 10 blocks:

- Block A1 comprises 18 no. apartments, a creche facility associated outdoor space;
- Block A2 comprises 24 no. apartments;
- Blocks B1 and B2 comprises 69 no. apartments;
- Blocks B3 and B4 comprises 62 no. apartments;
- Blocks C1, C2 and C3 comprise 187 no. apartments.

2.1 Review of SW Drainage Proposals

The review is based on the following documents provided by O'Connor Sutton Cronin & Associates on 3rd May 2022;

- Z040-OCSC-XX-XX-DR-C-0500-S4-P04
- Z040-OCSC-XX-XX-DR-C-0501-S4-P04
- Z040-OCSC-XX-XX-DR-C-0505-S4-P01
- Z040-OCSC-XX-XX-DR-C-0515-S4-P03
- Z040-OCSC-XX-XX-DR-C-0520-S4-P03
- Z040-OCSC-XX-XX-DR-C-0521-S4-P03
- Z040-OCSC-XX-XX-DR-C-0522-S4-P03
- Z040-OCSC-XX-XX-DR-C-0523-S4-P03
- Z040-OCSC-XX-XX-DR-C-0524-S4-P03
- Z040-OCSC-XX-XX-DR-C-0525-S4-P03
- Z040-OCSC-XX-XX-DR-C-0526-S4-P03
- Z040-OCSC-XX-XX-RP-C-0005-S2-P04

Documents included as part of revised design;

- Z040-OCSC-XX-XX-DR-C-0500-S4-P06
- Z040-OCSC-XX-XX-DR-C-0500-S4-P07
- Z040-OCSC-XX-XX-DR-C-0501-S4-P06
- Z040-OCSC-XX-XX-DR-C-0501-S4-P07
- Z040-OCSC-XX-XX-DR-C-0505-S4-P02
- Z040-OCSC-XX-XX-DR-C-0510-S4-P04
- Z040-OCSC-XX-XX-DR-C-0515-S4-P05
- Z040-OCSC-XX-XX-RP-C-0005-S4-P06

2.1.1 Site Characteristics

The site is currently greenfield in nature. The site is generally graded towards the north of the site with the highest point of the site being located at the south-west boundary and is approximately +160.12m AOD with the lowest point being located at the north-east boundary of the site and is approximately +138.72m AOD. This gives a typical gradient of approximately 8.2% across the site.

Each residential unit is afforded with associated private open space in the form of a terrace / balcony. The total open space area is approximately 22,033 sq. m. Podium level / basement level areas are proposed adjacent to / below Blocks A2, B1, B2, B3, B4, C1, C2 and C3, with a total GFA of approx. 12,733 sq. m. A total of 419 no. car parking spaces and 970 no. bicycle spaces are also proposed.

Vehicular / pedestrian and cyclist access to the development will be provided via Blackglen Road. Pedestrian and cyclist access is also provided via Woodside Road. A second vehicular access is proposed just east of the Blackglen Road. The second access will be minor and will provide access to a portion of car parking only, for the site.

The proposal also provides for Bin Storage areas and ESB substations at surface level.

2.1.2 Ground Investigation

A site investigation was carried out by Ground Investigations Ireland Ltd. between April and May 2021, with a second visit undertaken in June 2021 to complete testing and trial pits. Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.3m BGL. Made ground deposits were encountered beneath the topsoil layer at TP01 and TP03, present to a depth of between 1.3m and 2.3m BGL. Cohesive deposits were encountered beneath the topsoil and made ground. In some of the exploratory holes, weathered rock was encountered up to a depth of up to 1m below the top of the stratum. Trial pits were terminated upon encountering the more competent bedrock.

The rotary core boreholes encountered weathered bedrock at depths varying from 1.1m to 4.2m BGL.

No groundwater was encountered in any of the trial pits or rotary core logs.

A different infiltration rate has been used for the bioretention area compared to the filter drains. OCSC to explain rationale behind this.

The attenuation tank upstream of S78 will be at risk of groundwater cross-contamination. OCSC to clarify whether the tank will be lined to mitigate this.

RC01 & RC02 identified groundwater levels at 1.54m and 1.97m BGL. Due to the absence of existing topo survey, it is difficult to assess the proximity of infiltration measures to the groundwater table. OCSC to provide existing topo survey and determine where the proposed infiltration measures lie in relation to the groundwater table.

2.2 Design Parameters

Rainfall parameters can be estimated using Met Eireann data, using the Flood Studies Report (FSR) values or the values in the GDSDS. The Met Eireann method can be more representative of a site if selected correctly. The design values used by OCSC and considered by JBA are shown below:

Rainfall parameters	Designer values	JBA Comment
M5_60	19	Ok – Met Eireann
Ratio R	0.269	Ok – Met Eireann
SAAR (mm)	986	Ok – Met Eireann
Qbar l/s	15.9 l/s	Ok – UK SuDS
Climate Change	20%	Ok – 10% required in GDSDS

Surface Water Drainage Strategy

2.2.1 Site Drainage Strategy

The drainage for the proposed development and attenuation systems has been divided into two main surface water drainage catchments. Main Development (Catchment 1) discharges controlled and restricted flow rates to the existing stormwater network at Blackglen Road. This is split into five sub-catchments; 1A, 1B, 1C, 1D and 1E.

Access road to blocks B3 and B4 (Catchment 2) drains to the proposed infiltration soakaway.

Due to its size and layout, Catchment 1 will be divided into a number of sub-catchments, in order to best integrate the proposed SuDS measures. Each sub-catchment area will look to provide interception and treatment to the rainfall runoff, either at source or through site design.

Infiltration systems will be provided off podium areas where applicable as soakaway testing carried out on site resulted in good infiltration rates across the site.

A traditional gravity pipe and manhole network will be provided. Manholes, compliant with GDSDS and GDRCOP, are provided for maintenance access at branched connections. Manholes are spread out in intervals no greater than 90m.

The attenuated surface water will then be discharged to an existing surface water network to the north of the site. A new connection to this sewer is to be provided on Blackglen Rd.

A typical podium detail has not been provided. OCSC to provide a podium detail drawing.

2.2.2 SuDS Measures Considered

SuDS Technology	Comments
Green/Blue Roofs	It is proposed to provide green roofs on the buildings within the development. The overall area of green roof has been maximised but with consideration to the extensive PV panels also proposed at roof level as a sustainability measure. Green roofs are to be provided across the development with greater than 60% coverage, as required by DLR's planning policy.
Swale, Filter Drain, Infiltration Trench	Filter drains to be provided along roads where possible to intercept and treat polluted water. (Perforated pipe with CL505 surround) Filter drain also proposed to intercept rainfall from roof of Block A1 and drain to underground attenuation unit. (150mm perforated pipe)
Tree Pits, Bioretention Areas, Rain Gardens	Bioretention areas will act as the primary attenuation structures for the proposed development, providing 162m^3 temporally storage inside the filter medium as well as to provide treatment and interception. Runoff collected by the system ponds temporarily on the surface and then filters through the vegetation and underlying soils. The filtered runoff is then collected using runoff is then collected using underdrain pipes and partially infiltrated into the surrounding soil. All road gullies serving the proposed development are to be trapped, to help prevent sediment and gross pollutants. The grated covers are to have a minimum load classification of D400, for frequent vehicular traffic. Following consultation with Irish Water, it was requested to provide a temporary wastewater pumping station on site to limit the discharge rate to 5 l/s. This requires the main bioretention area to be reduced in size. Therefore, 2 smaller bioretention areas have been provided to compensate for the lost attenuation volume. The proposed pumping station is to be decommissioned, and thus will extend the main bioretention area, providing additional treatment and storage capacity. **The bioretention area is modelled as a rectangle, which won't be the shape in reality. OCSC to ensure the perimeter at the base of the area matches what will be constructed.** **A bioretention detail has not been provided. OCSC to provide a typical detail in compliance with CIRIA SuDS Manual.**
Permeable Paving	A Type B pervious paving, with a 300mm depth of open graded crushed rock as base course, is to be provided in all car parking spaces, within the development. An overflow pipe, from the base-course, will be provided to the drainage network, which will allow for interception of initial rainfall, groundwater discharge, with an attenuated outflow to the main network in extreme rainfall events. **OCSC to provide total area of permeable paving on the proposed development.**
Soakaways	A proposed infiltration soakaway is located in the southeast of the site, intercepting and draining the access road between Blocks B3/B4 and B2. 18m^3 of temporary storage to be provided.
Detention Basins,	None proposed.

Retention Ponds, Stormwater Wetlands	
Rainwater Harvesting	None proposed.
Petrol Interceptor	A Class 1 bypass fuel separator is to be provided immediately downstream of last attenuation system, as an additional and final mitigation measure.
Attenuation	Unlined attenuation units are provided for the development. These systems are to provide sufficient temporary storage volume for rainfall events up to, and including, the design 1% AEP rainfall event. These systems also allow for interception of initial rainfall to be provided at the base of the system. Access chambers for inspection and maintenance are also to be provided. Interception storage is to be provided below the development's primary attenuation. This will temporarily store and treat the first 5mm rainfall on the development. A flow control device (Hydro-brake optimum vortex control unit) is to be provided immediately downstream of attenuation system. The flow rate for the proposed development would be no greater than 15.9 l/s (Qbar). The required aperture of the proposed hydro-brake outlet has been designed to be greater than 50mm diameter, to minimise the risk of blockage. The flow control chamber is to be fitted with a penstock valve at the inlet and a bypass lever at the outlet (if required), to allow for easy access and maintenance. **OCSC to clarify whether attenuation tanks are to be lined to prevent cross-contamination from groundwater.**
Other	A manhole upstream of both attenuation systems is to contain a 600mm sump, below the invert level of the outlet pipe, in order to trap sediment and other gross pollutants.

2.2.3 Review of drainage drawings and SuDS drawings;

The SuDS drawings show a range of SuDS measures proposed throughout the site including permeable paving, green roofs, filter drains and bioretention areas. According to Z040-OCSC-XX-XX-DR-C-0500-S4-P06, it is proposed that runoff will be conveyed to these SuDS measures through filter drains and existing/new surface water pipes.

A 423 sq. m. bioretention area is proposed on the eastern boundary of the site. A hydro-brake system will be placed downstream of bioretention area to limit discharge to 15.9l/s (Qbar). A 137 sq. m. bioretention area is proposed east of Block 1B, with an orifice plate fitted to outlet to restrict flow to 4l/s. A 94 sq. m. bioretention area has been proposed east of Block C2, with an orifice plate to be fitted to the outlet which will limit flowrate to 2l/s.

Green roofs have been proposed on all blocks other than Blocks A1 and A2.

An infiltration soakaway has been proposed in the south-eastern part of the site, providing a temporary storage of 18m^3.

OCSC to clarify how rainfall runoff on Blocks A1 and A2 will be collected and connected to proposed SuDS measures.

An orifice manhole is included at S5 with a diameter of 40mm, which contradicts the proposal to limit diameters to 50mm.

It is unclear where orifice manhole S67 is located. If this is located between Blocks B1 & B2, the porosity should be amended.

It would be beneficial to label the orifice manholes on the drawings for the various outfalls from roofs and podiums.

OCSC to clarify the distance of the proposed soakaway from the adjacent building. Also, clarify the distance of the bioretention area from the properties on the adjacent land.

OCSC to clarify how the podiums and green roofs on Blocks B3 & B4 drain to manhole S35.

Downpipes are proposed on Blocks B3, B4 and all C Blocks. Blocks B1 and B2 show no connection to podium area. OCSC to provide indication of connectivity from Blocks to the podium area.

2 no. additional bio-retention areas have been included adjacent to block C2 and one adjacent to block B1. It is unclear whether it is intended to line these or not. The distance from the adjacent buildings hasn't been defined on the drawings. OCSC to clarify whether the bioretention areas will be lined adjacent to block C2. Confirm distance from foundations for both bioretention areas, and whether any infiltration is proposed.

The Wastewater pumping station and the podium for Block A2 clash in plan with the adjacent permeable paving. OCSC to check clashes with SuDS measures and adjacent structures.

Orifice manholes of 15mm (S71) and 17mm (S5) would significantly increase the risk of blockage. OCSC to provide a detail showing how the orifice plate will mitigate against debris less than 20mm in size.

The outline of a parking space is still presented over the podium at A2. The revised engineering report hasn't been updated to correct for the change in permeable paving area. OCSC to update report to ensure latest permeable paving area is included.

2.2.4 Review of Hydraulic Model

The proposed surface water network has been designed in accordance with the regulations and guidelines outlined in Section 1.2, using Microdrainage Design software:

- A 20% allowance for climate change has been included in the design.
- Cv values of 0.75 (summer) and 0.84 (winter) have been used in the design.

The run-off factors used contradict the development plan set out by DLRCC. Also, two different Cv values were used (1, 0.84). OCSC to clarify whether run-off approach has been agreed with DLRCC.
There doesn't seem to be an allowance for urban creep in the design. OCSC to provide rationale on this decision.
Page 26 of the calculations includes a contributing area for Catchment 1 of 1.81Ha, but the calcs provide a contributing area of 1.258Ha.
The calculations state the filter drain manholes have slopes of 1:35/1:25/1:20. This exceeds the permissible gradient suitable for being useable as an interception measure.
S77 is shown to have upstream attenuation, whereas the drawing indicates that it should be S78. Also, the design head for the associated hydrobrake is 1m, whereas the attenuation is 0.7m.
The water level at S66 is 142.422m AOD for a 100yr event. This will exceed the top of the podium storage volume (invert 141.684m, depth 300mm). This will result in flooding of the podium. Similarly, the invert at S5 is 152.757m but the invert of the storage is 152.357m. OCSC to review water/invert depths for podium storage.

2.2.5 Interception/Treatment

Interception of runoff is intended to prevent any runoff for small rainfall events which are less than 5mm (and up to 10mm if possible). Treatment of 15mm is required if interception is not provided.

The interception calculations provided on page 18 do not include the impermeable area that requires interception. OCSC to clarify contributing impermeable areas to each of the interception measures.

Table 24.6 of the CIRIA manual provides indication of deemed to satisfy criteria and it is considered that this should be complied with. All sources of runoff should also be intercepted where possible. A high level of Interception provided for some parts of the site is not to be considered as adequate compensation for a low degree of interception provision for other locations. Compliance is required for the whole site, or at least for road/paved areas, for it to be considered effective. Interception mechanisms are based on runoff retention. This can be achieved using rainwater harvesting or using soil storage and evaporation. Either infiltration or transpiration rates can dispose of the runoff from minor events to enable the next event to be captured.

2.3 Health & Safety and Maintenance Issues

The proposed drainage system comprises SuDS devices, traditional road gullies, manholes, attenuation systems, oil interceptors and underground pipes. These elements are considered acceptable from a Health & Safety perspective once supplier/manufacturers guides are followed and complied with during the detailed design, construction, and operation.

Optimum performance of the SUDs treatment train is subject to the frequency of maintenance provided. At detailed design stage, it is recommended that a maintenance regime be adopted.

Particular consideration is required at detailed design stage to the design, maintenance requirements and whole life plan (and replacement) of the SuDS system as a whole.

Regular maintenance of the hydrobrake will be required to remove any blockages, particularly in the wake of heavy rainfall events or local floods.

It is recommended that the oil interceptors be fitted with an audible high-level silt and oil alarm for maintenance and safety purposes. Regular inspection and maintenance is recommended for the oil interceptors.

Please note that silt and debris removed from the oil interceptor during maintenance will be classified as contaminated material and should only be handled and transported by a suitably licensed contractor and haulier and disposed of at a suitably licensed landfill only.

2.4 Items to be considered at Detailed Design Stage

The following should be considered at detailed design stage:

- Proper detail design and construction of SuDS devices is paramount to ensure long term optimum hydraulic performance as well as maximisation of biodiversity opportunity. It is recommended that a collaborated approach to detail design is adopted between engineers, architects, ecologists, and Landscape Architects.

2.5 Audit Report sign Off

Audit Report Prepared by:

David Micks
Technical Assistant

Approved by: ______________________

Michael O'Donoghue
Associate Director

Note:

JBA Consulting Engineers & Scientists Ltd. role on this project is as an independent reviewer/auditor. JBA Consulting Engineers & Scientists hold no design responsibility on this project. All issues raised and comments made by JBA are for the consideration of the Design Engineer. Final design, construction supervision, with sign-off and/or commissioning of the surface water system so that the final product is fit for purpose with a suitable design, capacity and life-span, remains the responsibility of the Design Engineers.

Appendix A – Audit Feedback Form

JBA Consulting Stormwater Audit - Stage 1 Feedback Form	
Project:	Stage 1 SWA, Woolside Road
Date:	03/05/2022
JBA Reviewers	David Micks/Michael O'Donoghue
Status	S3/P01
Project Number:	2022s0519

Item No.	JBA Review Comment	Comment/Clarification Request/Suggested Mitigation	Response from Client/Client Representative	Acceptable / Not Acceptable
P01				
Ref Docs	Z040-OCSC-XX-XX-DR-C-0500-S4-P04 Z040-OCSC-XX-XX-DR-C-0501-S4-P04 Z040-OCSC-XX-XX-DR-C-0505-S4-P01 Z040-OCSC-XX-XX-DR-C-0515-S4-P03 Z040-OCSC-XX-XX-DR-C-0520-S4-P03 Z040-OCSC-XX-XX-DR-C-0521-S4-P03 Z040-OCSC-XX-XX-DR-C-0522-S4-P03 Z040-OCSC-XX-XX-DR-C-0523-S4-P03 Z040-OCSC-XX-XX-DR-C-0524-S4-P03 Z040-OCSC-XX-XX-DR-C-0525-S4-P03 Z040-OCSC-XX-XX-DR-C-0526-S4-P03 Z040-OCSC-XX-XX-RP-C-0005-S2-P04			
1	***Z040-OCSC-XX-XX-RP-C-0005-S2-P04***			
a	The interception calculations provided on pg 18 do not include the impermeable area that requires interception. It's important that some areas that provide a redundancy in interception are not used to compensate for a lack of interception elsewhere. For example, excessive green roof capacity can't be used to compensate for a lack of interception at ground level.	Clarify contributing impermeable areas to each of the interception measures.	All sub-catchments (from 1A to 1E) consist only of roof area and podium areas and are intercepted in the provided green roofs and podium attenuation as described on page 18 of the Engineering services report. Catcment 1 is the road and is to be intercepted by filter drains and pervious pavement along the road and additional interception provided at primary attenuations. Catchement 2 is only the access road to B3 and B4 and is to be interceped by fitler drains and pervious pavement as noted in the report.	**Acceptable**
b	Run-off factor approach contradicts the Dun Laoghaire County Development plan. Secondly, the cv value proposal of 1 contradicted in the calculations, where pg 21 of the calculations state a Cv of 0.84 is to be used. If reduced run-off factors are proposed, they need prior agreement with Dun Laoghaire.	Clarify whether run-off factor approach has been agreed with Dun Laoghaire CC.	Run-off factor amended to the correct value of 1, refer to Appendix D of the Engineering services report	**Acceptable**
c	There doesn't seem to be an allowance for urban creep, as required in the latest County Development Plan.	Please clarify.	Considering that the whole development consist of apartment blocks the propability of urban creep occuring is higly unlikly and was not included in the calculations.	**Acceptable subject to approval with DLRCC**
d	Pg 26 includes a contributing area for Catchment 1 of 1.81Ha, but the the calculations state the contributing area is 1.258Ha.	Please clarify.	The total green roof area is 0.546ha and is not shown in the contributing area in the calculations. The total contributing area is 1.258ha + 0.546ha = 1.804ha. The green roof area can be seen under the Time area section of the calculations, also a note has been added to the calculations.	**Acceptable**
e	An orifice manhole is included at S5 with a diameter of 40mm, contradicting proposal to limit dia. to 50mm as stated in the report .	Please clarify.	Report ammended, any outlet that has an outlet less then 50mm is to be provided with an protective orifice plate to mitiagte the risk of blockage.	**Acceptable subject to approval with DLRCC**
f	The calculations state the filter drain manholes have slopes of 1:35/1:25/1:20. This exceeds the permissible gradient suitable for being useable as an interception measure.	If filter drains are to be used for interception, reduce to 1:100, stepping where necessary.	In order to increase the efficiency of the fitler drains and be able to use them for interception it is proposed to provide orrifice plates at every 20-25m to act as check dams.	**Acceptable**
g	The bioretention area is modelled as a rectangle, which won't be the shape in reality.	Ensure perimeter at the base of the area matches what will be constructed.	Bioretention area now modelled to better represend the exact shape.	**Acceptable**
h	A different infiltration rate has been used for the bioretention area compared to the filter drains.	Please explain rationale for this	In the Ground investigation report 3 boreholes have been examined, the one closest to the bioretention area has shown an infiltration of 0.05983m/hr). The other two boreholes had a much lower infiltration rate (0.01494m/hr) and this was used in the filter drain for a more conservative approach.	**Acceptable**
J	The orifice manhole at S67 has a diameter of 40mm, and a discharge rate of 0.5l/s. It is unclear where this is. The upstream storage area it contains has a porosity of 0.95. Is this the area between B1 & B2? If so, the porosity should be amended.	Clarify	This is the area between B1 & B2, the porosity has been amended to 0.3.	**Acceptable**
k	S77 is shown to have upstream attenuation, whereas the drawing indicates that it should be s78. The design head for the associated hydrobrake is 1m, whereas the attenuation is 0.7m	Clarify	This has been amended in the new calcuilations and is now shown in the coorect location (MH78). The design head was corrected to 0.7m	**Acceptable**
l	RC01 & RC02 identified groundwater levels at 1.54m and 1.97m BGL. No existing levels have been provided which makes it difficult to assess the proximity of infiltration measures to the groundwater table.	Please provide existing topo and determine wher	Topo survey with overlayed site layout provided, refer to drawing Z040-OCSC-XX-XX-DR-SK-0001-S1-P01	**See Note 4a**
2	***Drawings***			

JBA Consulting Stormwater Audit - Stage 1 Feedback Form	
Project:	Stage 1 SWA, Woolside Road
Date:	03/05/2022
JBA Reviewers	David Micks/Michael O'Donoghue
Status	S3/P01
Project Number:	2022s0519

Item No.	JBA Review Comment	Comment/Clarification Request/Suggested Mitigation	Response from Client/Client Representative	Acceptable / Not Acceptable
P01				
a	It would be helpful to label the orifice manholes on the drawing for the various outfalls from roofs and podiums.		All outfalls from podium attenuations that will have orifice plates as flow controls are labeled at the outfall location and marked with a red dot (manhole label added to notes for clarification).	Acceptable
b	Clarify distance of soakaway from adjacent building.	Clarify	The distance between the soakway and adjacent bulding is now labeled on the revised drawing and is 5m.	Acceptable
c	Clarify distance of bioretention area from properties on adjacent land.	Clarify	The proposed bioretention area is aproximately 2.5m away from a Cottage Ruin, the next closes propertie on adjacent land is approximately 9.3m away	Acceptable
d	The connectivity between the podium and the green roofs of B3 & B4 is not clear.	Please indicate how podium drains to S35.	It is proposed to route the surface water from Block B3 & B4 and podium at high level acros block B3	Acceptable
3	***Omissions***			
a	Bioretention detail not provided. Is this to be constructed on fill?	Please provide a section through bioretention area, in compliance with CIRIA SUDS Manual.	Detail provided, refer to drawing Z040-OCSC-XX-XX-DR-C-0527-S4-P01	Acceptable
b	Podium typical detail not provided.	Please provide	Detail provided, refer to drawing Z040-OCSC-XX-XX-DR-C-0525-S4-P04	Acceptable
P02	18/05/2022	18/05/2022		
4				
a	Based on the SI results, the attenuation tank upstream of S78 will be at risk of groundwater cross-contamination.	Clarify whether this attenuation tank will be lined to mitigate against groundwater cross-contamination.	The proposed attenuation tank upstream of S78 is to be lined, noted addded on revised drawing. Refer to drawing Z040-OCSC-XX-XX-DR-C-0500-S4-P05 & Z040-OCSC-XX-XX-DR-C-0501-S4-P05	Acceptable
P03	20/05/2022 - Form & Report Completed	20/05/2022 - Form & Report Completed		
P04	14/06/2022 - Design Updated	14/06/2022 - Design Updated		
5	***Drawings***			
a	Downpipes are proposed on Blocks B3, B4 and all C Blocks. Blocks B1 and B2 show no connection to podium area.	If downpipes are proposed on Blocks B1 and B2, please provide an indicative location on plan drawing. If not, please provide an indication of connectivity.	Downpipes are proposed on Blocks B1 and B2, indicative location shown on plan. Refer to drawings Z040-OCSC-XX-XX-DR-C-0500-S4-P06 & Z040-OCSC-XX-XX-DR-C-0501-S4-P06	Acceptable
b	2 no. additional bio-retention areas have been included adjacent to block C2 and one adjacent to block B1. It is unclear whether it is intended to line these or not. The distance from the adjacent buildings hasn't been defined on the drawings.	Clarify whether the bioretention areas will be lined adjacent to block C2. Confirm distance from foundations for both bioretention areas, and whether any infiltration is proposed.	It is proposed to have infiltration on both bioretention areas. Considering that a basement is proposed under block C2 the foundations are much deeper than the bioretention area and infiltration should have no negative effect on the structure.	Acceptable
c	Orifice manholes of 15mm (S71) and 17mm (S5) would significantly increase the risk of blockage.	Provide a detail showing how the orifice plate will mitigate against debris less than 20mm in size.	Minimum orifice plate size increased to 25mm.	See Note 7a
d	The Wastewater pumping station and the podium for Block A2 clash in plan with the adjacent permeable paving.	Check clashes with suds measures and adjacent structures.	Permeable paving removed from layout at the location. Refer to drawings Z040-OCSC-XX-XX-DR-C-0500-S4-P06 & Z040-OCSC-XX-XX-DR-C-0501-S4-P06	See Note 7b
6	***Design Report***			
a	The water level at S66 is 142.422m AOD for a 100yr event. This will exceed the top of the podium storage volume (invert 141.684m, depth 300mm). This will result in flooding of the podium. Similarly, the invert at S5 is 152.757m but the invert of the storage is 152.357m.	Review water/invert depths for podium storage.	Podium and pipe inverts and water levels reviewed, refer to Appendix D of the revised Engineering services report	Acceptable
7				
a	As requested, please provide detail of orifice plate.		Orifice plate detail added to the podium build-up. Refer to drawing Z040-OCSC-XX-XX-DR-C-0525	Acceptable
b	The outline of a parking space is still presented over the podium at A2. The revised engineering report hasn't been updated to correct for the change in permeable paving area.	Update report to ensure latest permeable paving area is included.	Report updated, correct permeable area is now included (are reduced by 24sq.m.)	Acceptable

APPENDIX G. IRISH WATER CONFIRMATION OF FEASIBILITY & STATEMENT OF DESIGN ACCEPTANCE

Appendix G

Irish Water Confirmation Of Feasibility &

Statement Of Design Acceptance

UISCE
ÉIREANN : IRISH
WATER

Marko Komso

OCSC
9 Prussia Street
Stoneybatter
Dublin 7
Dublin
D07KT57

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office
Cork City

www.water.ie

25 May 2022

Re: CDS22002623 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 450 units at Blackglen Road, Sandyford, Dublin

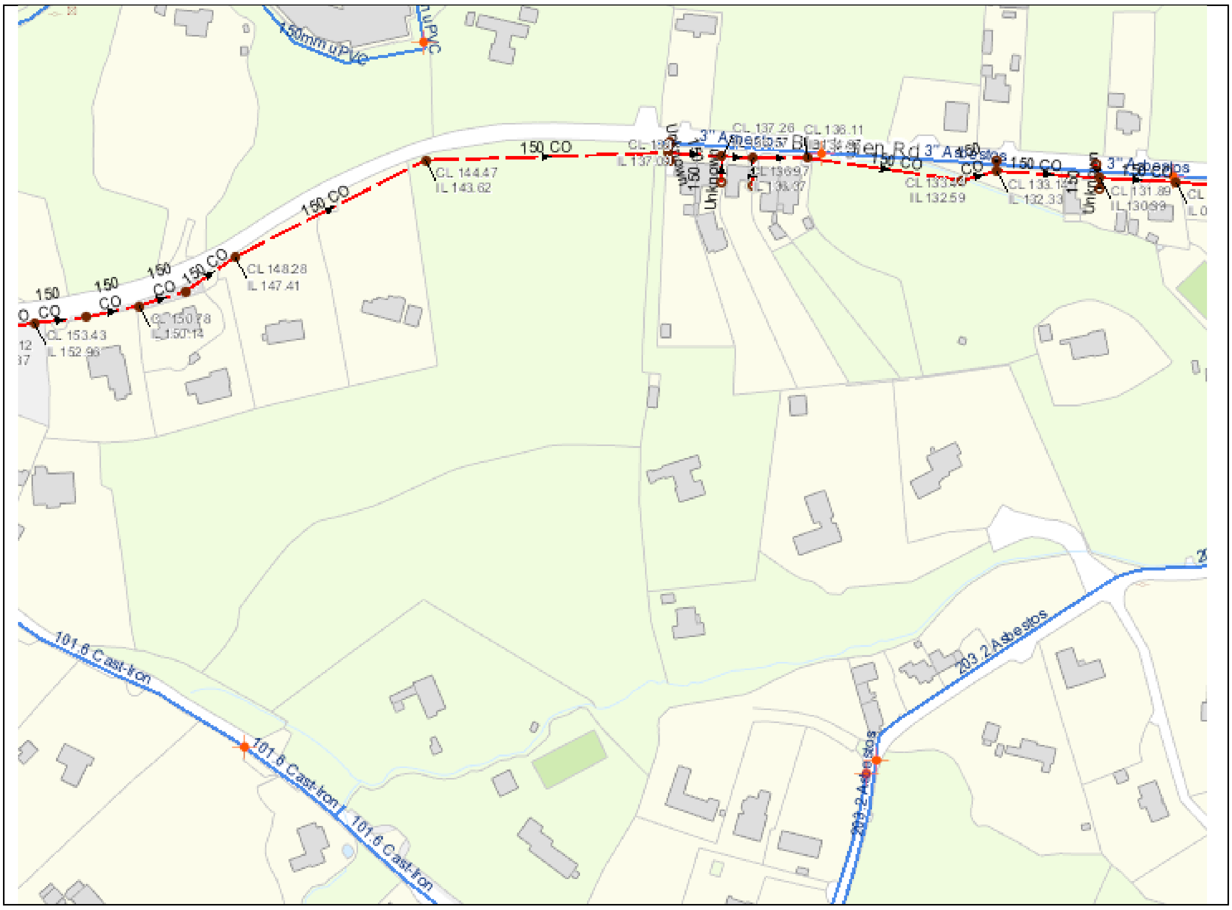
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Blackglen Road, Sandyford, Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible Subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	Connection main should be a 150mm pipe connected to the newly laid 200mm ID main in Blackglen Road, with a bulk meter installed on the line. The new main must be operational before the connection. A PRV installation may be required for the connection.
Wastewater Connection	In order to accommodate the proposed connection, temporary flow controls from the site are required to limit the flows to 5l/s until Irish Water have increased capacity in the downstream network. The Irish Water capital upgrade project is currently at preliminary design stage. Installation of an on-site pumping station is usual flow control method. The pump station should be designed to be bypassed and decommissioned once upgrades are delivered in the catchment and permission is given by Irish Water. The scheduling of the pumping will also need to be managed

	and a telemetry link with a downstream depth monitor on the Irish Water network may be required. The details of the flow management will need to be agreed at a connection application stage. All cost related to the flow management will be on the Customer.
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

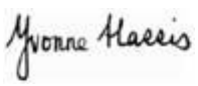
Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team via email mzbyrne@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

UISCE ÉIREANN : IRISH WATER

Marko Komso
9 Prussia Street
Stoneybatter
Dublin 7
Dublin D07KT57

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

12 May 2022

Re: Design Submission for Blackglen Road, Sandyford, Dublin (the "Development") (the "Design Submission") / Connection Reference No: CDS22002623

Dear Marko Komso,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: Antonio Garzón
Phone: 0838983711
Email: Antonio.garzon@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- Z040-OCSC-XX-XX-DR-C-0500-S4-P05
- Z040-OCSC-XX-XX-DR-C-0501-S4-P05
- Z040-OCSC-XX-XX-DR-C-0515-S4-P04
- Z040-OCSC-XX-XX-DR-C-0550-S4-P05
- Z040-OCSC-XX-XX-DR-C-0551-S4-P05

Additional Comments

The design submission will be subject to further technical review at connection application stage

For further information, visit ***www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

APPENDIX H. CELLULAR ATTENUATION SYSTEM

- Y-E.S.S. Pluvial Cube with Access and Inspection Chamber

Appendix H

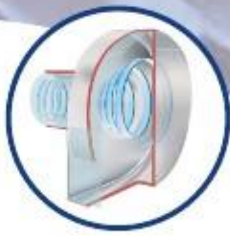
Cellular Attenuation System

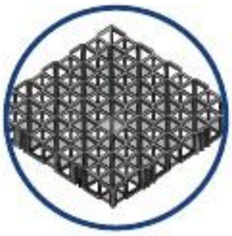
Modular Geo-Void Systems

Total Water Management

ESS EcoCell

Ecological Tank Systems





ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

Environmental Sustainable Solutions

Welcome to Environmental Sustainable Solutions; specialist suppliers and designers of geocomposites and water re-use systems. Environmental Sustainable Solutions can help you achieve innovative results for all your requirements:-

- Stormwater Management
- Gas Barrier Protection
- Stormwater Attenuation
- Contaminated Land Development
- Stormwater Drainage
- Ground Stabilisation
- Rainwater Recycling Management
- Structural Waterproofing
- Gas Venting Systems
- Damp-proofing projects

Over the last 12 years Environmental Sustainable Solutions, and associated companies, have designed and installed thousands of water recycling, drainage and attenuation tank systems for schools, car parks, retail parks, offices and sports arenas throughout Ireland, UK, Europe and the Middle East.

Our wide range of environmental protection products, surface water drainage modules and modular water storage tank systems provides maximum design flexibility for engineers and architects working on even the most demanding of storm water storage and recycling projects.

Stormwater Management And Design

Stormwater is the phrase used to describe the excess rainwater that flows from rooftops, roads, car parks and other buildings. This water can contain many pollutants picked up from roofs and highways. In extreme weather conditions sudden heavy downpours of rain can cause major environmental disasters. Using our Rainmanager products; stormwater can not only safely be removed, but it can be stored and recycled for commercial and domestic use.

How it works - ESS Attenuation Tank

Stormwater enters the attenuation tank via the inlet manhole, which incorporates a silt collection sump and a galvanised leaf collection basket. Water passes through the tank and exits through the outlet manhole, which contains an AquaBrake flow control device.
This flow control device regulates the release rate of water from the tank, and in so doing, enables the tank to fill. As a result of water entering the tank at a greater rate than it can exit, the void space then fills with water. While the tank fills, air is vented from the tank.
The Inlet/Outlet pipe will act as a flushing channel. This perforated pipe is wrapped completely in High Flow Filtering Geotextile, which prevents silt entering the block area. As the tank continues to empty at a pre-determined rate, air re-enters the tank via the same air vent system. The roof of the completed tank must be lower than the lowest gully trap on site.

Benefits

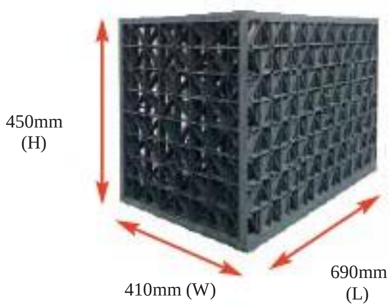
- 100% sealed tank
- Full installation service provided
- 12 years experience as market leader
- Quick installation – reduce site access delays
- Increased land usage – tanks are sub surface
- Economical – generally more cost efficient than any other equivalent sealed tank
- Cost effective – reduced costs for excavation and disposal of material
- Modular – easy to create any shape
- Strong – designed to support shear loading
- Lightweight – no cranes required
- Determinate volume – one cubic metre of matrix tank modules contain 950 litres of water, whereas stone fill will only provide 300 litres of storage per cubic metre.

Soakaway

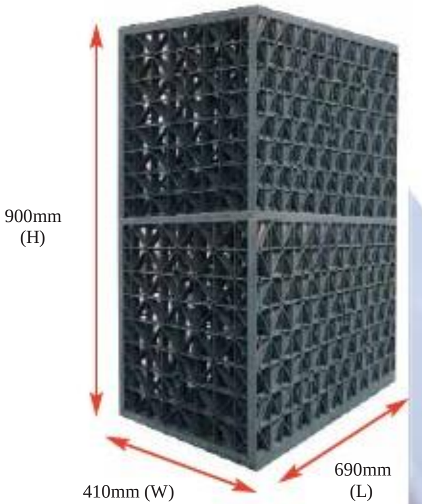
The soakaway is normally best built as a long narrow structure.
The inlet pipe comes in at roof level and faces downwards so that the water can percolate into the tank.
The blocks are wrapped in Geotextile, to protect them and also to keep clay from filling up the void.
An air vent pipe is installed on the highest point with a cowl on top or vented back to an inlet manhole.
There is no outlet from a soakaway, therefore no flow control unit is required.

Stormwater Storage Tank

SUITABLE FOR USE UNDER:
- Roadways
- Car parks
- Green areas



Single
8 Modules/m^3
Flowrate - 2300 I/min



Double
4 Modules/m^3
Flowrate - 4600 I/min

Triple
2.6 Modules/m^3
Flowrate - 6900 I/min

Notes:
Blocks must be positioned in the correct orientation.
See opposite above

SPECIFICATION (SINGLE)

Weight (maximum)	9.17kg
Crush Strength (up to)	400kN/m^2
Lateral Strength	80kN/m^2
Minimum Cover (green areas)	500mm
(trafficked areas)	650mm
Maximum Cover	3m
Material	Polypropylene
Void Ratio (Internal)	>95%

Design Requirements:

Tank storage capacity (m^3)
Depth restrictions
Location (Road, Car Park, Green Area)
Design constraints on site

A set of loading calculations specific to the site requirement will be done by ESS and submitted on all tanks

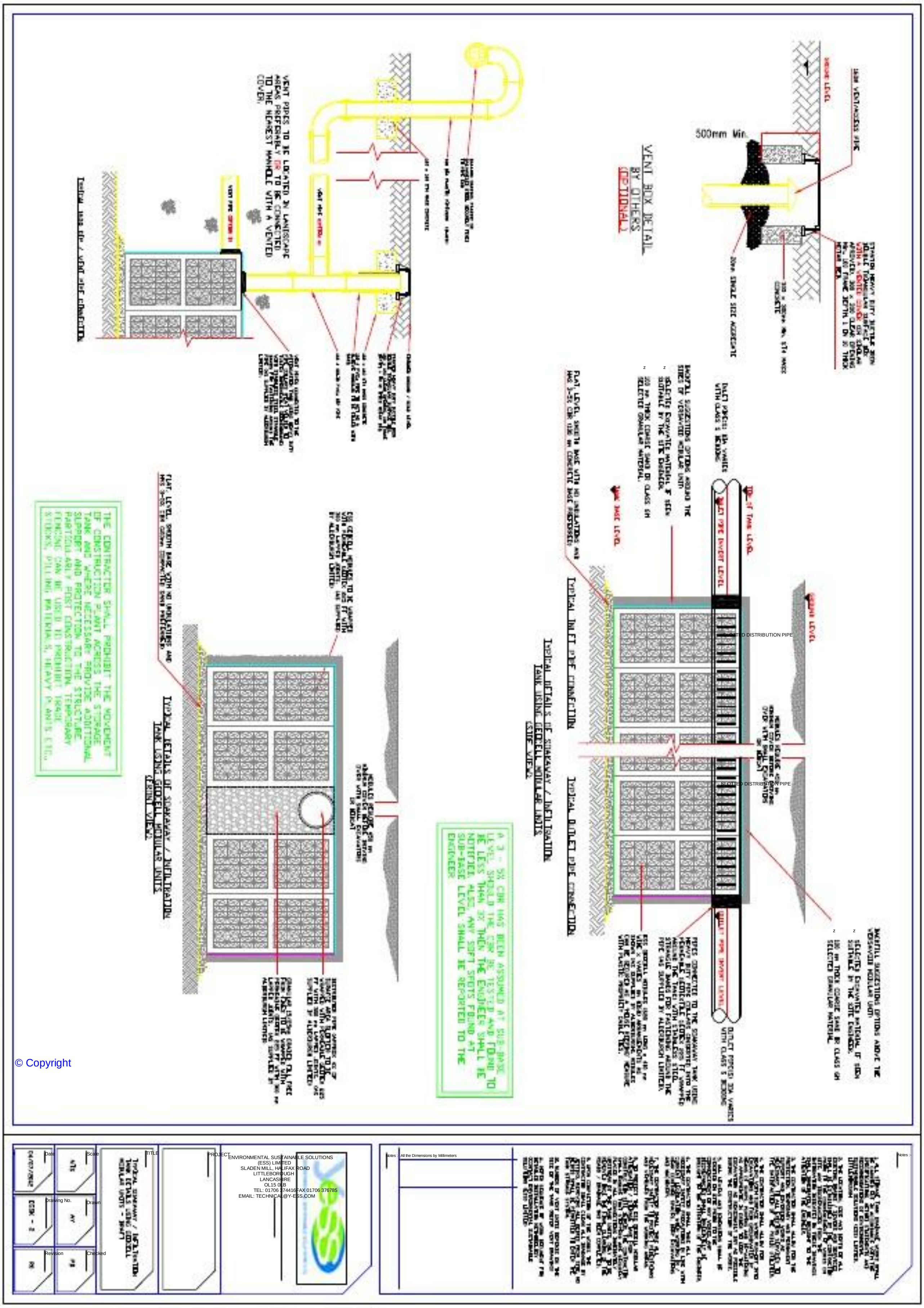
DESIGN CRITERIA

The attenuation tank is constructed using matrix module blocks. These blocks can take passing loads of up to 40 tonnes/m^2. The void ratio of each block is 95%. The blocks are made from polypropylene.

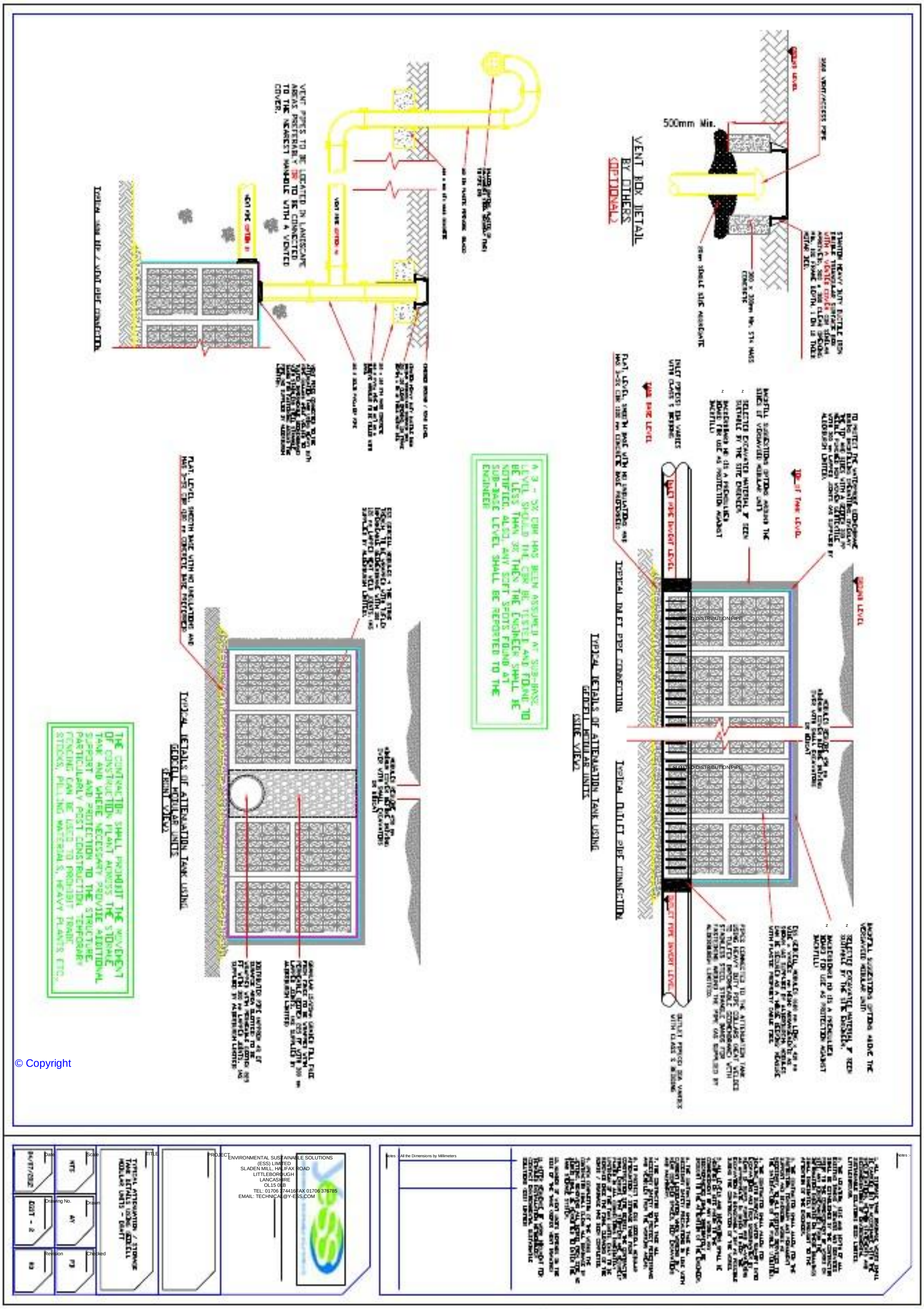
The tank is sealed with a layer of Tuflex membrane, which is fully welded together to form a 100% seal. All pipe penetrations are fully sealed to the membrane. The Tuflex membrane is protected by a layer of heavy duty protection geotextile, to prevent damage from construction or backfilling. A number of air extraction vents/flushing points are placed in the roof of the tank.

Note:
It is vital that the underground tanks are fully sealed, otherwise ground water and silt particles may enter the void space and use up capacity. Preferably, the base of the tank should be 500mm above the ground water level. Otherwise ground water relief measures should be implemented.

Typical arrangement using ESS Ecological Tank System for water quality



Typical on site collection and recycling arrangement using ESS Ecological Tank System



Infiltration Swales & Underground Channels

Please refer to separate data sheets for the following products

Modular VersaVoid System

Benefits

G **Quick**
Reduce site access delays

G **Lightweight**
No cranes required

G **Strong**
Designed for maximum anticipated loads

G **Maintenance Free Tank**
All debris and sediment is pre-filtered

G **Determinate Volume**
One cubic metre of Tank modules contain 950 litres of water

G **Cost Effective**
Reduces excavation and disposal by up to 5 x compared with conventional soak wells

G **High Infiltration**
98% void surface area

G **Totally Modular**
For greatest flexibility designed to cope. Units start at 300mm deep for shallow inverts to 3050mm+ deep in 250mm increments.

G **Designed by Engineers for Engineers** – to specify with confidence.

G **Designing out Problems**
with such systems (access, maintenance, loading etc.)

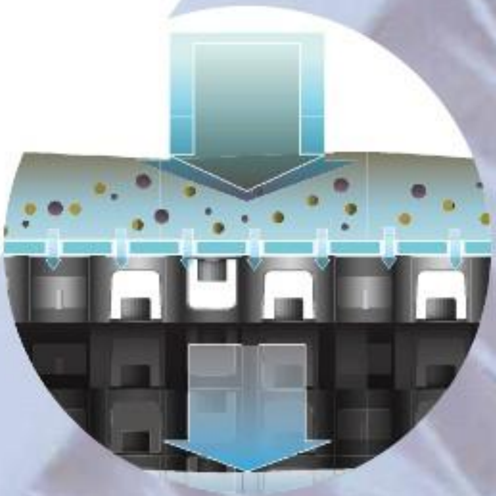
G **Designing in Answers**
to design requirements.

G **Total 3D Access**
For total maintenance with total confidence.

G **Structurally Designed**
with built in safety factor to carry all loads with complete confidence.
16 clear vertical access chambers per m2.

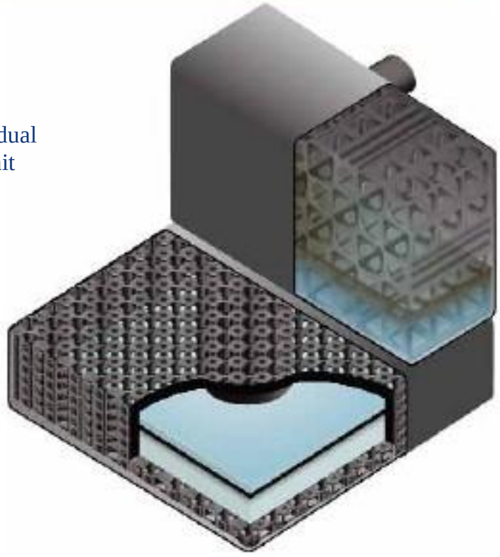
G **Total Void Creation**
With the greatest strength from any modular systems.

Oil Filtration



Benefits

G Source control designed to handle catastrophic spillages
G Capture, filter and break down residual hydrocarbons - all in one compact unit
G Self-maintaining ecosystems decompose hydrocarbon compounds and clean filters
G Load bearing, modular components provide up to 200t/m² loading capacity



Aquabrake

Benefits

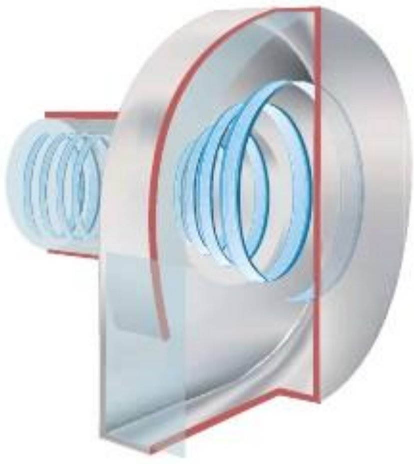
G Cost Savings
Can reduce upstream storage requirements by up to 30%.

G Durability
Corrosion resistant stainless steel.

G No energy requirements
Self-activating solution with no moving parts.

G Clog Resistant
AquaBrake design prevents blockages likely to occur in traditional orifices.

G Flexible Design
Several options for attachment available.

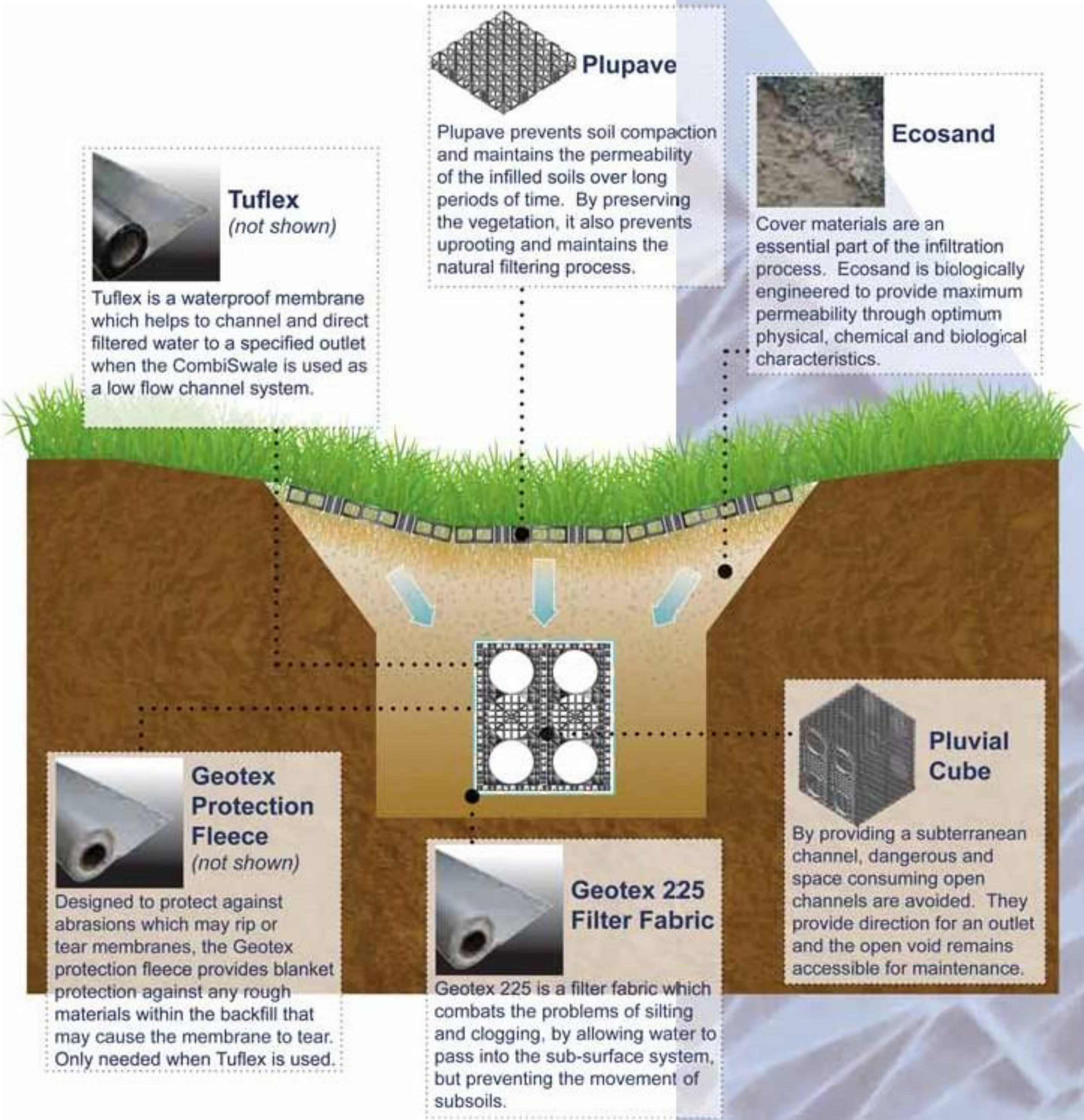


Water Sensitive Urban Channels

Surface and Sub-Surface Water Treatment

By combining surface and sub-surface channeling and treatment solutions, ESS has created the ideal in bioswale water management.

The CombiSwale system includes the addition of permeable sub-surface waterways that further restore water quality and recharge the natural environment. The sub-surface ESS channel system provides a unique way of working with nature to solve the enormous problems currently associated with open concrete channels and swales.



All products are manufactured to the highest quality, being subject to rigid quality control. However, the company cannot control conditions of application and use of its products, thus any warranty, written or implied, is given in good faith for materials only. ESS Ltd will not accept any responsibility for damage or injury arising from storage handling, misapplication or misuse of its products All transactions are subject to our standard condition of sale, copies of which are available on request.

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers

APPENDIX I. GROUND INVESTIGATION REPORT

Appendix I

Ground Investigation Report

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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

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

Ground Investigations Ireland

Blackglen Road

OCSC

Ground Investigation Report

July 2021

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
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D22 YD52

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

DOCUMENT CONTROL SHEET

Project Title	Blackglen Road
Engineer	OCSC
Client	Glencar
Project No	10477-03-21
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
B	Final	J McDowell	D Maglochlainn	C Finnerty	Dublin	22 July 2021

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.

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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

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

CONTENTS

APPENDICES

1.0 Preamble

On the instructions of OCSC Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd. between April and May 2021 at the site of the proposed residential development on Blackglen road, South County Dublin. A second visit to site was undertaken in June 2021 to complete additional trial pits and testing.

2.0 Overview

2.1. Background

It is proposed to construct a new residential development with associated services, access roads and car parking at the proposed site. The site is currently greenfield however there is a quarry shown on the northern portion of the site in the historic mapping available on the OSI website. In the Aerial photograph from c. 2000 there looks to be archaeological trenching or earthworks being completed over the majority of the site. A portion of the site has a sewer passing through, parallel with the northern boundary of the site along the Grange Road and there are some Made Ground deposits associated with this service. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant. Rock excavation may be required in parts of the site due to the shallow bedrock which is visible over a portion of the site.

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 14 No. Trial Pits & 2 No Trenches to a maximum depth of 2.3m BGL
- Carry out 6 No. In-situ Plate Bearing Tests within each trial pit
- Carry out 3 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Carry out 2 Days of. Dynamic Probes to determine soil strength/density characteristics
- Carry out 8 No additional trial pits to verify bedrock/shallow DPH refusal
- Carry out 4 No. Rotary Core Boreholes to a maximum depth of 8.50m BGL
- Installation of 4 No. Groundwater monitoring wells
- Groundwater monitoring with continuous data loggers
- Chemical & Environmental Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing 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 an 8T & 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. Some additional trial pits were completed demonstrate the shallow refusal on many of the probes over the southern portion of the site were due to shallow bedrock, and not boulders or stiff glacial till.

3.3. Slit Trenching

The slit trenches were excavated using an 8T 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 soil was slowly stripped using a spotter on the trench to alert the driver if any services were seen, to avoid damage to any underlying services. The slit trenches 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 slit trench records which are provided in Appendix 2 of this Report.

3.4. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 3 of this Report.

3.5. Dynamic Probing

The dynamic probe tests (DPH) were carried out at the locations shown in the location plan in Appendix 1 in accordance with B.S. 1377: Part 9 1990. The test consists of mechanically driving a cone with a 50kg weight in 100mm intervals and monitoring the number of blows required. An equivalent Standard Penetration Test (SPT) 'N' value may be calculated by dividing the total number of blows over a 300mm drive length by 1.5. The dynamic probe logs are provided in Appendix 4 of this Report. Where shallow rock was expected to lead to a shallow refusal on the dynamic probe, a trial pit was excavated to prove the depth to shallow bedrock and to increase the confidence in the dynamic probing results.

3.6. Insitu Plate Bearing Test

The plate bearing tests were carried out using a 450mm diameter plate at the locations shown on the site plan in Appendix 1. The plate was loaded in increments using a hydraulic jack and an excavator to provide a reaction and the displacement was monitored in accordance with BS1377 Part 9 using independently mounted digital strain gauges. The constrained modulus and equivalent CBR are calculated in accordance with HD29/75 and are provided on the test reports in Appendix 5 of this Report.

3.7. Rotary Boreholes

The rotary coring was carried out by a track mounted T41 Beretta rig at the locations shown on the location plan in Appendix 1.

The T41 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T41 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 6 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 Rilta Suite, pH and sulphate testing was carried out by Element Materials Technology Laboratory in the UK. The Rilta suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria.

The results of the laboratory testing are included in Appendix 7 of this Report.

3.9. Surveying

The exploratory hole locations have been recorded using a Trimble R10 GNSS 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.

3.10. Groundwater Monitoring Installations

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

The groundwater monitoring is included in Appendix 8 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
- Made Ground
- Cohesive Deposits
- Weathered Bedrock
- Bedrock

TOPSOIL: Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.30m BGL.

MADE GROUND: Made Ground deposits were encountered beneath the Topsoil at the locations of TP01 and TP03 and were present to a depth of between 1.30m and 2.30m BGL. These deposits were described generally as *brown sandy gravelly Clay with occasional angular to subangular cobbles, some boulders and contained occasional fragments of concrete, wire and glass.* The presence of a historic quarry over a portion of the site may explain the presence of this material in TP01.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Topsoil and Made Ground where present and were described typically as *soft or soft to firm reddish brown/brown sandy gravelly CLAY with occasional angular to subangular cobbles and some boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the cohesive matrix. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

WEATHERED BEDROCK: In some of the exploratory holes weathered rock was encountered which was diggable with the large excavator to a depth of up to 1.0m below the top of the stratum. The trial pits were terminated upon encountering the more competent bedrock, in which further excavation became more difficult. This material was recovered typically as fine to coarse angular to subangular gravel and cobbles of Granite, however there was some variability in the fracture spacing and the ease at which the excavator could progress. Some clay and sand were also present with the rock mass either from weathering or as infilling to fractures which were opened upon excavation.

BEDROCK: The rotary core boreholes recovered Medium strong to strong massive grey coarsely crystalline GRANITE, partially to distinctly weathered.
The depth to rock varies from 1.10m BGL in RC03 in the western portion of the site, to a maximum of 4.20m BGL in RC04, located in the southern portion of the site. RC01 & RC02 in the northern portion of the site show rock level to be between 2.30m and 2.60m BGL. 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. In RC02 between 6.0m and 8.0m BGL the rock is weathered to such an extent that Total Core Recovery (44% and 52%) and the associated indices reduced, with the driller noting the material partially recovered as a sand.

4.2. Insitu Strength Testing

The correlated DPH blow counts indicate that the overburden deposits are soft or soft to firm to depths of 1.0m to 3.6m BGL and become firm or firm to stiff with depth. Many probes refused at shallow depths indicating the presence of bedrock or large boulders. DP01 & DP3 had low blow counts in the presumed Made Ground deposits to a depth of 2.3 to 3.2m BGL while DP9, PD16, DP20 and DP38 all had deep overburden deposits with soft or soft to firm strengths indicated by the blow counts.

4.3. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. 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 tide, time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in RC01, RC02 RC03 and RC04 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 8 of this Report.

4.4. Laboratory Testing

4.4.1. Chemical Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

4.4.1. Environmental Laboratory Testing

A number of samples was analysed for a suite of parameters which allows for the assessment of the sampled material in terms of total pollutant content for classification of materials as *hazardous* or *non-hazardous*. The suite also allows for the assessment of the sampled material in terms of suitability for placement at licenced landfills (inert, stable non-reactive, hazardous etc.). The parameter list for the suite includes analysis of the solid samples for arsenic, barium, cadmium, chromium, copper, cyanide, lead, nickel, mercury, zinc, speciated aliphatic and aromatic petroleum hydrocarbons, pH, sulphate, sulphide, moisture content, soil organic matter and an asbestos screen.

The suite also includes those parameters specified in the EU Council Decision establishing criteria for the acceptance of waste at Landfills (Council Decision 2003/33/EC), which for the solid samples are total organic carbon (TOC), speciated aliphatic and aromatic petroleum hydrocarbons, BTEX, phenol, polychlorinated biphenyls (PCB) and PAH.

As part of the suite a leachate is generated from the solid sample which is analysed for antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, chloride, fluoride, soluble sulphate, sulphide, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS).

While the laboratory report provides a comparison with the waste acceptance criteria limits it does not provide a waste classification of the material sampled nor does it comment on any potentially hazardous properties of the materials tested. 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. A waste classification report is recommended to be carried out on material which will be disposed of off site.

5.0 Recommendations & Conclusions

5.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

5.2. Foundations

An allowable bearing capacity of 125 kN/m^2 is recommended for conventional strip or pad foundations on the firm to stiff cohesive deposits at the depths indicated in the table below. Where the soft cohesive/made ground deposits are deeper, such as at the location of DP1, DP3, DP7, DP8, DP9, DP16, DP20, DP21, DP22, DP38 & DP39 lean mix trench fill to the depths indicated in the table below are proposed to achieve a presumed allowable bearing capacity of 200 kN/m^2 on the weathered/intact rock. Generally these are where the soft deposits / Made Ground were noted and the weathered rock is assumed to be present where the probing indicated refusal, however boulders or inclusions sin the Made Ground may be responsible for these terminations. A higher allowable bearing capacity is available on the intact rock where present.

In any part of the site, should part of the foundation be on rock we would recommend that all the foundations of the unit in question be lowered to the competent rock stratum to avoid differential settlement.

The possibility for variation in the depth of the made ground in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete.

A ground bearing floor slab is recommended to be based on the firm to stiff cohesive deposits or weathered bedrock with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:2014 +A1:2016 and/or NRA SRW CL808 Type E granular stone fill. Where the depth of Made Ground/Soft deposits exceeds 0.9m then suspended floor slabs should be considered.

	Allowable Bearing Capacities (ABC) kN/m2						
Trial Pit	**ABC**	**Depth**	**Comment**	**Trial Pit**	**ABC**	**Depth**	**Comment**
No.	**kN/m2**	**m BGL**		**No.**	**kN/m2**	**m BGL**	
DP01	200	2.3	**Refusal**	**DP020**	125	1.9	**Cohesive**
DP02	200	0.5	**Refusal**	**DP021**	200	1.7	**Refusal**
DP03	125	3.2	**Cohesive**	**DP022**	200	1.8	**Refusal**
DP04	125	0.7	**Cohesive**	**DP023**	200	0.7	**Refusal**
DP05	200	1.2	**Refusal**	**DP024**	200	0.7	**Refusal**
DP06	200	0.7	**Refusal**	**DP025**	200	0.7	**Refusal**
DP07	200	1.7	**Refusal**	**DP026**	200	0.7	**Refusal**

DP08	80	2.0	**Cohesive**	**DP027**	200	0.7	**Refusal**
DP08	200	2.6	**Refusal**	**DP28**	200	0.7	**Refusal**
DP09	200	3.2	**Refusal**	**DP29**	200	0.7	**Refusal**
DP010	200	1.2	**Refusal**	**DP030**	200	0.7	**Refusal**
DP011	200	0.7	**Refusal**	**DP031**	200	0.7	**Refusal**
DP012	200	1.4	**Refusal**	**DP033**	200	0.7	**Refusal**
DP013	200	0.7	**Refusal**	**DP034**	200	0.7	**Refusal**
DP014	200	0.7	**Refusal**	**DP035**	200	0.7	**Refusal**
DP015	200	0.7	**Refusal**	**DP036**	200	0.7	**Refusal**
DP016	200	3.2	**Refusal**	**DP037**	200	0.7	**Refusal**
DP017	200	0.7	**Refusal**	**DP038**	200	3.8	**Cohesive**
DP018	200	0.7	**Refusal**	**DP039**	1.25	1.5	**Cohesive**
DP019	200	0.7	**Refusal**	**DP040**	200	0.9	**Refusal**

The pH and sulphate testing completed on samples recovered from the exploratory holes indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are required for concrete foundations to prevent sulphate attack. The samples tested were below the limits of DS1 in the BRE Special Digest 1:2005.

5.3. External Pavements

The proposed pavements are recommended to be designed in accordance with the CBR test results included in the Appendices of this Report. The low CBR test results indicate that a capping layer or a sufficient depth of crushed stone fill may be required. Plate bearing tests are recommended at the time of construction to verify the design assumptions for the proposed pavement make up and to verify adequate compaction has been achieved.

The use of a geogrid and separation membrane may improve the performance of the proposed pavement and enable a more economical pavement design to be achieved, a specialist supplier is recommended to advise of the required strength, depth and type of geotextile for the proposed design.

5.4. Excavations

Excavations in the Made Ground, Peat or soft Cohesive Deposits will require to be appropriately battered or the sides supported due to the low strength of these deposits.

Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25m BGL or is required to permit man entry.

Any excavations which penetrate the granular weathered rock deposits will require to be appropriately battered or the sides supported and are likely to require dewatering due to the groundwater seepages noted in the exploratory hole logs in the Appendices of this Report.

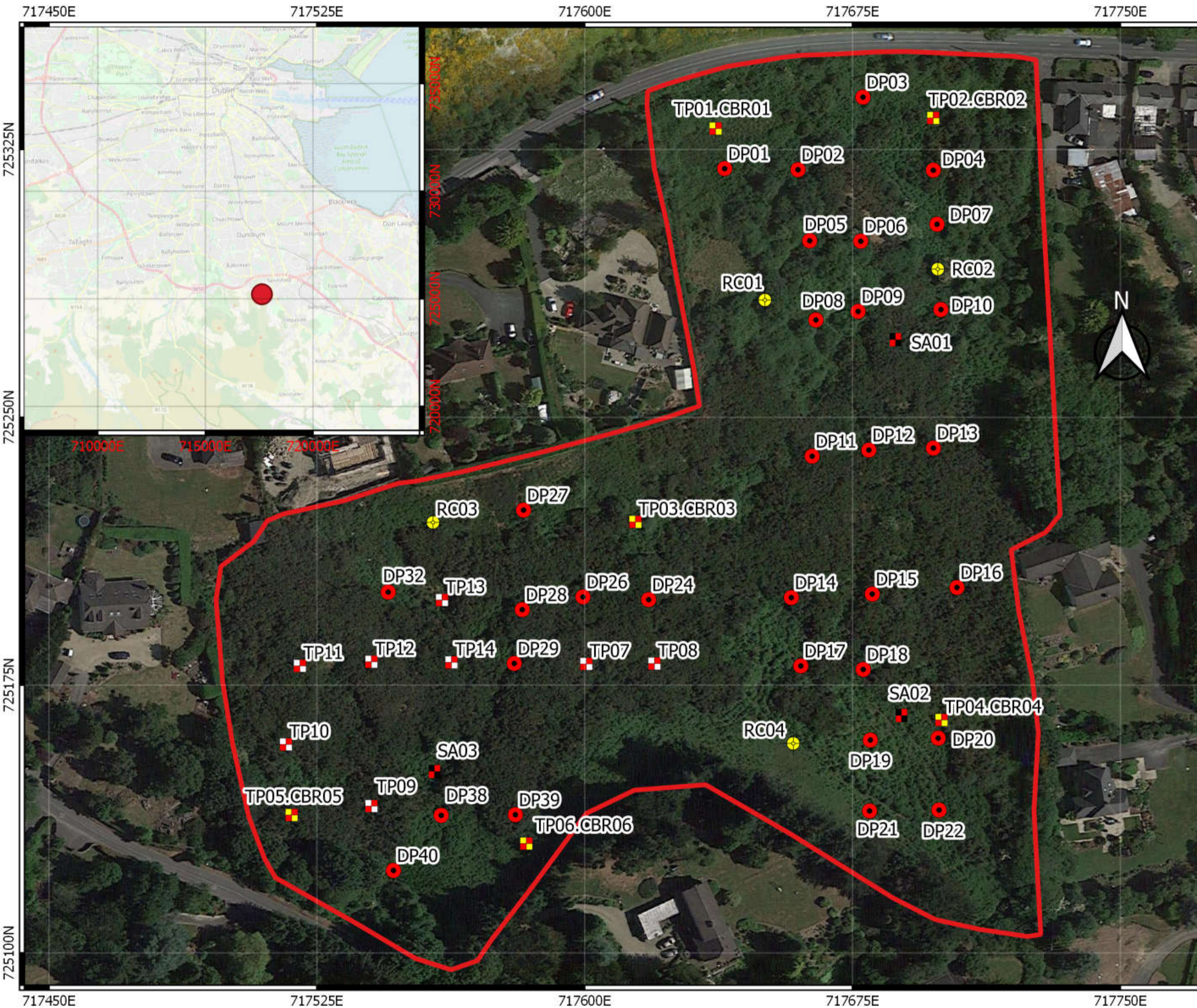
The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations.

Excavations in the upper cohesive and weathered rock deposits are expected to be excavatable with conventional excavation equipment, with zones of more intact bedrock below this depth requiring rock breaking techniques. Based

on the fracture spacing, the rock strength descriptions (estimated) and Pettifer & Fookes (1994) Revised Excavatability Graph, the Granite ranges from hard digging to extremely hard ripping. The 8T excavator was generally able to excavate to depths of 0.3m to 1.0m below the top of the weathered rock, and became difficult to excavate within the confines of the trial pit on encountering the more competent rock.
Any waste material to be removed off site should be disposed of to a suitably licenced landfill.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

APPENDIX 1 - Site Location Plan



Site Location
Indicative Site Boundary
Trial Pit
Trial Pit with CBR Plate Test
Dynamic Probe
Rotary Core Borehole
Soakaway Test

Client:

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

Project Code:
10477-03-21

Project Title:
Blackglen Road

Drawing Title:
Figure 1 - Site Location Plan

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

0 10 20 30 40 50 m

Drawn By:	Date:
J McDowell	31/05/2021

Legend

- Trial Pit
- Slit Trenches

Client:

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

Project Code:

10477-03-21

Project Title:

Blackglen Road Environmental Pits

Drawing Title:

Figure 1 Site Location

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

0 10 20 30 40 m

Drawn By:	Date:
EB	18/06/2021

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd
www.gii.ie

Machine : 8 Tonne Tracked Excavator **Method :** Trial Pit	**Dimensions** 3.50m x 0.85m x 2.30m (L x W x D)	**Ground Level (mOD)** 142.36	**Site** Blackglen Road **Client** OCSC	**Trial Pit Number** TP01 **Job Number** 10477-03-21
	Location 717636.5 E 725330.6 N	**Dates** 01/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL: Brown sandy gravelly Clay with rootlets. Gravel is subangular to subrounded fine to coarse.		
				142.06	0.30	MADE GROUND: Brown sandy gravelly Clay with old pipe and wire fragments and occasional angular to subangular cobbles and some subangular boulders. Gravel is angular to subrounded fine to coarse. (Soft).		
0.50	B				(0.70)			
1.00	B			141.36	1.00	MADE GROUND: Brown sandy gravelly Clay with plastic, old fencing and wire fragments and occasional angular to subangular cobbles and some subangular boulders. Gravel is angular to subrounded fine to coarse. (Firm).		
					(1.30)	OBSTRUCTION at 2.30m BGL due to presumed bedrock or boulder.		
				140.06	2.30	Complete at 2.30m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 2.30m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP01

Ground Investigations Ireland Ltd
www.gii.ie

Machine : 8 Tonne Tracked Excavator **Method :** Trial Pit	**Dimensions** 3.20m x 0.85m x 2.20m (L x W x D)	**Ground Level (mOD)** 139.19	**Client** OCSC	**Job Number** 10477-03-21
	Location 717697.4 E 725333.6 N	**Dates** 01/04/2021	**Engineer**	**Sheet** 1/1

Site: Blackglen Road
Trial Pit Number: TP02

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL: Dark brown sandy gravelly Clay with rootlets. Gravel is subangular to subrounded fine to coarse.		
0.50	B			138.89	0.30 (0.60)	Soft to firm light grey mottled brown slightly sandy gravelly CLAY. Gravel is angular to subangular fine to coarse.		
1.20	B			138.29	0.90 (1.00)	Firm light brown mottled grey slightly sandy gravelly CLAY with occasional angular to subangular cobbles. Gravel is angular to subrounded fine to coarse.		
2.00	B			137.29	1.90 (0.30)	WEATHERED ROCK: Brownish grey clayey sandy angular to subangular fine to coarse Gravel with occasional angular to subangular cobbles. OBSTRUCTION at 2.20m BGL due to presumed bedrock or boulder.		
			slow seepage(1) at 2.20m.	136.99	2.20	Complete at 2.20m		∇1

Plan

Remarks

Groundwater encountered at 2.20m (slow seepage).
Side walls stable.
Trial pit terminated at 2.20m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP02

Ground Investigations Ireland Ltd www.gii.ie		Site Blackglen Road	Trial Pit Number **TP03**
Machine : 8 Tonne Tracked Excavator **Method :** Trial Pit	**Dimensions** 2.90m x 0.85m x 1.30m (L x W x D)	**Ground Level (mOD)** 150.93	**Client** OCSC	**Job Number** 10477-03-21
	Location 717614.1 E 725220.4 N	**Dates** 01/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				150.73	(0.20) 0.20	TOPSOIL: Dark brown sandy gravelly Clay with rootlets. Gravel is subangular to subrounded fine to coarse.		
				150.48	(0.25) 0.45	MADE GROUND: Greyish brown slightly sandy gravelly Clay with some subangular cobbles. Gravel is angular to subrounded fine to coarse.		
0.50	B			150.23	(0.25) 0.70	MADE GROUND: Brownish black very sandy slightly gravelly Clay with concrete blocks and glass fragments. Gravel is angular to subrounded fine to coarse.		
1.00	B			149.63	(0.60) 1.30	POSSIBLE MADE GROUND: Reddish brown very sandy gravelly Clay with occasional angular to subangular cobbles and some subangular boulders. Gravel is angular to subrounded fine to coarse. (Soft to firm). OBSTRUCTION at 1.30m BGL due to presumed bedrock or boulder.		
						Complete at 1.30m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 1.30m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP03

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Trial Pit Number: TP04
Machine : 8 Tonne Tracked Excavator Method : Trial Pit	Dimensions: 3.50m x 0.85m x 1.60m (L x W x D)	Ground Level (mOD): 140.31	Client: OCSC	Job Number: 10477-03-21
	Location: 717699.8 E 725164.9 N	Dates: 01/04/2021	Engineer:	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL: Dark brown sandy gravelly Clay with organic matter and rootlets. Gravel is angular to subrounded fine to coarse.		
				140.11	0.20	Soft Reddish brown mottled grey sandy gravelly CLAY with some angular to subangular cobbles and rare subangular boulders. Gravel is angular to subangular fine to coarse.		
0.50	B				(0.70)			
				139.41	0.90	Greyish brown/yellow slightly clayey sandy angular to subangular fine to coarse Gravel with occasional angular to subangular cobbles and rare subangular boulders.		
1.10	B				(0.70)	OBSTRUCTION at 1.60m BGL due to presumed bedrock or boulder.		
				138.71	1.60	Complete at 1.60m		

Plan

Remarks

Groundwater encountered at 0.90m BGL (medium seepage).
Side walls spalling at 0.40m BGL.
Trial pit terminated at 1.60m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP04

Ground Investigations Ireland Ltd
www.gii.ie

Machine : 8 Tonne Track Excavator **Method :** Trial Pit	**Dimensions** 1.70m x 0.85m x 0.70m (L x W x D)	**Ground Level (mOD)** 157.49	**Site** Blackglen Road **Client** OCSC	**Trial Pit Number** TP05 **Job Number** 10477-03-21
	Location 717517.8 E 725138.3 N	**Dates** 01/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				157.39	(0.10) 0.10	TOPSOIL: Brown sandy gravelly Clay. Gravel is angular to subangular fine to medium.		
0.50	B			156.79	(0.60) 0.70	Soft brown sandy gravelly CLAY with angular to subangular cobbles and rootlets. Gravel is angular to subangular fine to coarse. OBSTRUCTION at 0.70m BGL due to presumed bedrock or boulder.		
						Complete at 0.70m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 0.70m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP05

Ground Investigations Ireland Ltd www.gii.ie	Site Blackglen Road	Trial Pit Number **TP06**

Machine : 8 Tonne Tracked Excavator Method : Trial Pit	Dimensions 2.30m x 1.10m x 1.10m (L x W x D)	Ground Level (mOD) 154.12	Client OCSC	Job Number 10477-03-21
	Location 717583.5 E 725130.3 N	Dates 01/04/2021	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				154.02	(0.10) 0.10	TOPSOIL: Brown sandy gravelly Clay. Gravel is angular to subangular fine to medium.		
0.50	B				(1.00)	Soft light brown sandy very gravelly Clay with occasional angular to subangular cobbles and some angular to subangular boulders. Gravel is angular to subangular fine to coarse. OBSTRUCTION at 1.10m BGL presumed bedrock or boulder.		
				153.02	1.10	Complete at 1.10m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 1.10m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP06

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Trial Pit Number: **TP07**
Machine : 8 Tonne Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.30m x 1.00m x 0.60m (L x W x D)	**Ground Level (mOD)** 153.61	**Client** OCSC	**Job Number** 10477-03-21
	Location DP25	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				153.51	(0.10) 0.10	TOPSOIL: Dark brown sandy gravelly Clay with rootlets. Gravel is angular to subrounded fine to coarse.		
				153.01	(0.50) 0.60	Soft light brown sandy gravelly CLAY with occasional angular to subrounded cobbles. Gravel is subangular to subrounded fine to coarse. OBSTRUCTION at 0.60m BGL due to presumed bedrock or boulder.		
						Complete at 0.60m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 0.60m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP07

Ground Investigations Ireland Ltd www.gii.ie	Site Blackglen Road	Trial Pit Number **TP08**

Machine : 8 Tonne Tracked Excavator Method : Trial Pit	Dimensions 1.40m x 1.00m x 0.15m (L x W x D)	Ground Level (mOD) 151.37	Client OCSC	Job Number 10477-03-21
	Location (dGPS) DP23	Dates 09/04/2021	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				151.22	(0.15) 0.15	TOPSOIL: Dark brown sandy gravelly Clay with rootlets. Gravel is angular to subrounded fine to coarse. OBSTRUCTION at 0.15m BGL due to presumed bedrock or boulder.		
						Complete at 0.15m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 0.15m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP08

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Trial Pit Number: **TP09**
Machine : 8 Tonne Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.70m x 1.00m x 0.50m (L x W x D)	**Ground Level (mOD)** 155.19	**Client** OCSC	**Job Number** 10477-03-21
	Location (dGPS) DP37	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				155.09	(0.10) 0.10	TOPSOIL: Dark brown sandy gravelly Clay with rootlets. Gravel is angular to subrounded fine to coarse.		
				154.69	(0.40) 0.50	Soft brown sandy gravelly CLAY with occasional angular to subangular cobbles. Gravel is angular to subangular fine to coarse. OBSTRUCTION at 0.50m BGL due to presumed bedrock or boulder.		
						Complete at 0.50m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 0.50m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP09

Ground Investigations Ireland Ltd www.gii.ie	Site Blackglen Road	Trial Pit Number **TP10**

Machine : 155.187 Method : Trial Pit	Dimensions 1.60m x 1.00m x 0.60m (L x W x D)	Ground Level (mOD) 153.61	Client OCSC	Job Number 10477-03-21
	Location (dGPS) DP35	Dates 09/04/2021	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	TOPSOIL: Dark brown sandy gravelly Clay with some angular cobbles.		
				153.21	0.40 (0.20)	Soft light brown sandy gravelly CLAY with frequent angular to subangular cobbles. Gravel is angular to subrounded fine to coarse.		
				153.01	0.60	Complete at 0.60m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 0.60m BGL due to presumed bedrock or boulder.
Trail pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP10

Ground Investigations Ireland Ltd www.gii.ie		Site Blackglen Road	Trial Pit Number TP11
Machine : 8 Tonne Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.40m x 1.00m x 0.45m (L x W x D)	**Ground Level (mOD)** 158.90	**Client** OCSC	**Job Number** 10477-03-21
	Location (dGPS) DP34	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL: Dark brown sandy gravelly Clay with some angular cobbles.		
				158.70	0.20			
					(0.25)	Soft grey slightly sandy gravelly CLAY with occasional angular to subangular cobbles. Gravel is angular to subrounded fine to coarse.		
				158.45	0.45	Complete at 0.45m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 0.45m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP11

Ground Investigations Ireland Ltd www.gii.ie		Site Blackglen Road	Trial Pit Number TP12
Machine : 8 Tonne Tracked Excavator Method : Trial Pit	Dimensions 1.60m x 1.00m x 0.20m (L x W x D)	Ground Level (mOD) 157.56	Client OCSC	Job Number 10477-03-21
	Location (dGPS) DP33	Dates 09/04/2021	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				157.46	(0.10) 0.10	TOPSOIL: Dark brown sandy gravelly Clay with some angular cobbles.		
				157.36	(0.10) 0.20	Soft greyish brown sandy gravelly CLAY. Gravel is angular to subangular fine to coarse. OBSTRUCTION at 0.20m BGL due to presumed bedrock or boulder.		
						Complete at 0.20m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 0.20m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP12

Ground Investigations Ireland Ltd www.gii.ie		Site Blackglen Road	Trial Pit Number **TP13**
Machine : 8 Tonne Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.50m x 1.00m x 1.10m (L x W x D) **Ground Level (mOD)** 153.14	**Client** OCSC	**Job Number** 10477-03-21
	Location (dGPS) DP30 **Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				153.04	(0.10) 0.10	TOPSOIL: Dark brown sandy gravelly Clay with some angular cobbles.		
				152.04	(1.00) 1.10	WEATHERED ROCK: Brown/yellow sandy slightly clayey angular to subangular fine to coarse Gravel with frequent angular to subangular cobbles. OBSTRUCTION at 1.10m BGL due to presumed bedrock or boulder.		
						Complete at 1.10m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 1.10m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP13

Ground Investigations Ireland Ltd www.gii.ie	Site Blackglen Road	Trial Pit Number **TP14**

Machine : 8 Tonne Tracked Excavator Method : Trial Pit	Dimensions 1.50m x 1.00m x 1.00m (L x W x D)	Ground Level (mOD) 153.76	Client OCSC	Job Number 10477-03-21
	Location (dGPS) DP31	Dates 09/04/2021	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL: Brown sandy gravelly Clay with rootlets. Gravel is angular to subangular fine to coarse.		
				153.46	0.30 (0.70)	Soft brown mottled grey sandy gravelly CLAY with occasional angular to subangular cobbles. Gravel is angular to subangular fine to coarse. OBSTRUCTION at 1.00m BGL due to presumed bedrock or boulder.		
				152.76	1.00	Complete at 1.00m		

Plan

Remarks

No groundwater encountered.
Side walls stable.
Trial pit terminated at 1.00m BGL due to presumed bedrock or boulder.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	M.Sheehan	10477-03-21.TP14

Ground Investigations Ireland Ltd www.gii.ie	Site: Blackglen Road	Trial Pit Number: ENV TP01

Machine : 8T Tracked Excavator Method : Trial Pit	Dimensions	Ground Level (mOD): 138.73	Client: OCSC	Job Number: 10477-03-21
	Location: 717709.9 E 725341.2 N	Dates: 17/06/2021	Engineer	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.30)	Dark brown slightly sandy slightly gravelly TOPSOIL		
				138.43	0.30 (0.65)	MADE GROUND: Grey/brown slightly sandy gravelly Clay		
1.00-1.70	EN			137.78	0.95 (0.45)	MADE GROUND: Grey/brown slightly sandy gravelly Clay with some angular cobbles and boulders		
			Slow seepage(1) at 1.50m.	137.33	1.40 (0.30)	Grey/white angular fine to coarse GRAVEL with some cobbles and boulders of Granite		∇1
				137.03	1.70	Terminated due to rock Complete at 1.70m		

Plan

Remarks

Trial Pit stable
Groundwater encountered at 1.50m BGL as slow seepage
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	EB	10477-03-21.ENV TP01

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Trial Pit Number: ENV TP02
Machine : 8T Tracked Excavator Method : Trial Pit	Dimensions	Ground Level (mOD): 139.21	Client: OCSC	Job Number: 10477-03-21
	Location: 717699.1 E 725346.7 N	Dates: 17/06/2021	Engineer	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.80)	MADE GROUND: Reddish brown slightly sandy gravelly Clay		
1.00-2.00	EN			138.41	0.80 (1.20)	MADE GROUND: Grey mottled brown slightly sandy gravelly Clay with occasional subangular to subrounded cobbles and boulders		
2.00-3.00	EN			137.21	2.00 (1.60)	Grey slightly clayey very sandy fine to coarse rounded GRAVEL with many cobbles and boulders		
3.00-3.60	EN		Fast ingress(1) at 3.00m.					∇1
				135.61	3.60	Terminated due to ingress Complete at 3.60m		

Plan

Remarks

Trial Pit collapsing from surface
Groundwater encountered at 3.00m BGL as fast ingress
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	EB	10477-03-21.ENV TP02

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Trial Pit Number: ENV TP03
Machine : 8T Tracked Excavator Method : Trial Pit	Dimensions	Ground Level (mOD): 139.44	Client: OCSC	Job Number: 10477-03-21
	Location: 717676 E 725342.2 N	Dates: 17/06/2021	Engineer	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.20)	Brown slightly sandy slightly gravelly TOPSOIL		
				139.24	0.20	MADE GROUND: Grey mottled brown slightly sandy gravelly Clay with occasional subangular to subrounded cobbles and boulders		
					(1.00)			
1.00-2.00	EN							
				138.24	1.20	Grey slightly clayey very sandy fine to coarse subrounded to rounded GRAVEL with some cobbles and boulders		
					(2.10)			
			Fast ingress(1) at 3.20m.					∇1
				136.14	3.30	Grey slightly clayey very sandy fine to coarse subangular to subrounded GRAVEL with many cobbles and boulders		
					(0.50)			
				135.64	3.80	Terminated due to ingress		
						Complete at 3.80m		

Plan

Remarks

Trial Pit collapsing from surface
Groundwater encountered at 3.20m BGL as fast ingress
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	EB	10477-03-21.ENV TP03

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Trial Pit Number: ENV TP04
Machine : 8T Tracked Excavator Method : Trial Pit	Dimensions	Ground Level (mOD): 139.65	Client: OCSC	Job Number: 10477-03-21
	Location: 717693.6 E 725311.6 N	Dates: 17/06/2021	Engineer	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.20)	Brown slightly sandy slightly gravelly TOPSOIL		
				139.45	0.20	MADE GROUND: Reddish brown slightly sandy slightly gravelly Clay with occasional granite cobbles		
					(0.70)			
				138.75	0.90	Grey fine to coarse angular GRAVEL of Granite		
					(0.60)			
			Slow seepage(1) at 1.50m.	138.15	1.50	GRANITE		∇1
					(0.10)			
				138.05	1.60	Terminated due to rock		
						Complete at 1.60m		

Plan

Remarks

Trial Pit stable
Groundwater encountered at 1.50m BGL as slow seepage
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	EB	10477-03-21.ENV TP04

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Trial Pit Number: ENV TP05
Machine : 8T Tracked Excavator Method : Trial Pit	Dimensions	Ground Level (mOD): 139.67	Client: OCSC	Job Number: 10477-03-21
	Location: 717710.5 E 725271.7 N	Dates: 17/06/2021	Engineer	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.30)	Brown slightly sandy slightly gravelly TOPSOIL		
				139.37	0.30 (0.70)	MADE GROUND: Reddish brown slightly sandy slightly gravelly Clay		
1.00-2.00	EN			138.67	1.00 (0.80)	Soft greyish brown slightly sandy gravelly CLAY with occasional cobbles		
				137.87	1.80 (0.70)	Soft greyish brown slightly sandy gravelly CLAY with some cobbles and boulders of Granite		∇1
			Moderate ingress(1) at 2.50m.	137.17	2.50	Complete at 2.50m		

Plan

Remarks

Trial Pit spalling from 1.80m BGL
Groundwater encountered at 2.50m BGL as moderate ingress
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	EB	10477-03-21.ENV TP05

Ground Investigations Ireland Ltd www.gii.ie		Site Blackglen Road	Trial Pit Number ENV TP06
Machine : 8T Tracked Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 142.39	**Client** OCSC	**Job Number** 10477-03-21
	Location 717686.1 E 725294.6 N	**Dates** 17/06/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				142.34	0.05	Dark brown TOPSOIL		
				142.33	0.06	GRANITE Terminated due to rock		
						Complete at 0.06m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	EB	10477-03-21.ENV TP06

Ground Investigations Ireland Ltd
www.gii.ie

Machine : 8T Tracked Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 147.93	**Client** OCSC	**Job Number** 10477-03-21
	Location 717631.3 E 725205.6 N	**Dates** 17/06/2021	**Engineer**	**Sheet** 1/1

Site: Blackglen Road

Trial Pit Number: ENV TP07

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.90)	MADE GROUND: Reddish brown slightly slightly gravelly Clay with occasional cobbles and boulders of Granite		
				147.03	0.90 (0.40)	Brown very clayey slightly sandy fine to coarse angular to subrounded GRAVEL with occasional cobbles and boulders		
				146.63 146.53	1.30 (0.10) 1.40	Competent GRANITE Terminated due to rock		
						Complete at 1.40m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	EB	10477-03-21.ENV TP07

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Trial Pit Number: ENV TP08
Machine : 8T Tracked Excavator Method : Trial Pit	Dimensions	Ground Level (mOD): 148.65	Client: OCSC	Job Number: 10477-03-21
	Location: 717636.8 E 725236 N	Dates: 17/06/2021	Engineer	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.50)	MADE GROUND: Brown slightly sandy slightly gravelly Clay with rootlets		
				148.15	0.50 (0.50)	Firm reddish brown slightly sandy slightly gravelly CLAY with occasional cobbles of Granite		
				147.65	1.00 (0.10)	Competent GRANITE		
				147.55	1.10	Terminated due to rock Complete at 1.10m		

Plan

Remarks

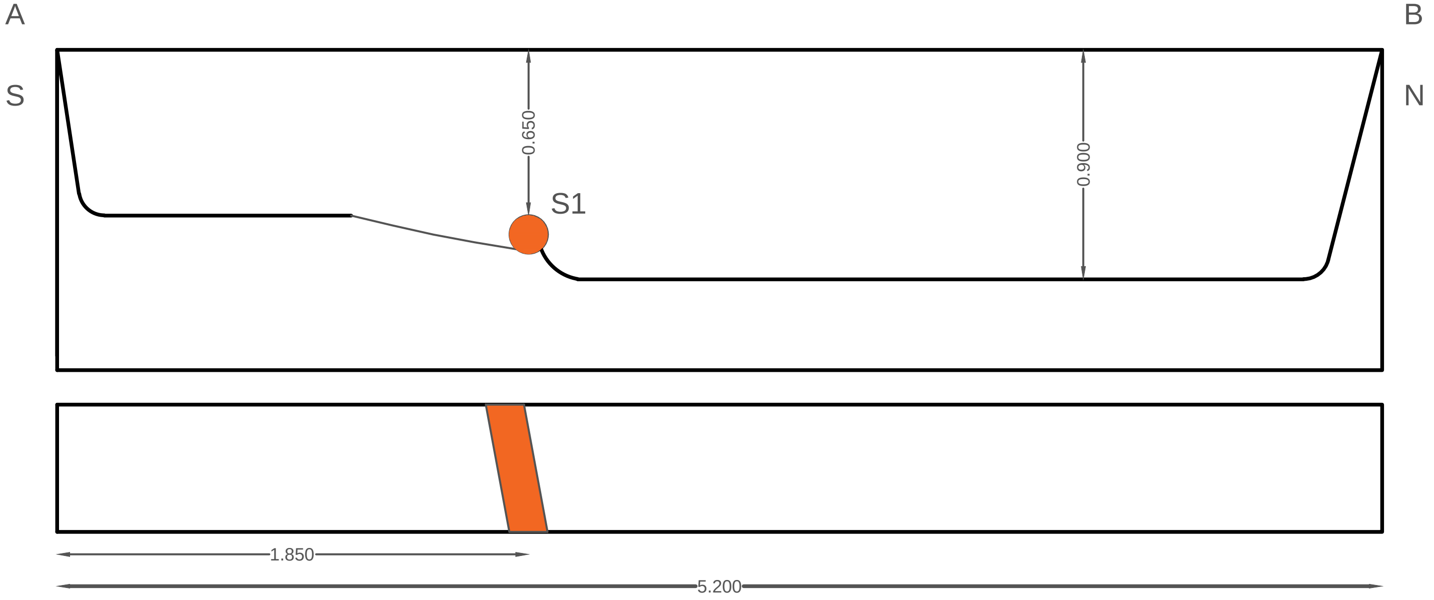
Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	EB	10477-03-21.ENV TP08

E 717709.926
N 725343.030
Z 138.704

ENV ST02

E 717710.239
N 725348.276
Z 138.551



From (m)	To (m)	Description
0.00	0.30	Dark brown slightly sandy slightly gravelly TOPSOIL
0.30	0.50	MADE GROUND: Dark brown slightly sandy slightly gravelly Clay
0.50	0.90	MADE GROUND: Grey slightly sandy gravelly Clay with occasional cobbles and boulders

Service No	ø (mm)	Colour-Material	Utility	Angle to trench
S1	0.15	Orange Wavin	Foul	100

Sample depth	Sample type

Surface from/to		Surface type
0.00	5.20	Topsoil

Groundwater	Y/N	Depth
Slow	Y	0.8

DATE OF EXCAVATION : 17/06/2021

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

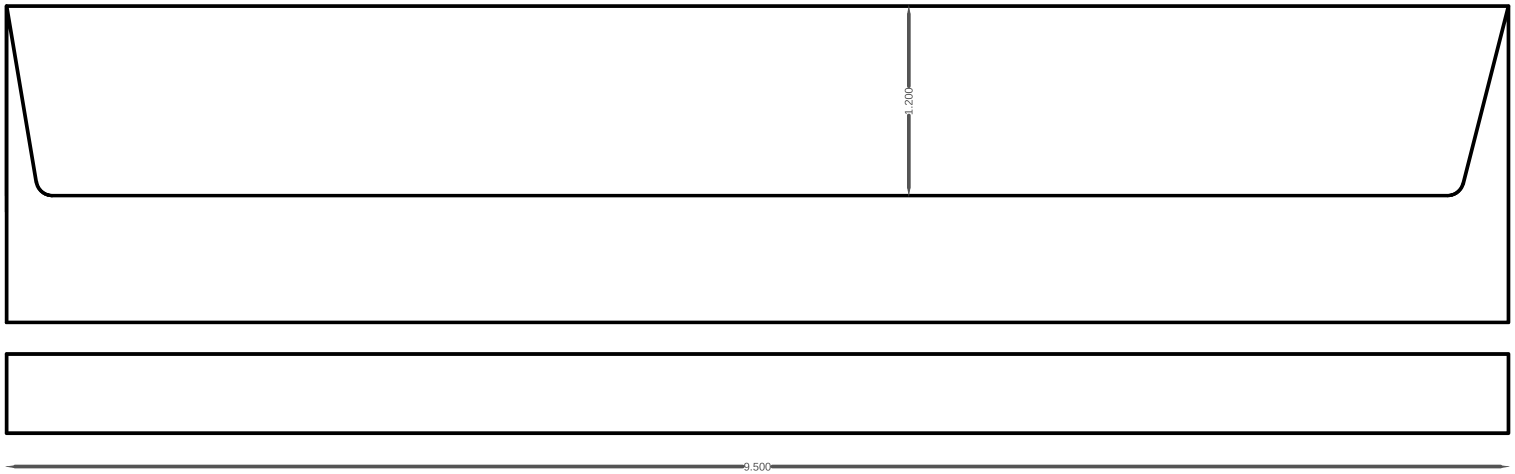
PROJECT:	Blackglen Road
DRAWING No.:	10477-03-21 ENV ST02
DATE:	JUNE 2021
CLIENT:	OCSC
SCALE:	NTS @ A4

Version:	Date:	Drawn By:	Checked:
No.	Initials	Initials	Initials
A	18/06/2021	EB	CF

ENV ST01

E 717628.011
N 725334.259
Z 142.120
A
S

E 717629.547
N 725324.878
Z 142.940
B
N



From (m)	To (m)	Description
0.00	0.20	Brown slightly sandy slightly gravelly TOPSOIL
0.20	2.00	MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional cobbles and boulders and concrete fragments

Service No	ø (mm)	Colour-Material	Utility	Angle to trench

Surface from/to		Surface type
0.00	9.50	Topsoil

Groundwater	Y/N	Depth
	N	

Sample type	Sample depth
EN	0.00-1.00
EN	1.00-2.00

DATE OF EXCAVATION : 17/06/2021

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

PROJECT:	Blackglen Road
DRAWING No.:	10477-03-21 ENV ST01
DATE:	JUNE 2021
CLIENT:	OCSC
SCALE:	NTS @ A4

Version:	Date:	Drawn By:	Checked:
No.	Initials	Initials	Initials
A	18/06/2021	EB	CF

Blackglen Road Trial Pit Photographs.

TP01

TP01

TP01

TP02

TP02

TP02

TP03

TP03

TP03

TP04

TP04

TP04

TP05

TP05

TP05

TP06

TP06

TP06

Blackglen Road Photographs
17.06.21

ENV
TP01

ENV
TP01

ENV
TP01

ENV
TP02

ENV TP02

ENV TP03

ENV
TP03

ENV
TP03

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ENV TP08

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ST01

ENV
ST01

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ST01

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ST01

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ST01

ENV
ST01

ENV
ST02

ENV ST02

APPENDIX 3 –Soakaway Records

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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

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

SA01

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.80m x 0.60m 1.20m (L x W x D)

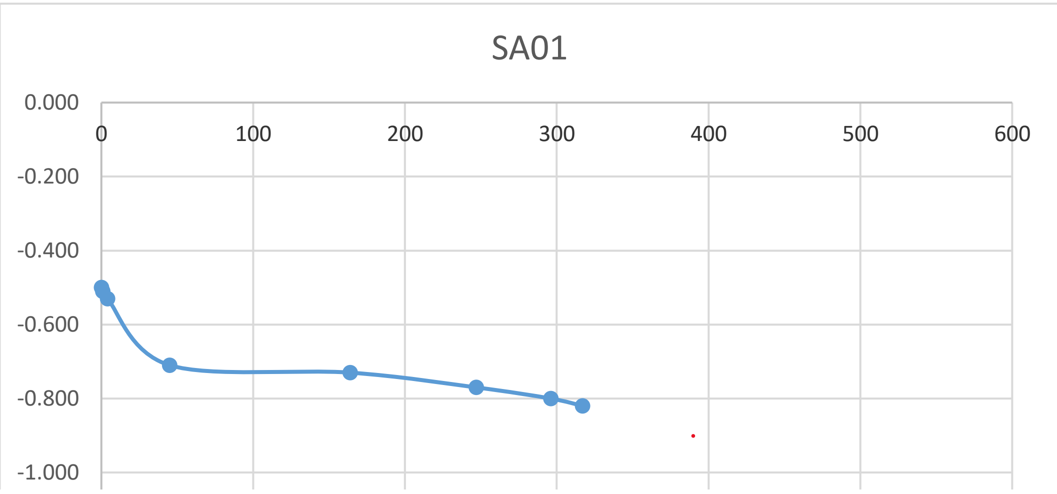
Date	Time	Water level (m bgl)
09/04/2021	0	-0.500
09/04/2021	1	-0.510
09/04/2021	4	-0.530
09/04/2021	45	-0.710
09/04/2021	164	-0.730
09/04/2021	247	-0.770
09/04/2021	296	-0.800
09/04/2021	317	-0.820

Start depth	Depth of Pit	Diff	75% full	25%full
0.50	**1.200**	**0.700**	**0.675**	**1.025**

Length of pit (m)	Width of pit (m)	75-25Ht (m)	Vp75-25 (m3)
1.700	0.600	0.350	0.36

Tp75-25 (from graph) (s)	**32700**	50% Eff Depth	ap50 (m2)
		0.350	2.63

f = 4.151E-06 m/s



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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Newcastle,
Co. Dublin.
D22 YD52

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

SA02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.60m x 0.60m 1.20m (L x W x D)

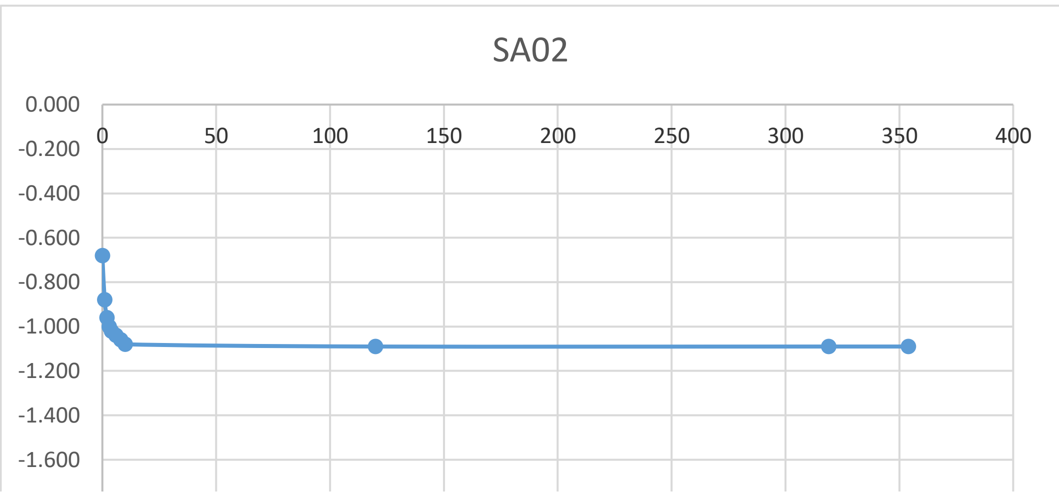
Date	Time	Water level (m bgl)
09/04/2021	0	-0.680
09/04/2021	1	-0.880
09/04/2021	2	-0.960
09/04/2021	3	-1.000
09/04/2021	4	-1.020
09/04/2021	6	-1.040
09/04/2021	8	-1.060
09/04/2021	10	-1.080
09/04/2021	120	-1.090
10/04/2021	319	-1.090
11/04/2021	354	-1.090

Start depth	Depth of Pit	Diff	75% full	25%full
0.68	**1.200**	**0.520**	**0.81**	**1.07**

Length of pit (m)	Width of pit (m)	75-25Ht (m)	Vp75-25 (m3)
1.700	0.600	0.260	0.27

Tp75-25 (from graph) (s)		50% Eff Depth	ap50 (m2)
	7200	0.260	2.216

f = 1.662E-05 m/s



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
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D22 YD52

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

SA03

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.70m x 0.60m 1.20m (L x W x D)

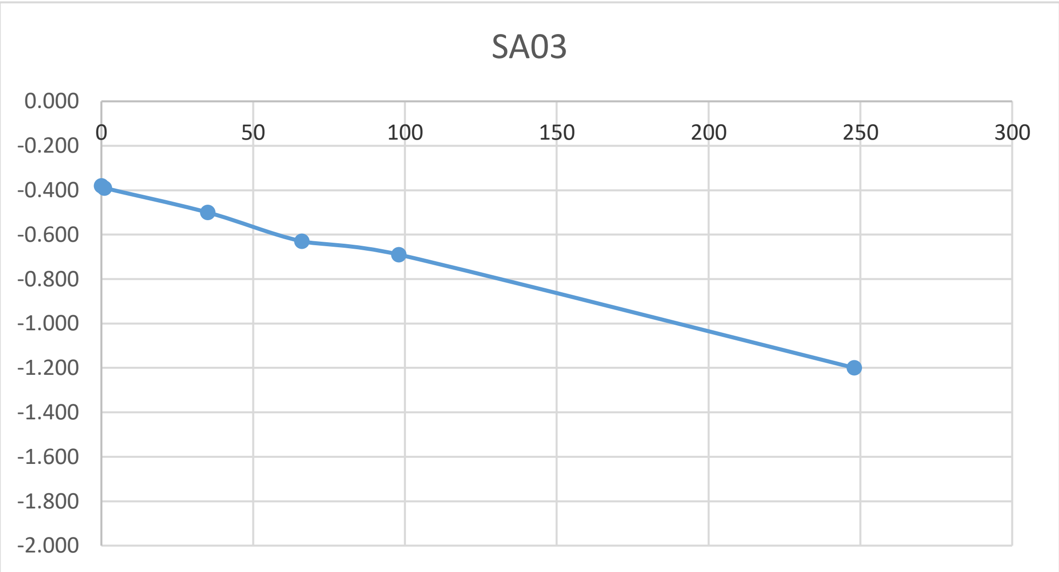
Date	Time	Water level (m bgl)
09/04/2021	0	-0.380
09/04/2021	1	-0.390
09/04/2021	35	-0.500
09/04/2021	66	-0.630
09/04/2021	98	-0.690
09/04/2021	248	-1.200

Start depth	Depth of Pit	Diff	75% full	25%full
0.38	**1.200**	**0.820**	**0.585**	**0.995**

Length of pit (m)	Width of pit (m)	75-25Ht (m)	Vp75-25 (m3)
1.700	0.600	0.410	0.42

Tp75-25 (from graph) (s)	**9000**	50% Eff Depth	ap50 (m2)
		0.410	2.906

f = 1.599E-05 m/s



APPENDIX 4 –Dynamic Probing Records

www.gii.ie

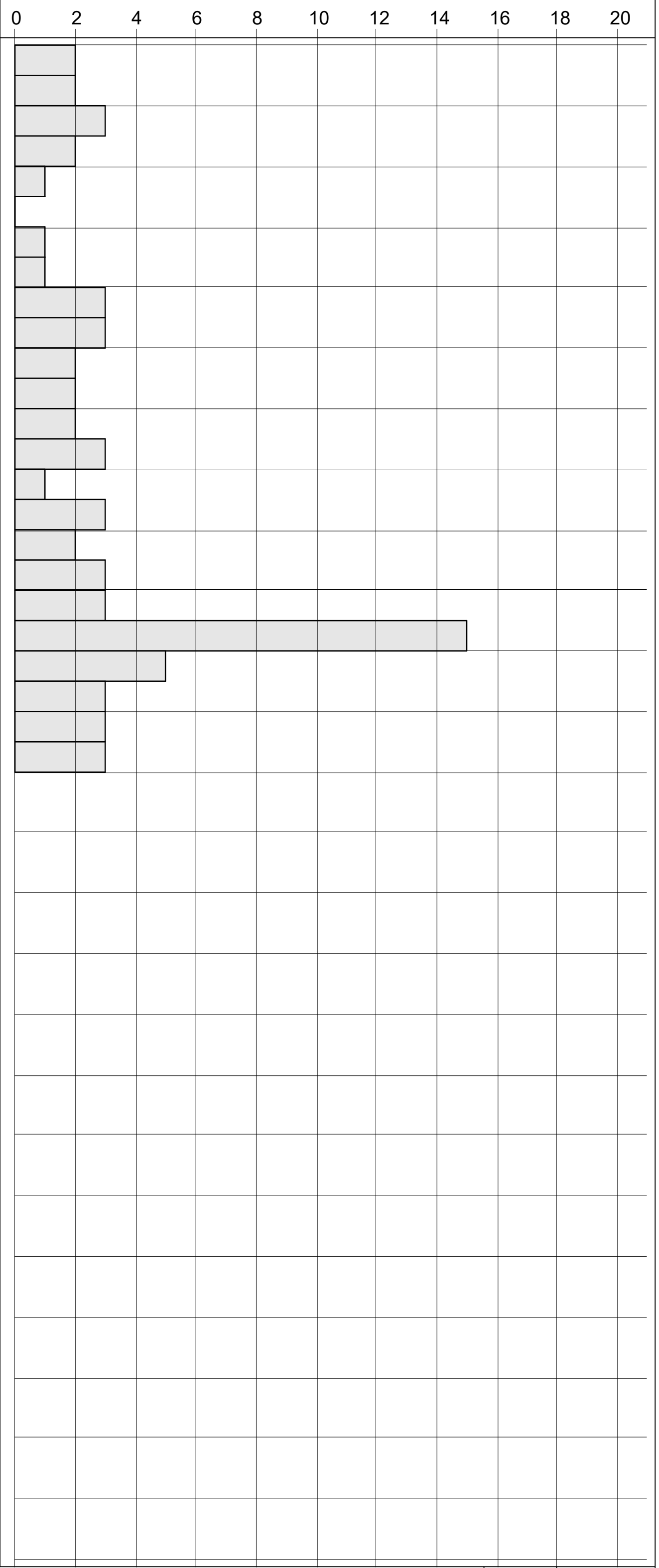
Ground Investigations Ireland Ltd
www.gii.ie

Site	Blackglen Road		**Probe Number**	**DPH01**
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 143.22	**Client** OCSC	**Job Number** 10477-03-21
	Location 717639.2 E 725319.8 N	**Dates** 12/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	2	
0.10-0.20	2	
0.20-0.30	3	
0.30-0.40	2	
0.40-0.50	1	
0.50-0.60	0	
0.60-0.70	1	
0.70-0.80	1	
0.80-0.90	3	
0.90-1.00	3	
1.00-1.10	2	
1.10-1.20	2	
1.20-1.30	2	
1.30-1.40	3	
1.40-1.50	1	
1.50-1.60	3	
1.60-1.70	2	
1.70-1.80	3	
1.80-1.90	3	
1.90-2.00	15	
2.00-2.10	5	
2.10-2.20	3	
2.20-2.30	3	
2.30-2.40	3	

Level (mOD)	Depth (m)
143.22	0.00
142.72	0.50
142.22	1.00
141.72	1.50
141.22	2.00
140.72	2.50
140.22	3.00
139.72	3.50
139.22	4.00
138.72	4.50
138.22	5.00

Blows for Depth Increment



Remarks
Refusal at 2.40m BGL for 25 blows

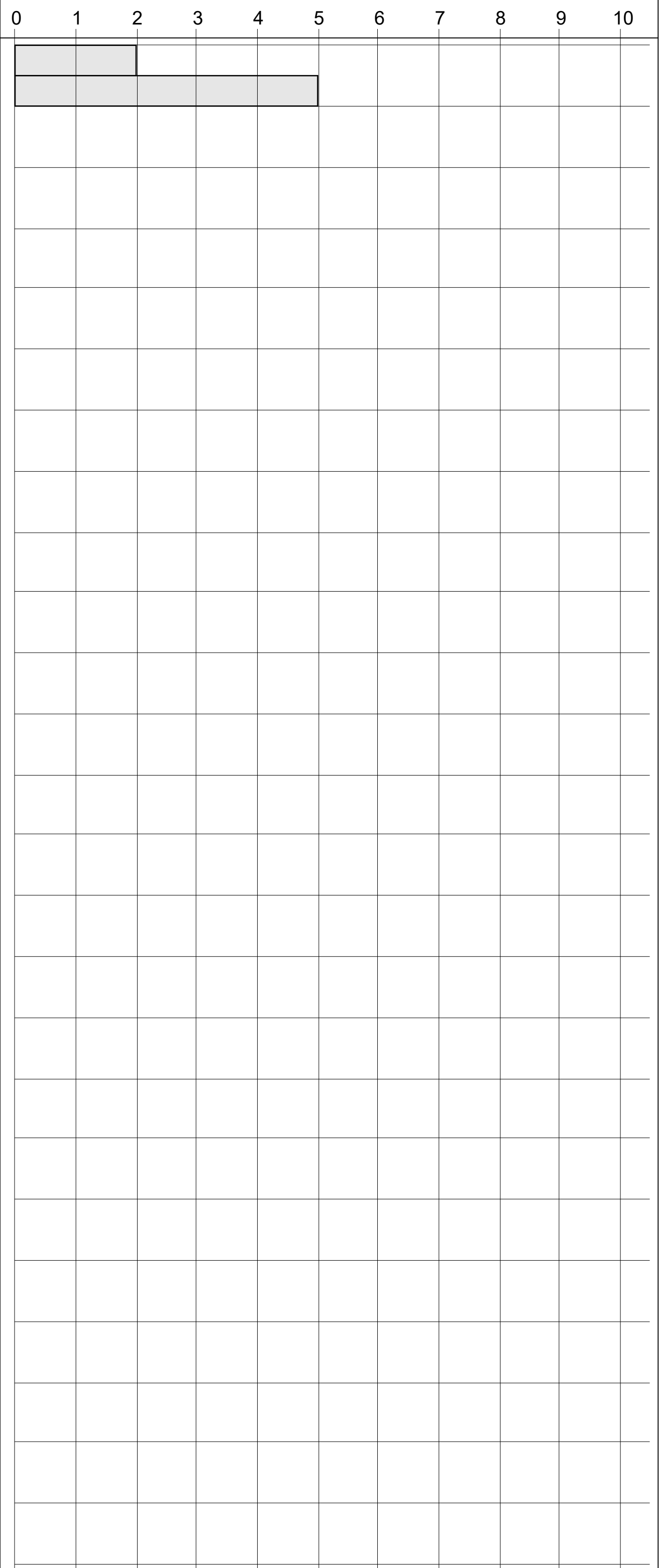
Scale (approx)	**Logged By**
1:25	CF

Figure No.
10477-03-21.DPH01

Ground Investigations Ireland Ltd www.gii.ie			Site Blackglen Road	Probe Number **DPH02**
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 143.17	**Client** OCSC	**Job Number** 10477-03-21
	Location 717659.7 E 725319.5 N	**Dates** 12/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	2		143.17	0.00
0.10-0.20	5			
			142.67	0.50
			142.17	1.00
			141.67	1.50
			141.17	2.00
			140.67	2.50
			140.17	3.00
			139.67	3.50
			139.17	4.00
			138.67	4.50
			138.17	5.00

Blows for Depth Increment



Remarks
Refusal at 0.20m BGL 25 blows for 50mm

Scale (approx)	Logged By
1:25	CF

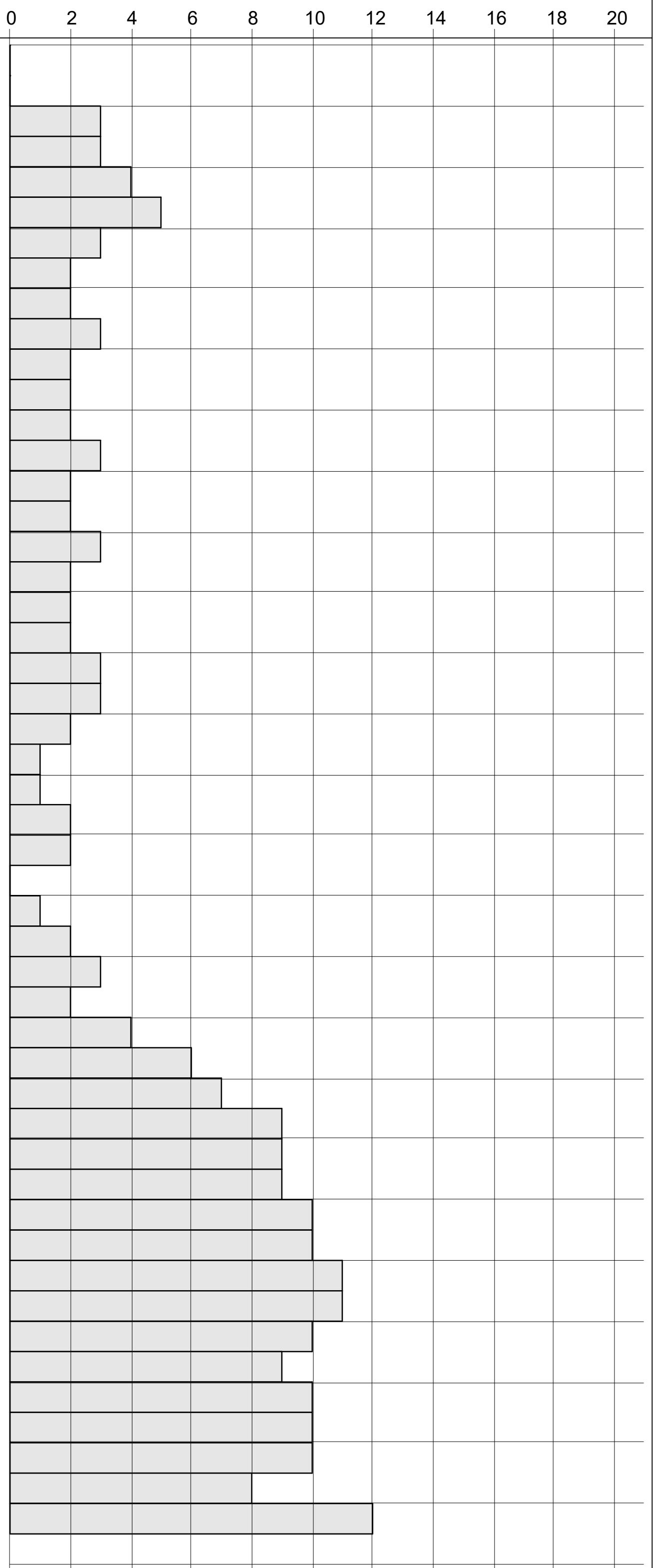
Figure No.
10477-03-21.DPH02

Ground Investigations Ireland Ltd www.gii.ie	Site: Blackglen Road	Probe Number: **DPH03**

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	43.7mm	139.32	OCSC	10477-03-21
	Location	**Dates**	**Engineer**	**Sheet**
	717677.9 E 725339.8 N	12/04/2021		1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		139.32	0.00
0.10-0.20	0			
0.20-0.30	3			
0.30-0.40	3			
0.40-0.50	4			
0.50-0.60	5		138.82	0.50
0.60-0.70	3			
0.70-0.80	2			
0.80-0.90	2			
0.90-1.00	3			
1.00-1.10	2		138.32	1.00
1.10-1.20	2			
1.20-1.30	2			
1.30-1.40	3			
1.40-1.50	2			
1.50-1.60	2		137.82	1.50
1.60-1.70	3			
1.70-1.80	2			
1.80-1.90	2			
1.90-2.00	2			
2.00-2.10	3		137.32	2.00
2.10-2.20	3			
2.20-2.30	2			
2.30-2.40	1			
2.40-2.50	1			
2.50-2.60	2		136.82	2.50
2.60-2.70	2			
2.70-2.80	0			
2.80-2.90	1			
2.90-3.00	2			
3.00-3.10	3		136.32	3.00
3.10-3.20	2			
3.20-3.30	4			
3.30-3.40	6			
3.40-3.50	7			
3.50-3.60	9		135.82	3.50
3.60-3.70	9			
3.70-3.80	9			
3.80-3.90	10			
3.90-4.00	10			
4.00-4.10	11		135.32	4.00
4.10-4.20	11			
4.20-4.30	10			
4.30-4.40	9			
4.40-4.50	10			
4.50-4.60	10		134.82	4.50
4.60-4.70	10			
4.70-4.80	8			
4.80-4.90	12			
4.90	0			
			134.32	5.00

Blows for Depth Increment



Remarks
Refusal at 4.90m BGL 25 blows for 50mm

Scale (approx)	Logged By
1:25	CF

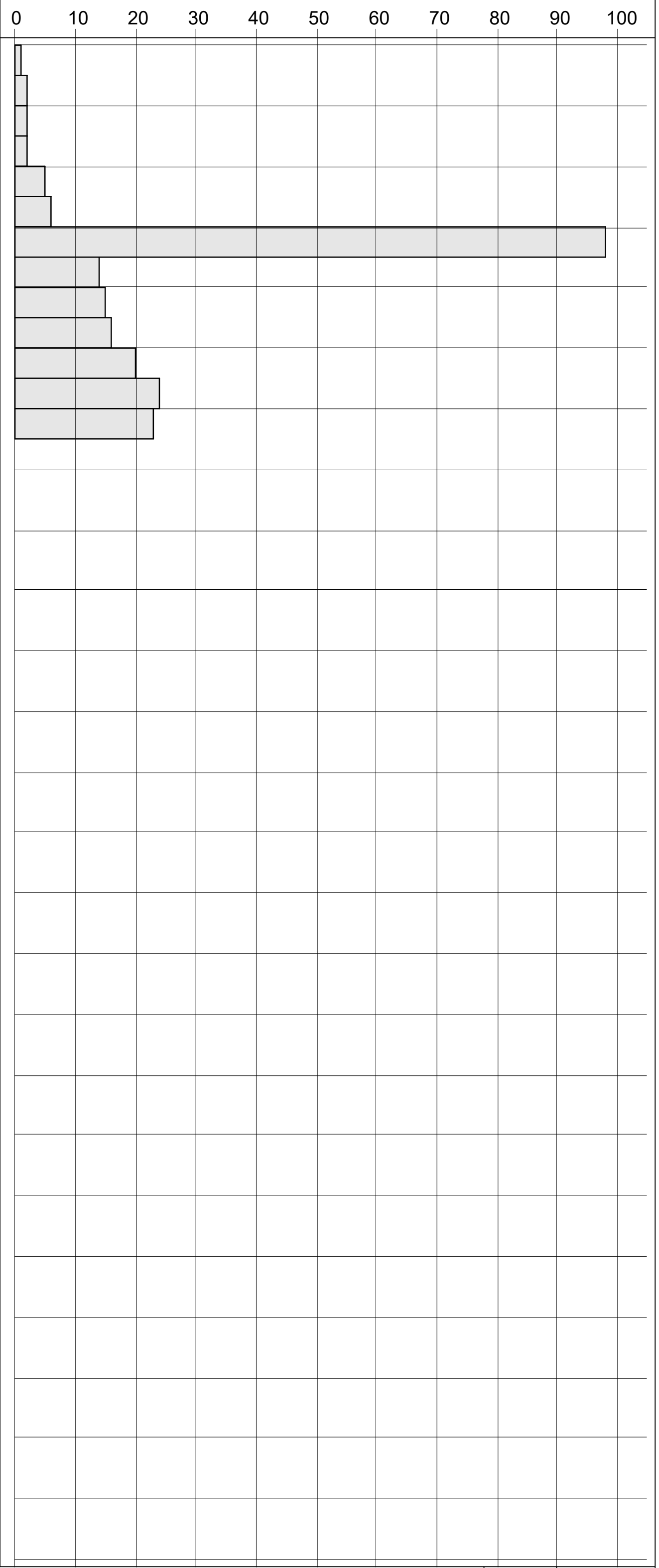
Figure No. 10477-03-21.DPH03

Ground Investigations Ireland Ltd www.gii.ie			**Site** Blackglen Road	**Probe Number** DPH04
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 139.55	**Client** OCSC	**Job Number** 10477-03-21
	Location 717697.6 E 725319.4 N	**Dates** 12/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	1	
0.10-0.20	2	
0.20-0.30	2	
0.30-0.40	2	
0.40-0.50	5	
0.50-0.60	6	
0.60-0.70	98	
0.70-0.80	14	
0.80-0.90	15	
0.90-1.00	16	
1.00-1.10	20	
1.10-1.20	24	
1.20-1.30	23	

Level (mOD)	Depth (m)
139.55	0.00
139.05	0.50
138.55	1.00
138.05	1.50
137.55	2.00
137.05	2.50
136.55	3.00
136.05	3.50
135.55	4.00
135.05	4.50
134.55	5.00

Blows for Depth Increment

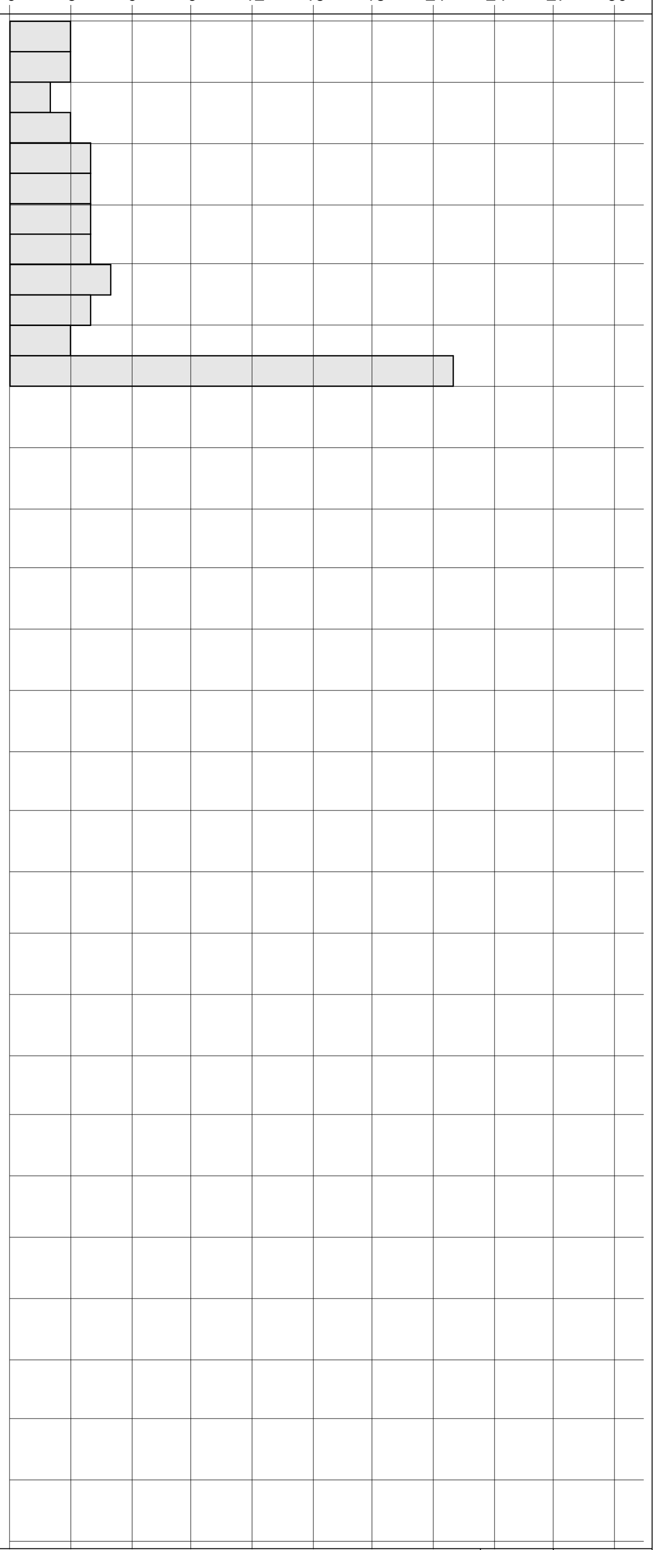


Remarks	Scale (approx)	Logged By
	1:25	CF
	Figure No. 10477-03-21.DPH04	

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH05
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	Cone Dimensions: 43.7mm	Ground Level (mOD): 145.27	Client: OCSC	Job Number: 10477-03-21
	Location: 717663 E 725299.6 N	Dates: 09/04/2021	Engineer:	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		145.27	0.00
0.10-0.20	3			
0.20-0.30	2			
0.30-0.40	3			
0.40-0.50	4			
0.50-0.60	4		144.77	0.50
0.60-0.70	4			
0.70-0.80	4			
0.80-0.90	5			
0.90-1.00	4			
1.00-1.10	3		144.27	1.00
1.10-1.20	22			
			143.77	1.50
			143.27	2.00
			142.77	2.50
			142.27	3.00
			141.77	3.50
			141.27	4.00
			140.77	4.50
			140.27	5.00

Blows for Depth Increment



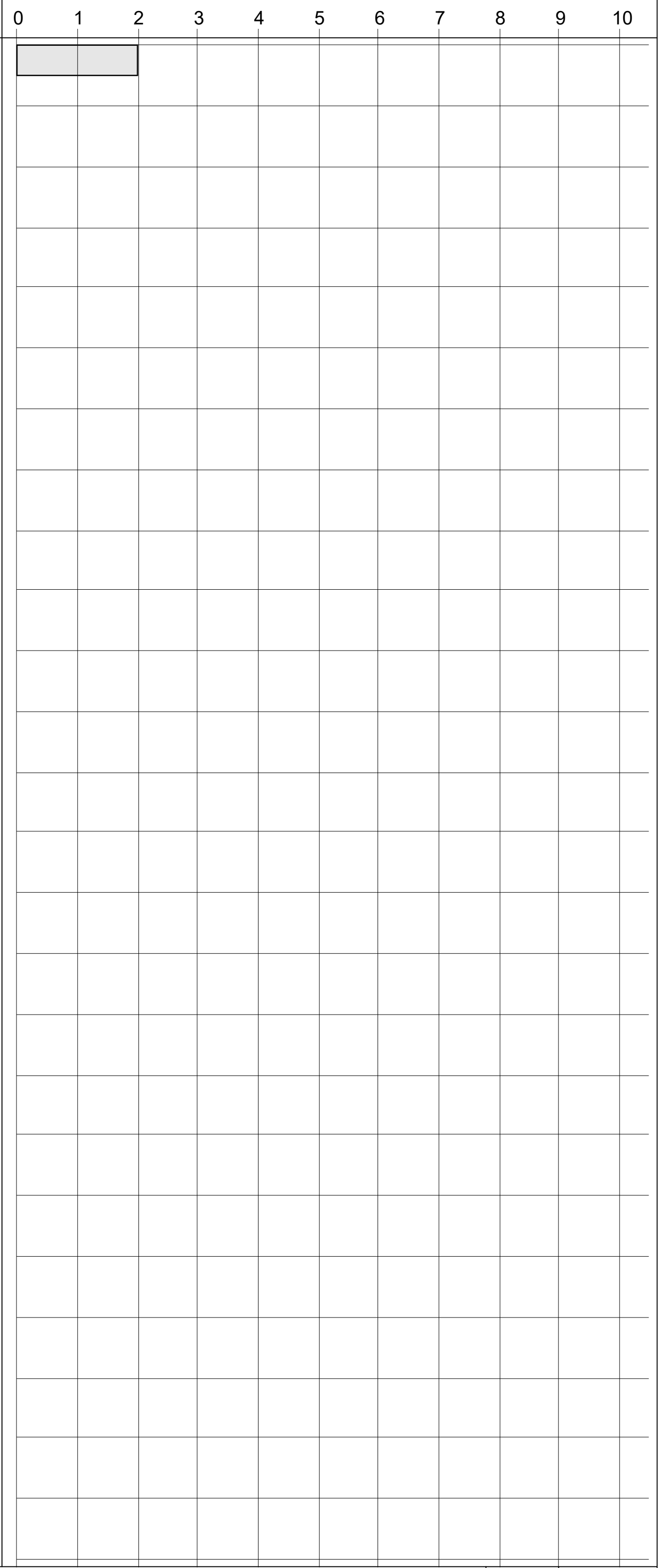
Remarks
Refusal at 1.20m BGL 25 blows for 50mm

Scale (approx)	Logged By
1:25	CF

Figure No. 10477-03-21.DPH05

Ground Investigations Ireland Ltd www.gii.ie			Site Blackglen Road	Probe Number **DPH06**
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 144.41	**Client** OCSC	**Job Number** 10477-03-21
	Location 717677.3 E 725299.5 N	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	2		144.41	0.00
			143.91	0.50
			143.41	1.00
			142.91	1.50
			142.41	2.00
			141.91	2.50
			141.41	3.00
			140.91	3.50
			140.41	4.00
			139.91	4.50
			139.41	5.00



Remarks
Refusal at 0.10m BGL for 25 blows

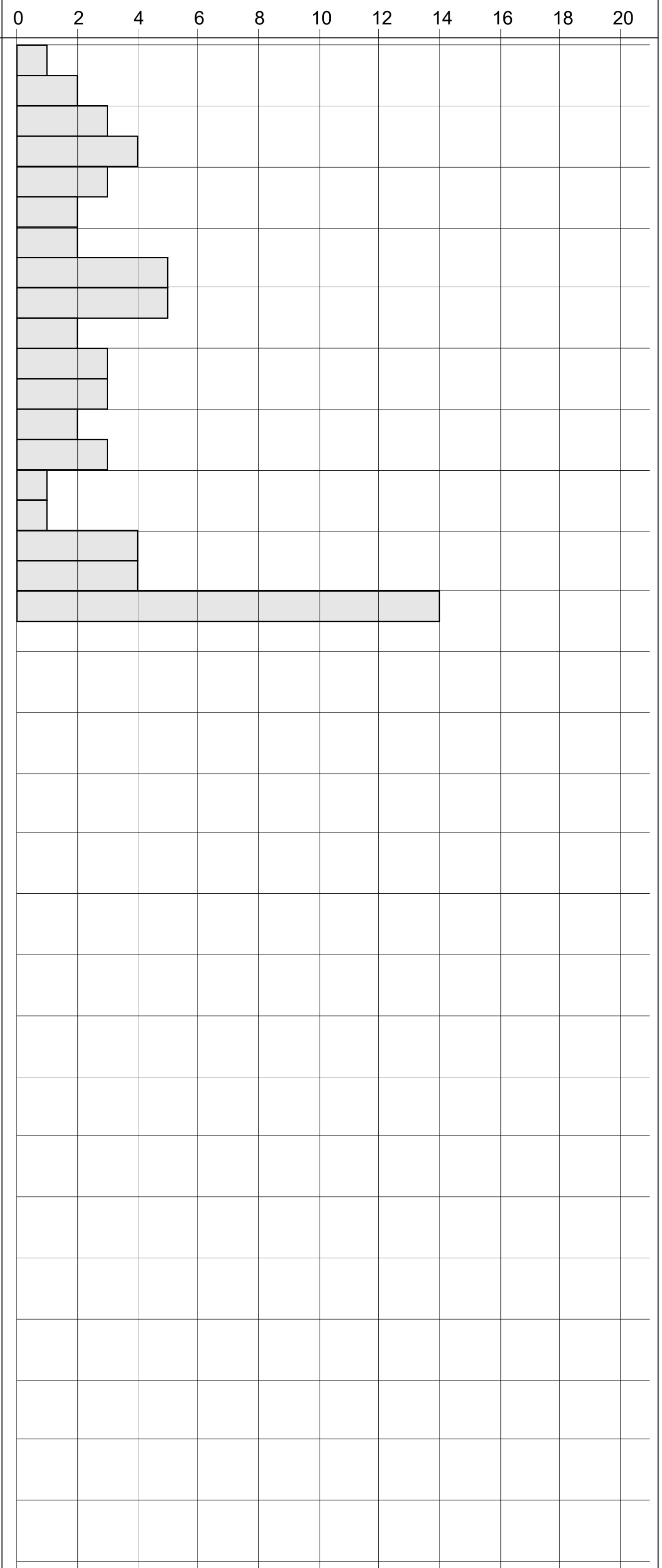
Scale (approx)	Logged By
1:25	CF

Figure No.
10477-03-21.DPH06

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH07
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	Cone Dimensions: 43.7mm	Ground Level (mOD): 139.44	Client: OCSC	Job Number: 10477-03-21
	Location: 717698.6 E 725304.3 N	Dates: 09/04/2021	Engineer:	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	1		139.44	0.00
0.10-0.20	2			
0.20-0.30	3			
0.30-0.40	4			
0.40-0.50	3			
0.50-0.60	2		138.94	0.50
0.60-0.70	2			
0.70-0.80	5			
0.80-0.90	5			
0.90-1.00	2			
1.00-1.10	3		138.44	1.00
1.10-1.20	3			
1.20-1.30	2			
1.30-1.40	3			
1.40-1.50	1			
1.50-1.60	1		137.94	1.50
1.60-1.70	4			
1.70-1.80	4			
1.80-1.90	14			
			137.44	2.00
			136.94	2.50
			136.44	3.00
			135.94	3.50
			135.44	4.00
			134.94	4.50
			134.44	5.00

Blows for Depth Increment



Remarks
Refusal at 1.90m BGL for 29 blows

Scale (approx)	Logged By
1:25	CF

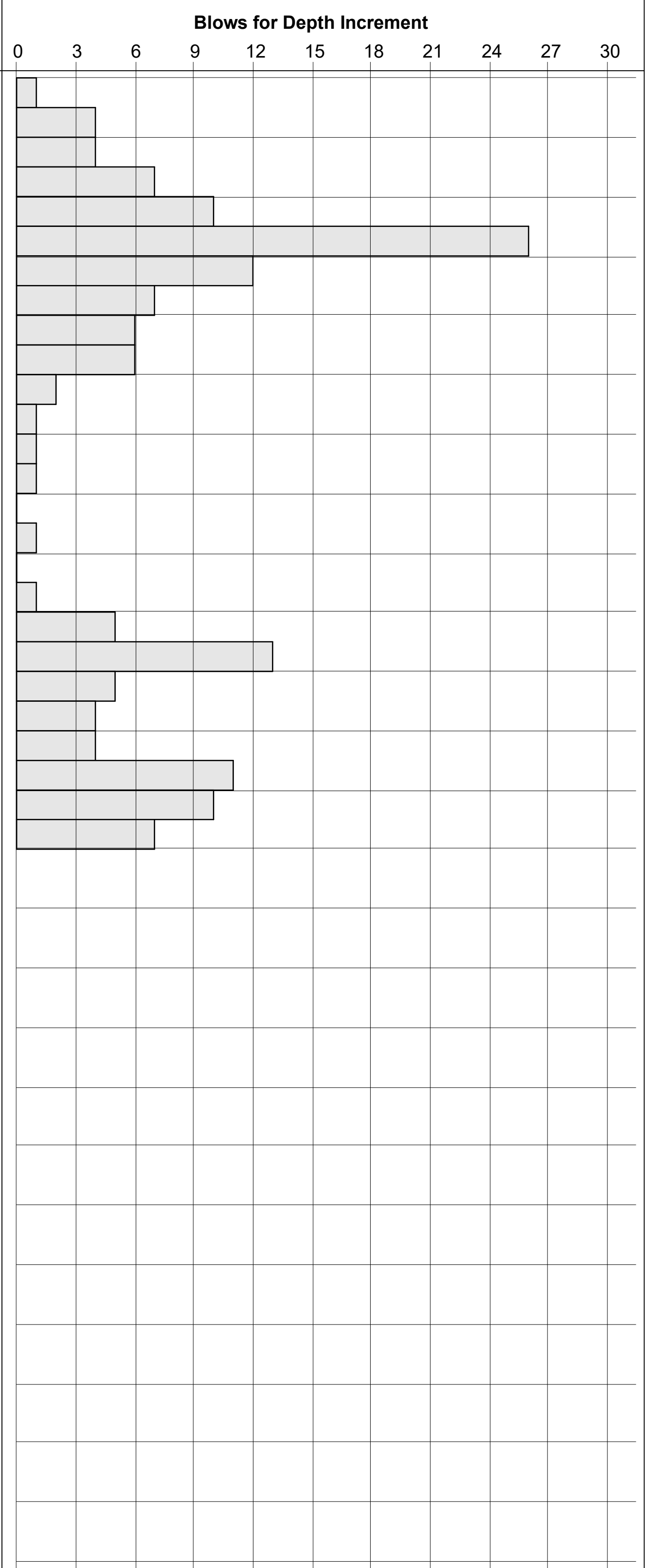
Figure No.
10477-03-21.DPH07

Ground Investigations Ireland Ltd www.gii.ie	Site: Blackglen Road	Probe Number: DPH08

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	43.7mm	145.78	OCSC	10477-03-21
	Location	**Dates**	**Engineer**	**Sheet**
	717664.8 E 725277.4 N	08/04/2021		1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	1	
0.10-0.20	4	
0.20-0.30	4	
0.30-0.40	7	
0.40-0.50	10	
0.50-0.60	26	
0.60-0.70	12	
0.70-0.80	7	
0.80-0.90	6	
0.90-1.00	6	
1.00-1.10	2	
1.10-1.20	1	
1.20-1.30	1	
1.30-1.40	1	
1.40-1.50	0	
1.50-1.60	1	
1.60-1.70	0	
1.70-1.80	1	
1.80-1.90	5	
1.90-2.00	13	
2.00-2.10	5	
2.10-2.20	4	
2.20-2.30	4	
2.30-2.40	11	
2.40-2.50	10	
2.50-2.60	7	

Level (mOD)	Depth (m)
145.78	0.00
145.28	0.50
144.78	1.00
144.28	1.50
143.78	2.00
143.28	2.50
142.78	3.00
142.28	3.50
141.78	4.00
141.28	4.50
140.78	5.00



Remarks
Refusal at 2.60m BGL 25 blows for 10mm

Scale (approx)	Logged By
1:25	CF

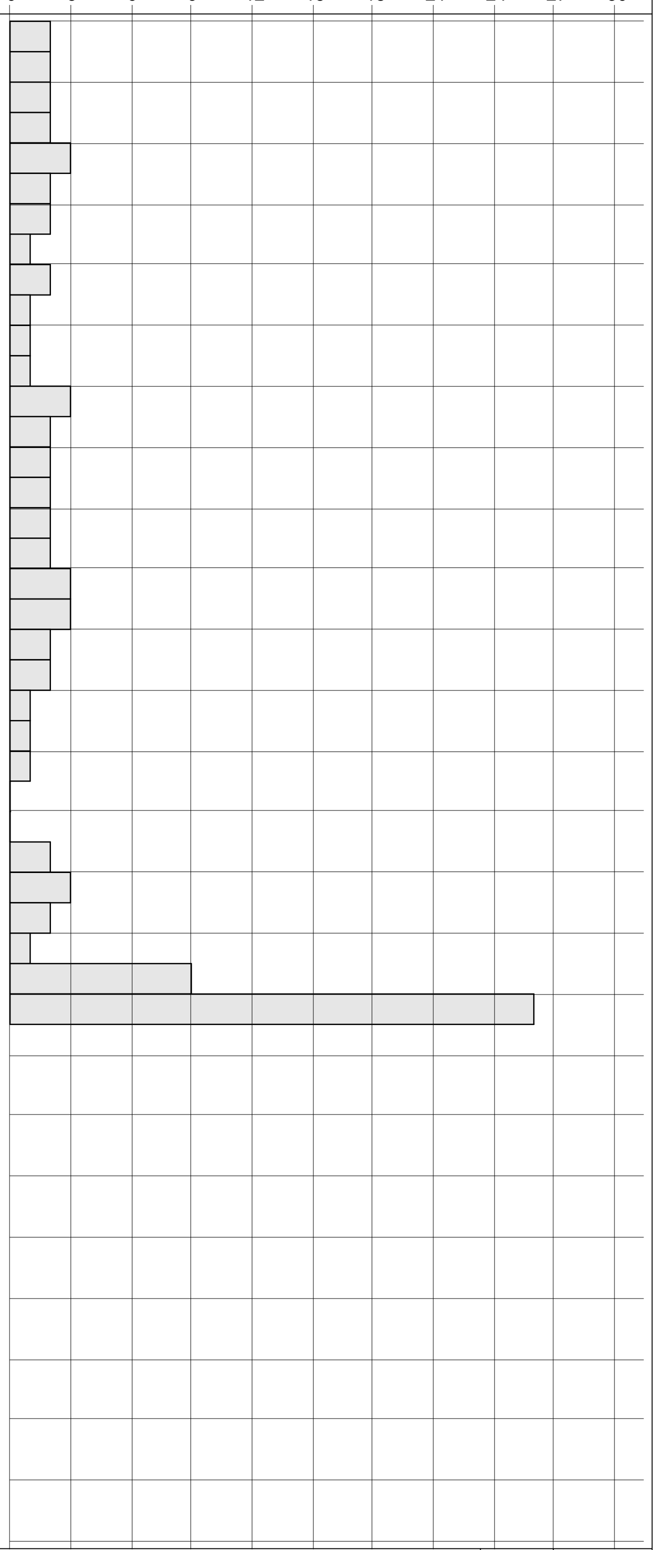
Figure No. 10477-03-21.DPH08

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH09
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions**: 43.7mm	**Ground Level (mOD)**: 144.46	**Client**: OCSC	**Job Number**: 10477-03-21
	Location: 717676.6 E 725279.8 N	**Dates**: 12/04/2021	**Engineer**:	**Sheet**: 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	2	
0.10-0.20	2	
0.20-0.30	2	
0.30-0.40	2	
0.40-0.50	3	
0.50-0.60	2	
0.60-0.70	2	
0.70-0.80	1	
0.80-0.90	2	
0.90-1.00	1	
1.00-1.10	1	
1.10-1.20	1	
1.20-1.30	3	
1.30-1.40	2	
1.40-1.50	2	
1.50-1.60	2	
1.60-1.70	2	
1.70-1.80	2	
1.80-1.90	3	
1.90-2.00	3	
2.00-2.10	2	
2.10-2.20	2	
2.20-2.30	1	
2.30-2.40	1	
2.40-2.50	1	
2.50-2.60	0	
2.60-2.70	0	
2.70-2.80	2	
2.80-2.90	3	
2.90-3.00	2	
3.00-3.10	1	
3.10-3.20	9	
3.20-3.30	26	

Level (mOD)	Depth (m)
144.46	0.00
143.96	0.50
143.46	1.00
142.96	1.50
142.46	2.00
141.96	2.50
141.46	3.00
140.96	3.50
140.46	4.00
139.96	4.50
139.46	5.00

Blows for Depth Increment



Remarks
Refusal at 3.30m BGL for 25 blows

Scale (approx)	Logged By
1:25	CF

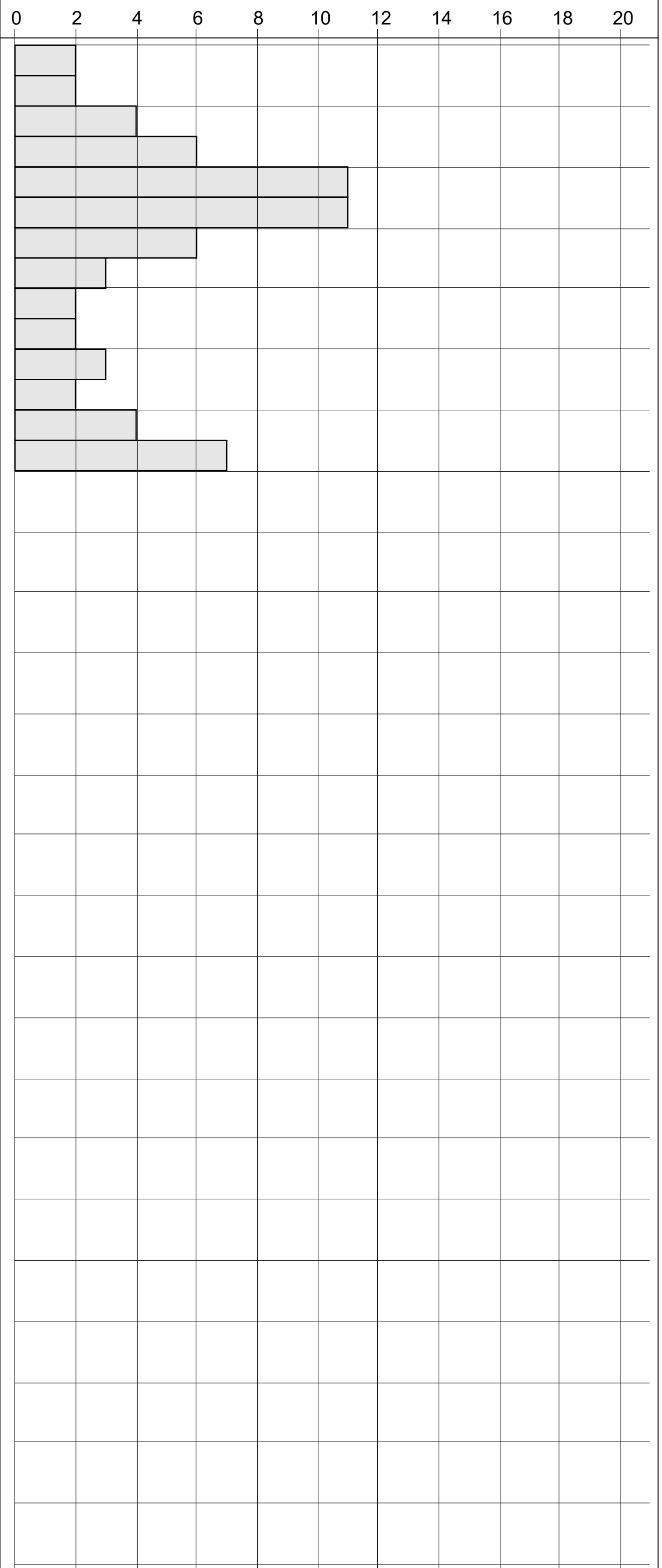
Figure No. 10477-03-21.DPH09

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: **DPH10**
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 140.30	**Client** OCSC	**Job Number** 10477-03-21
	Location 717699.8 E 725280.3 N	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	2	
0.10-0.20	2	
0.20-0.30	4	
0.30-0.40	6	
0.40-0.50	11	
0.50-0.60	11	
0.60-0.70	6	
0.70-0.80	3	
0.80-0.90	2	
0.90-1.00	2	
1.00-1.10	3	
1.10-1.20	2	
1.20-1.30	4	
1.30-1.40	7	

Level (mOD)	Depth (m)
140.30	0.00
139.80	0.50
139.30	1.00
138.80	1.50
138.30	2.00
137.80	2.50
137.30	3.00
136.80	3.50
136.30	4.00
135.80	4.50
135.30	5.00

Blows for Depth Increment



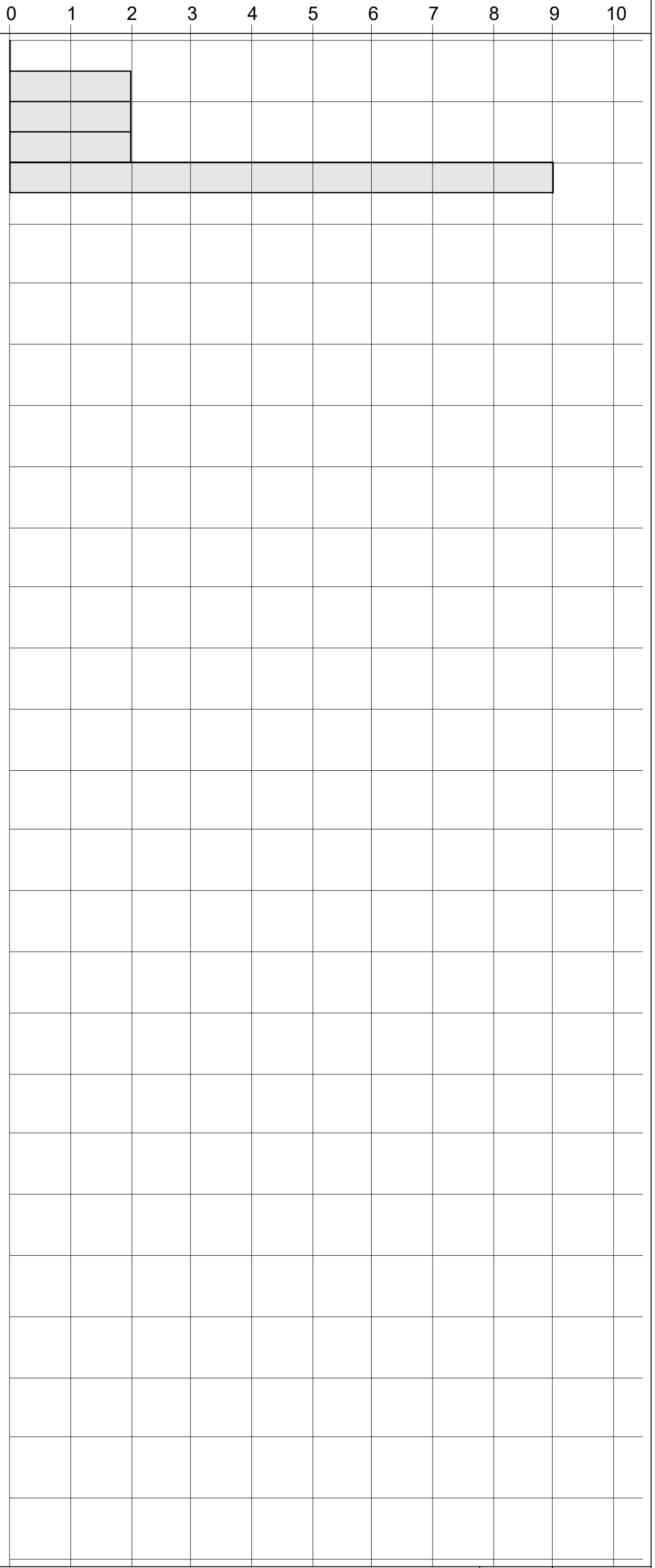
Remarks
Refusal at 1.40m BGL BGL for 25 blows

Scale (approx)	Logged By
1:25	CF

Figure No. 10477-03-21.DPH10

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH11
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	Cone Dimensions: 43.7mm	Ground Level (mOD): 147.43	Client: OCSC	Job Number: 10477-03-21
	Location: 717663.7 E 725239.3 N	Dates: 09/04/2021	Engineer:	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		147.43	0.00
0.10-0.20	2			
0.20-0.30	2			
0.30-0.40	2			
0.40-0.50	9			
			146.93	0.50
			146.43	1.00
			145.93	1.50
			145.43	2.00
			144.93	2.50
			144.43	3.00
			143.93	3.50
			143.43	4.00
			142.93	4.50
			142.43	5.00



Remarks
Refusal at 0.50m BGL 25 blows for 10mm

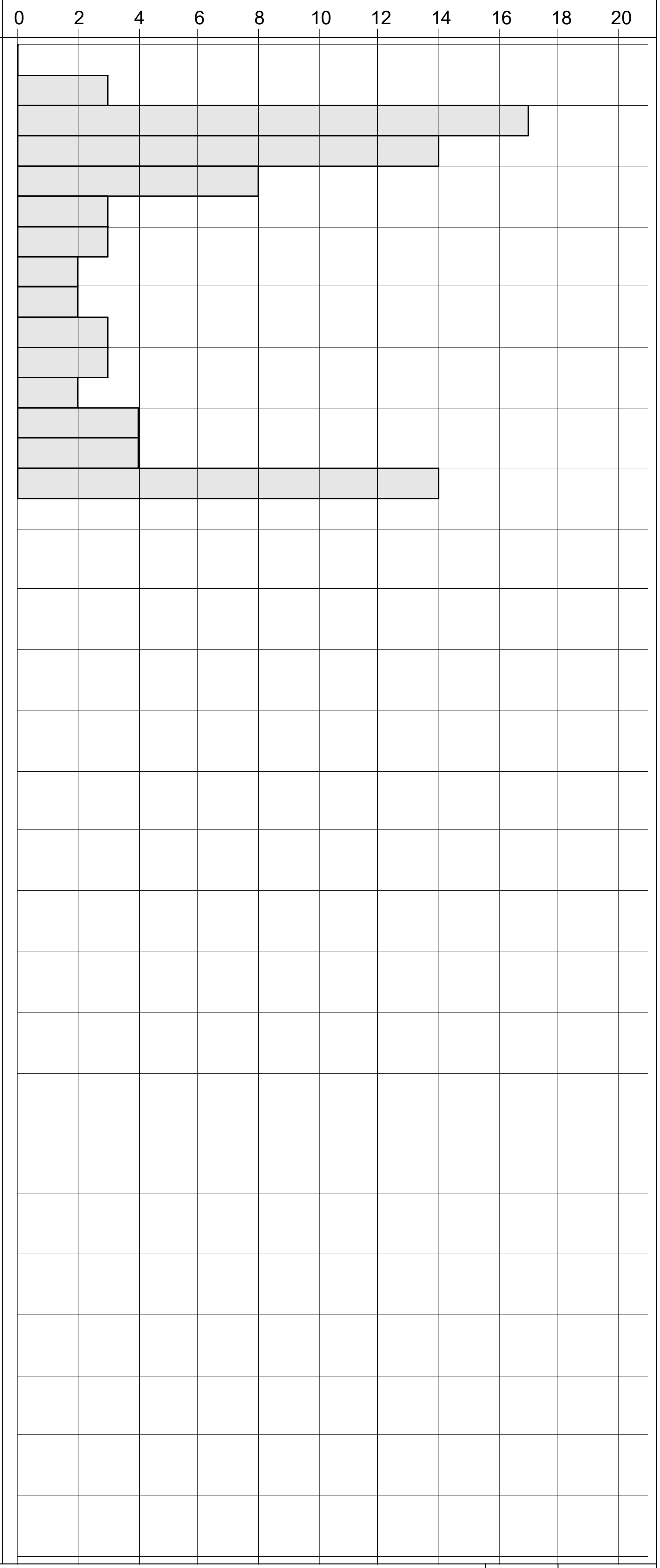
Scale (approx)	Logged By
1:25	CF

Figure No.
10477-03-21.DPH11

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH12
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	Cone Dimensions: 43.7mm	Ground Level (mOD): 145.73	Client: OCSC	Job Number: 10477-03-21
	Location: 717679.6 E 725241 N	Dates: 09/04/2021	Engineer	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		145.73	0.00
0.10-0.20	3			
0.20-0.30	17			
0.30-0.40	14			
0.40-0.50	8			
0.50-0.60	3		145.23	0.50
0.60-0.70	3			
0.70-0.80	2			
0.80-0.90	2			
0.90-1.00	3			
1.00-1.10	3		144.73	1.00
1.10-1.20	2			
1.20-1.30	4			
1.30-1.40	4			
1.40-1.50	14			
			144.23	1.50
			143.73	2.00
			143.23	2.50
			142.73	3.00
			142.23	3.50
			141.73	4.00
			141.23	4.50
			140.73	5.00

Blows for Depth Increment



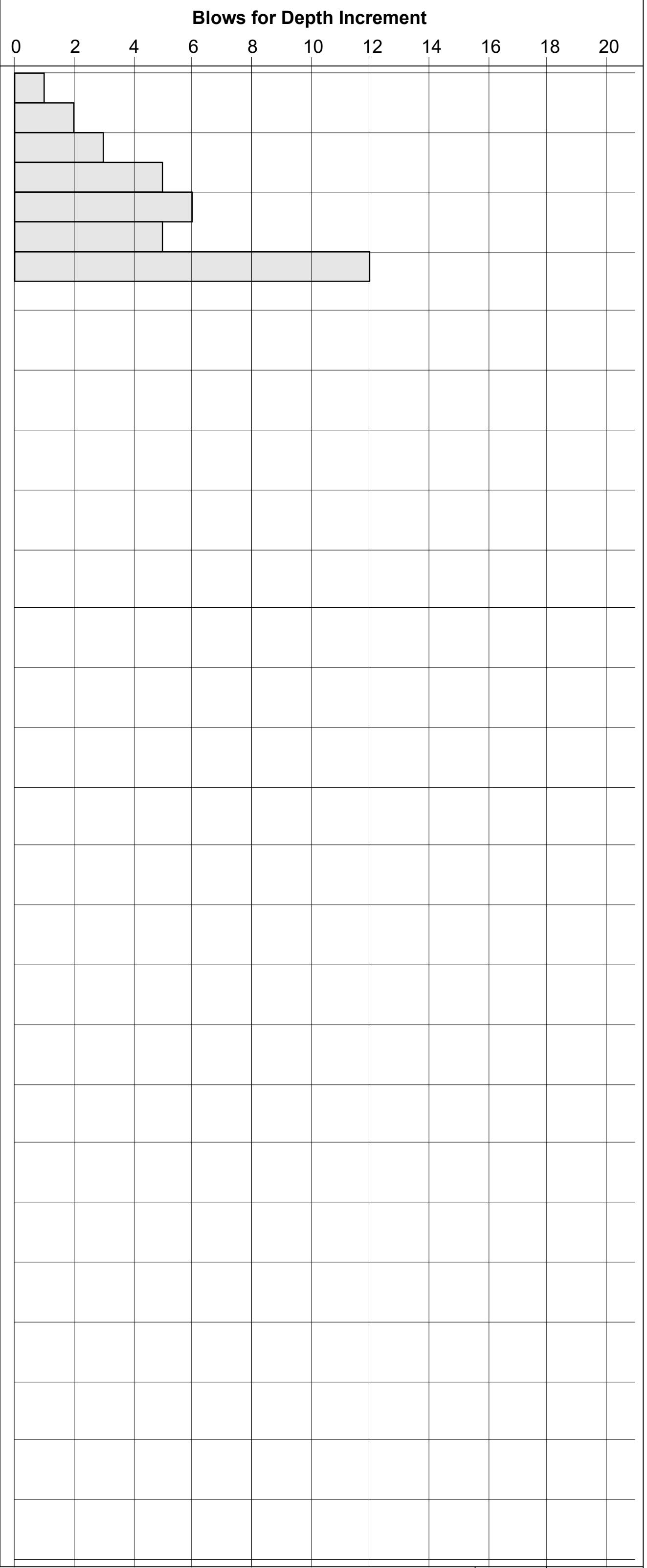
Remarks
Refusal at 1.50m BGL 25 blows for 75mm

Scale (approx)	Logged By
1:25	CF

Figure No.
10477-03-21.DPH12

Ground Investigations Ireland Ltd www.gii.ie		Site: Blackglen Road	Probe Number: DPH13
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions**: 43.7mm	**Ground Level (mOD)**: 144.13	**Client**: OCSC	**Job Number**: 10477-03-21
	Location: 717697.6 E 725241.6 N	**Dates**: 09/04/2021	**Engineer**:	**Sheet**: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	1		144.13	0.00
0.10-0.20	2			
0.20-0.30	3			
0.30-0.40	5			
0.40-0.50	6			
0.50-0.60	5		143.63	0.50
0.60-0.70	12			
			143.13	1.00
			142.63	1.50
			142.13	2.00
			141.63	2.50
			141.13	3.00
			140.63	3.50
			140.13	4.00
			139.63	4.50
			139.13	5.00



Remarks
Refusal at 0.70m BGL 25 blows for 10mm

Scale (approx)	Logged By
1:25	CF

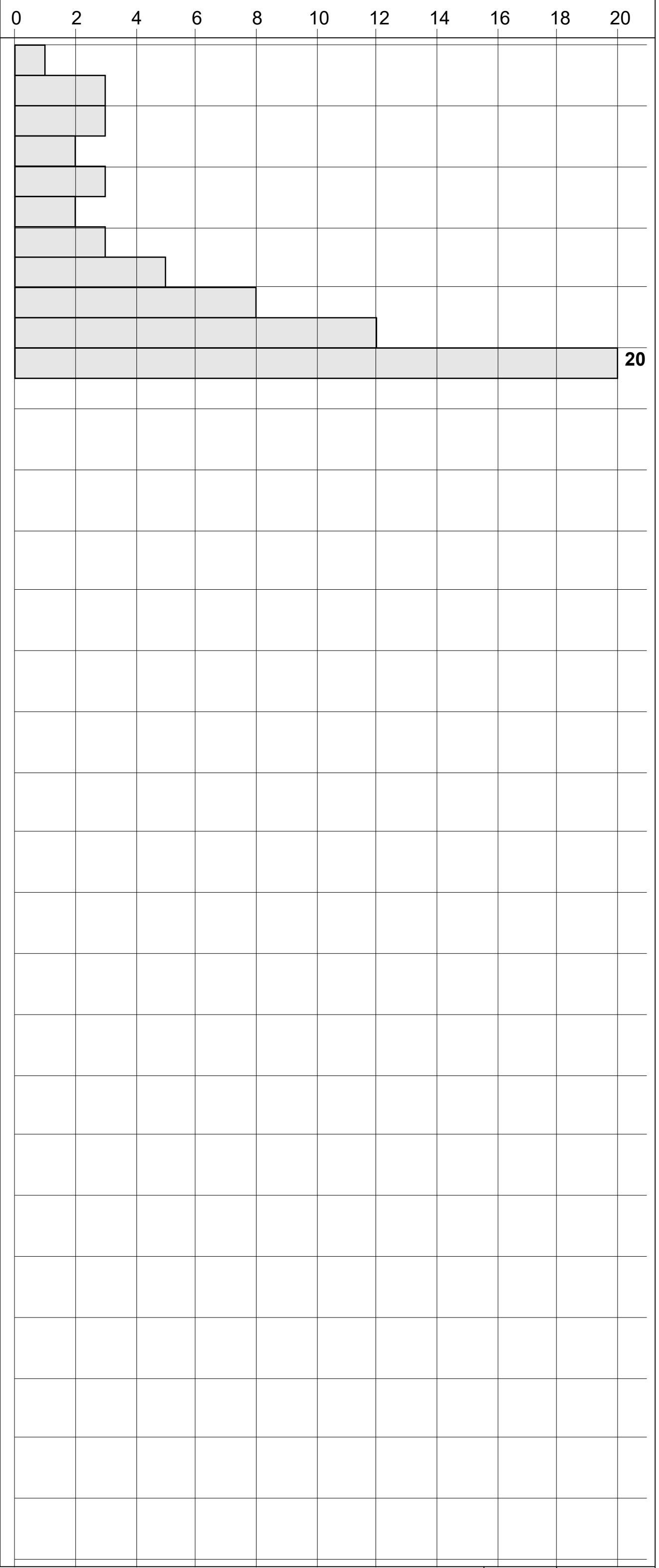
Figure No. 10477-03-21.DPH13

Ground Investigations Ireland Ltd www.gii.ie		Site: Blackglen Road	Probe Number: **DPH14**
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions**: 43.7mm / **Ground Level (mOD)**: 144.59	**Client**: OCSC	**Job Number**: 10477-03-21
	Location: 717657.9 E 725199.7 N / **Dates**: 12/04/2021	**Engineer**:	**Sheet**: 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	1	
0.10-0.20	3	
0.20-0.30	3	
0.30-0.40	2	
0.40-0.50	3	
0.50-0.60	2	
0.60-0.70	3	
0.70-0.80	5	
0.80-0.90	8	
0.90-1.00	12	
1.00-1.10	20	

Level (mOD)	Depth (m)
144.59	0.00
144.09	0.50
143.59	1.00
143.09	1.50
142.59	2.00
142.09	2.50
141.59	3.00
141.09	3.50
140.59	4.00
140.09	4.50
139.59	5.00

Blows for Depth Increment



Remarks
Refusal at 1.10m BGL for 25 blows

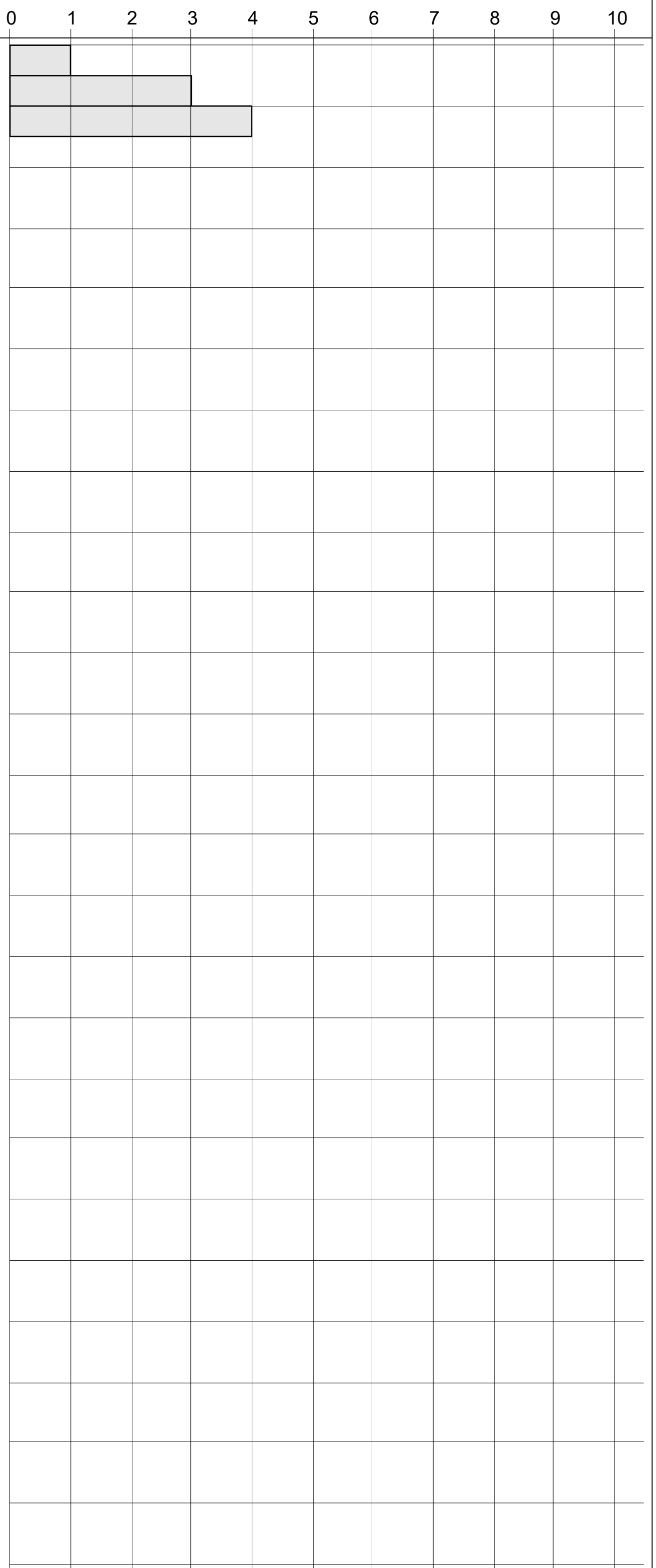
Scale (approx)	Logged By
1:25	CF

Figure No. 10477-03-21.DPH14

Ground Investigations Ireland Ltd www.gii.ie			Site Blackglen Road	Probe Number **DPH15**
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 144.63	**Client** OCSC	**Job Number** 10477-03-21
	Location 717680.5 E 725200.7 N	**Dates** 12/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	1		144.63	0.00
0.10-0.20	3			
0.20-0.30	4			
			144.13	0.50
			143.63	1.00
			143.13	1.50
			142.63	2.00
			142.13	2.50
			141.63	3.00
			141.13	3.50
			140.63	4.00
			140.13	4.50
			139.63	5.00

Blows for Depth Increment



Remarks	Scale (approx)	Logged By
Refusal at 0.30 BGL for 25 blows	1:25	CF
	Figure No. 10477-03-21.DPH15	

Ground Investigations Ireland Ltd

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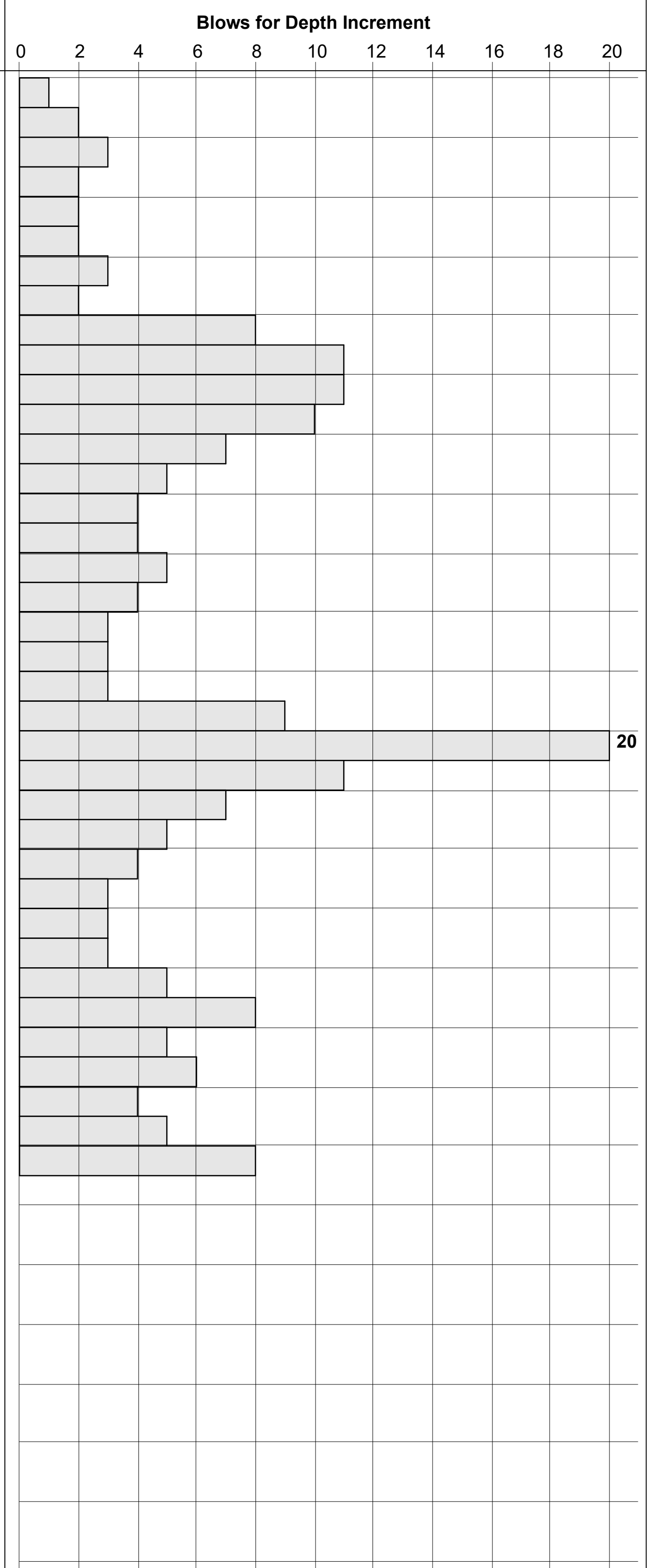
Site	Probe Number
Blackglen Road	DPH16

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	43.7mm	142.24	OCSC	10477-03-21
	Location	**Dates**	**Engineer**	**Sheet**
	717704.3 E 725202.5 N	12/04/2021		1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	1	
0.10-0.20	2	
0.20-0.30	3	
0.30-0.40	2	
0.40-0.50	2	
0.50-0.60	2	
0.60-0.70	3	
0.70-0.80	2	
0.80-0.90	8	
0.90-1.00	11	
1.00-1.10	11	
1.10-1.20	10	
1.20-1.30	7	
1.30-1.40	5	
1.40-1.50	4	
1.50-1.60	4	
1.60-1.70	5	
1.70-1.80	4	
1.80-1.90	3	
1.90-2.00	3	
2.00-2.10	3	
2.10-2.20	9	
2.20-2.30	20	
2.30-2.40	11	
2.40-2.50	7	
2.50-2.60	5	
2.60-2.70	4	
2.70-2.80	3	
2.80-2.90	3	
2.90-3.00	3	
3.00-3.10	5	
3.10-3.20	8	
3.20-3.30	5	
3.30-3.40	6	
3.40-3.50	4	
3.50-3.60	5	
3.60-3.70	8	

Level (mOD)	Depth (m)
142.24	0.00
141.74	0.50
141.24	1.00
140.74	1.50
140.24	2.00
139.74	2.50
139.24	3.00
138.74	3.50
138.24	4.00
137.74	4.50
137.24	5.00



Remarks
Refusal at 3.70m BGL for 25 blows

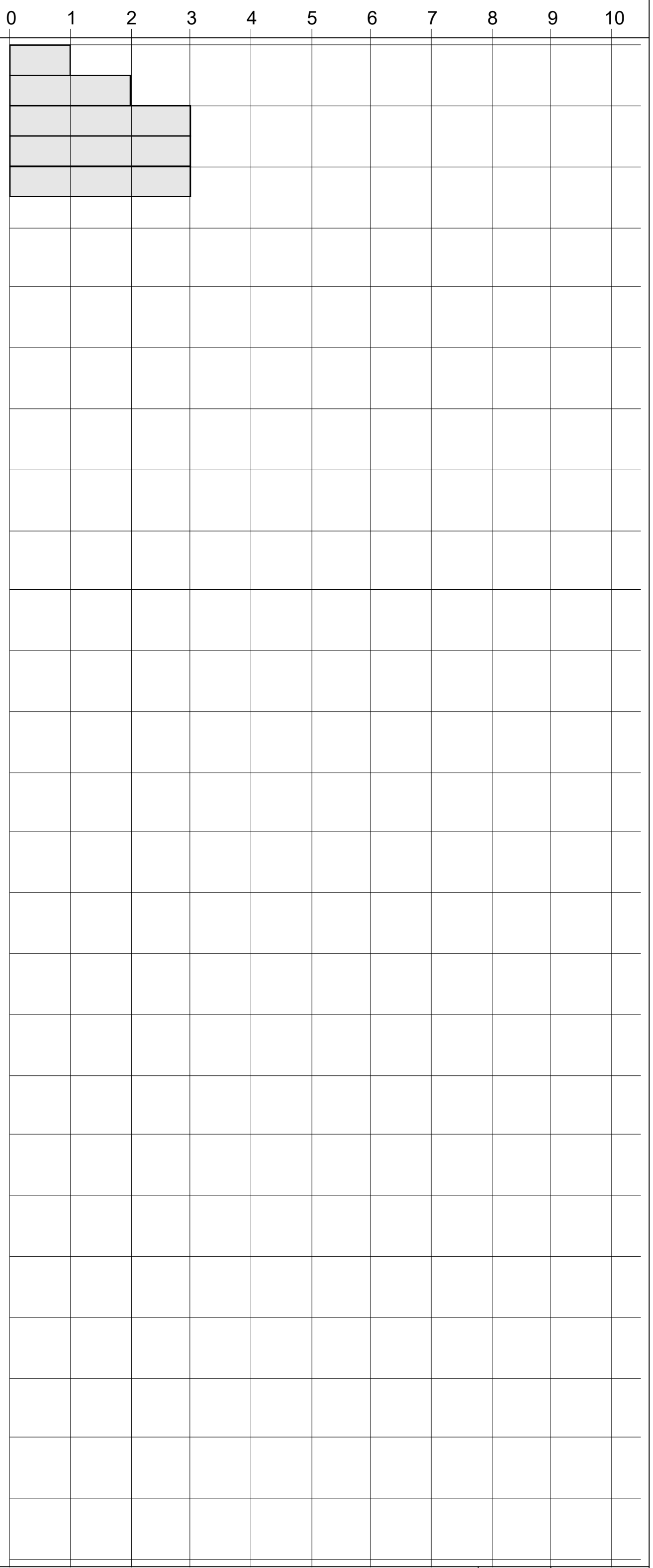
Scale (approx)	Logged By
1:25	CF

Figure No. 10477-03-21.DPH16

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH17
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 144.36	**Client** OCSC	**Job Number** 10477-03-21
	Location 717660.5 E 725180.5 N	**Dates** 12/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	1		144.36	0.00
0.10-0.20	2			
0.20-0.30	3			
0.30-0.40	3			
0.40-0.50	3			
			143.86	0.50
			143.36	1.00
			142.86	1.50
			142.36	2.00
			141.86	2.50
			141.36	3.00
			140.86	3.50
			140.36	4.00
			139.86	4.50
			139.36	5.00

Blows for Depth Increment



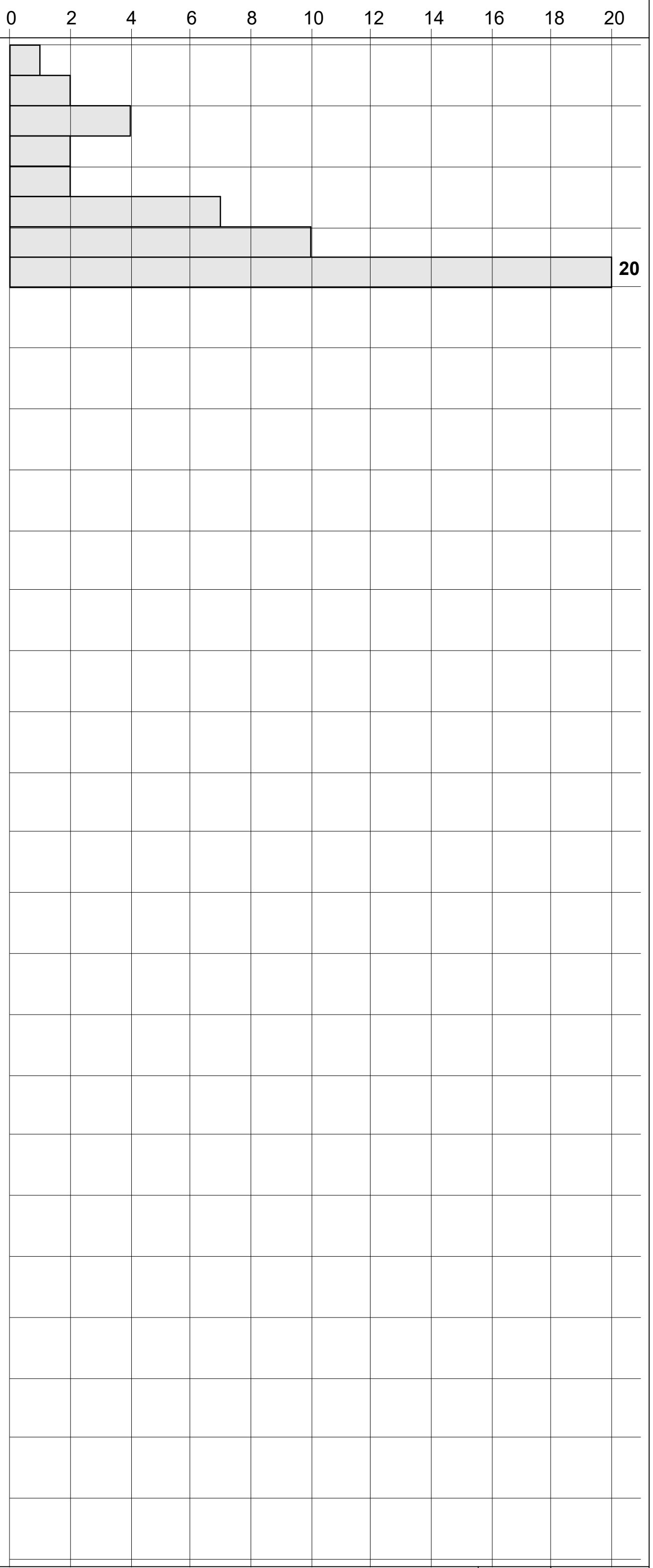
Remarks	Scale (approx)	Logged By
Refusal at 0.50m BGL 25 blows for 10mm	1:25	CF
	Figure No. 10477-03-21.DPH17	

Ground Investigations Ireland Ltd
www.gii.ie

Site	Blackglen Road			**Probe Number** DPH18
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 142.23	**Client** OCSC	**Job Number** 10477-03-21
	Location 717678 E 725179.6 N	**Dates** 12/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	1		142.23	0.00
0.10-0.20	2			
0.20-0.30	4			
0.30-0.40	2			
0.40-0.50	2			
0.50-0.60	7		141.73	0.50
0.60-0.70	10			
0.70-0.80	20			
			141.23	1.00
			140.73	1.50
			140.23	2.00
			139.73	2.50
			139.23	3.00
			138.73	3.50
			138.23	4.00
			137.73	4.50
			137.23	5.00

Blows for Depth Increment



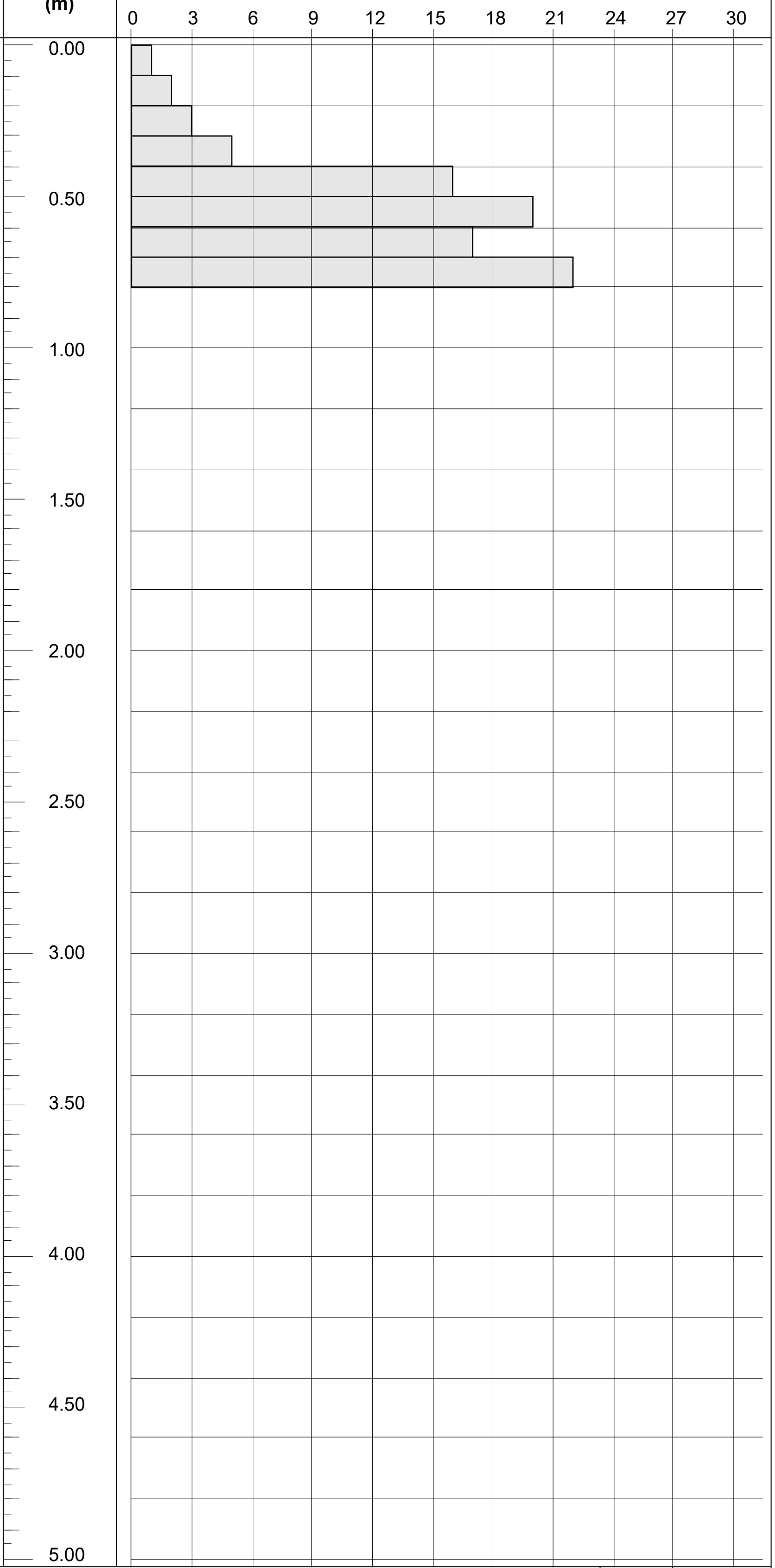
Remarks
Refusal at 0.80m BGL 25 blows for 50mm

Scale (approx) 1:25	**Logged By** CF
Figure No. 10477-03-21.DPH18	

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH19
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)**	**Client** OCSC	**Job Number** 10477-03-21
	Location	**Dates** 12/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	2		
0.20-0.30	3		
0.30-0.40	5		
0.40-0.50	16		
0.50-0.60	20		
0.60-0.70	17		
0.70-0.80	22		

Blows for Depth Increment



Remarks
Refusal at 0.80m BGL 25 blows for 10mm

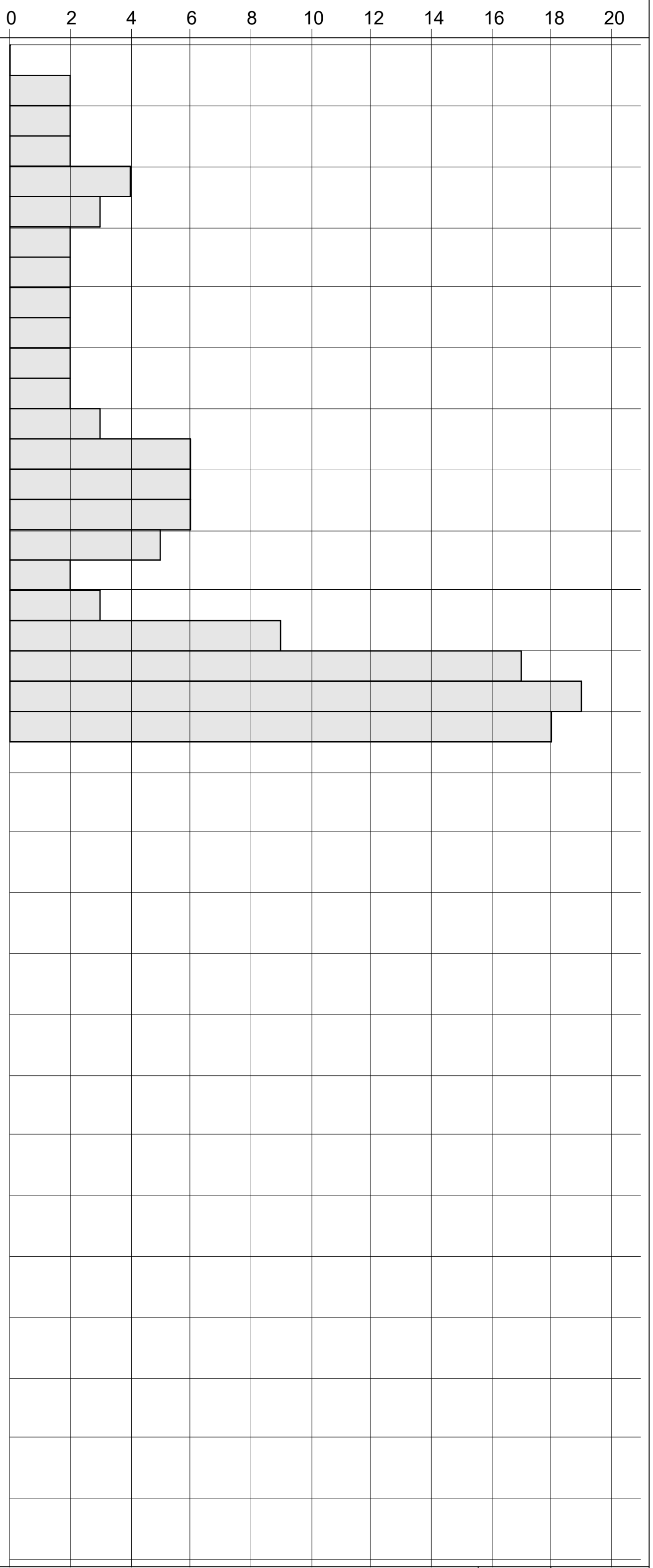
Scale (approx)	Logged By
1:25	CF

Figure No. 10477-03-21.DPH101

Ground Investigations Ireland Ltd www.gii.ie			Site Blackglen Road	Probe Number **DPH20**
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 140.53	**Client** OCSC	**Job Number** 10477-03-21
	Location 717698.9 E 725160.3 N	**Dates** 12/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		140.53	0.00
0.10-0.20	2			
0.20-0.30	2			
0.30-0.40	2			
0.40-0.50	4			
0.50-0.60	3		140.03	0.50
0.60-0.70	2			
0.70-0.80	2			
0.80-0.90	2			
0.90-1.00	2			
1.00-1.10	2		139.53	1.00
1.10-1.20	2			
1.20-1.30	3			
1.30-1.40	6			
1.40-1.50	6			
1.50-1.60	6		139.03	1.50
1.60-1.70	5			
1.70-1.80	2			
1.80-1.90	3			
1.90-2.00	9			
2.00-2.10	17		138.53	2.00
2.10-2.20	19			
2.20-2.30	18			
			138.03	2.50
			137.53	3.00
			137.03	3.50
			136.53	4.00
			136.03	4.50
			135.53	5.00

Blows for Depth Increment



Remarks	Scale (approx)	Logged By
Refusal at 2.30m BGL for 25 blows	1:25	CF
	Figure No. 10477-03-21.DPH20	

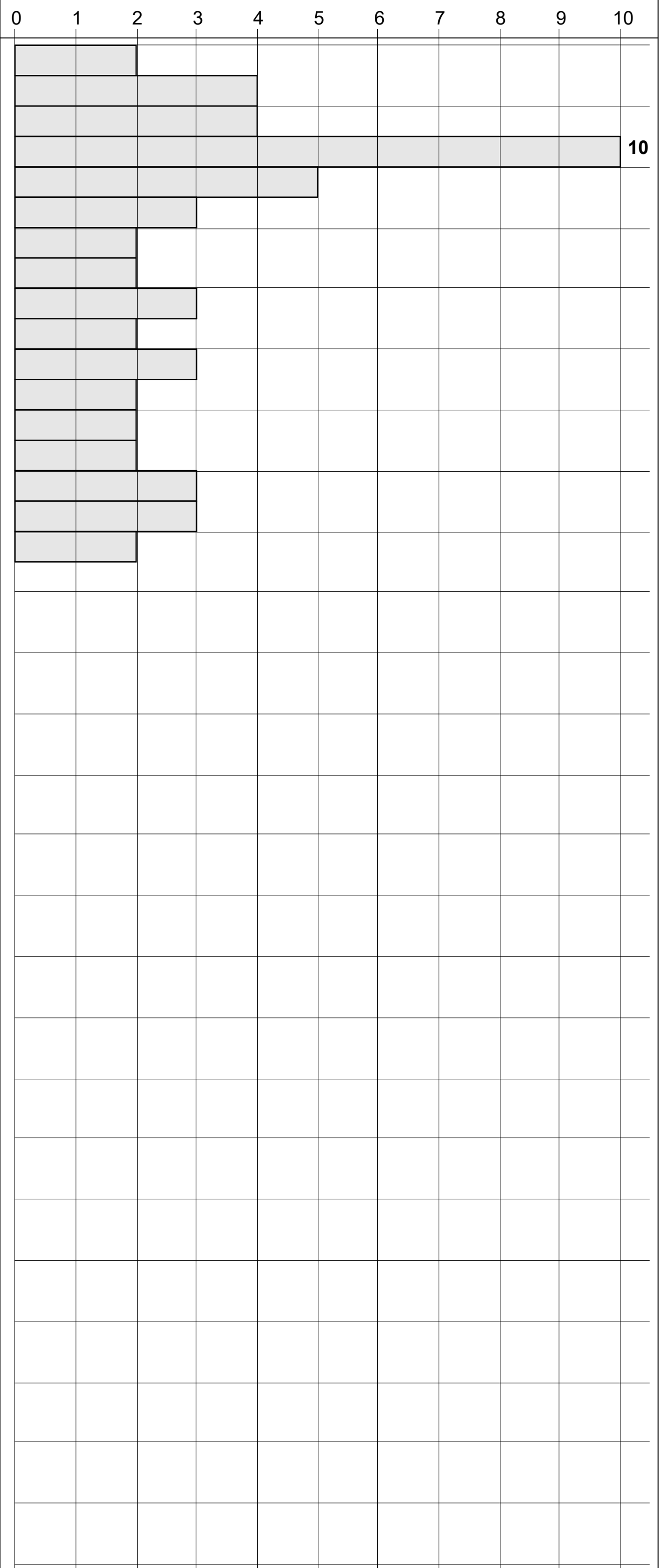
Ground Investigations Ireland Ltd www.gii.ie	Site Blackglen Road	Probe Number **DPH21**

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	43.7mm	143.80	OCSC	10477-03-21
	Location	**Dates**	**Engineer**	**Sheet**
	717679.8 E 725139.9 N	12/04/2021		1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	2	
0.10-0.20	4	
0.20-0.30	4	
0.30-0.40	10	
0.40-0.50	5	
0.50-0.60	3	
0.60-0.70	2	
0.70-0.80	2	
0.80-0.90	3	
0.90-1.00	2	
1.00-1.10	3	
1.10-1.20	2	
1.20-1.30	2	
1.30-1.40	2	
1.40-1.50	3	
1.50-1.60	3	
1.60-1.70	2	

Level (mOD)	Depth (m)
143.80	0.00
143.30	0.50
142.80	1.00
142.30	1.50
141.80	2.00
141.30	2.50
140.80	3.00
140.30	3.50
139.80	4.00
139.30	4.50
138.80	5.00

Blows for Depth Increment



Remarks
Refusal at 1.70m BGL 25 blows for 10mm

Scale (approx)	Logged By
1:25	CF

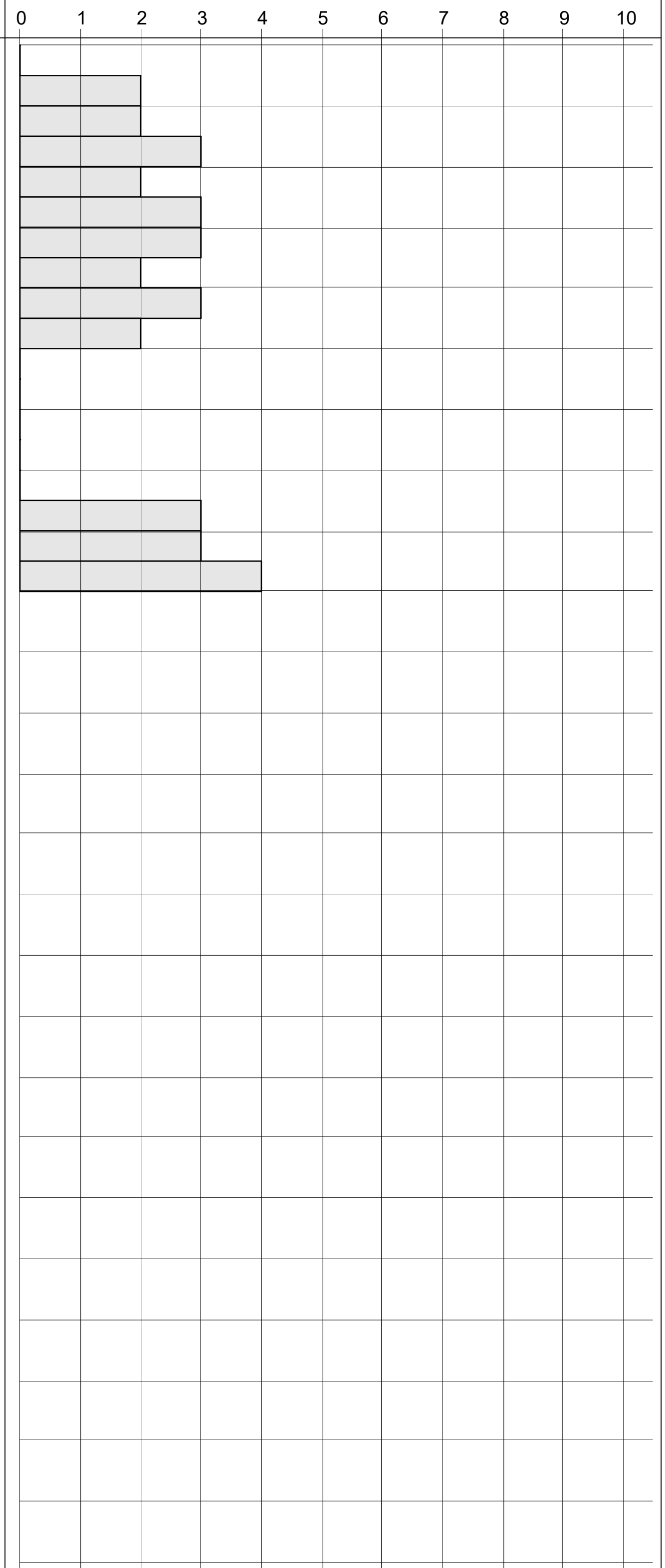
Figure No.
10477-03-21.DPH21

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH22
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	Cone Dimensions: 43.7mm	Ground Level (mOD): 142.54	Client: OCSC	Job Number: 10477-03-21
	Location: 717699.3 E 725140.1 N	Dates: 12/04/2021	Engineer:	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	2	
0.20-0.30	2	
0.30-0.40	3	
0.40-0.50	2	
0.50-0.60	3	
0.60-0.70	3	
0.70-0.80	2	
0.80-0.90	3	
0.90-1.00	2	
1.00-1.10	0	
1.10-1.20	0	
1.20-1.30	0	
1.30-1.40	0	
1.40-1.50	0	
1.50-1.60	3	
1.60-1.70	3	
1.70-1.80	4	

Level (mOD)	Depth (m)
142.54	0.00
142.04	0.50
141.54	1.00
141.04	1.50
140.54	2.00
140.04	2.50
139.54	3.00
139.04	3.50
138.54	4.00
138.04	4.50
137.54	5.00

Blows for Depth Increment



Remarks
Refusal at 1.80m BGL for 25 blows

Scale (approx)	Logged By
1:25	CF

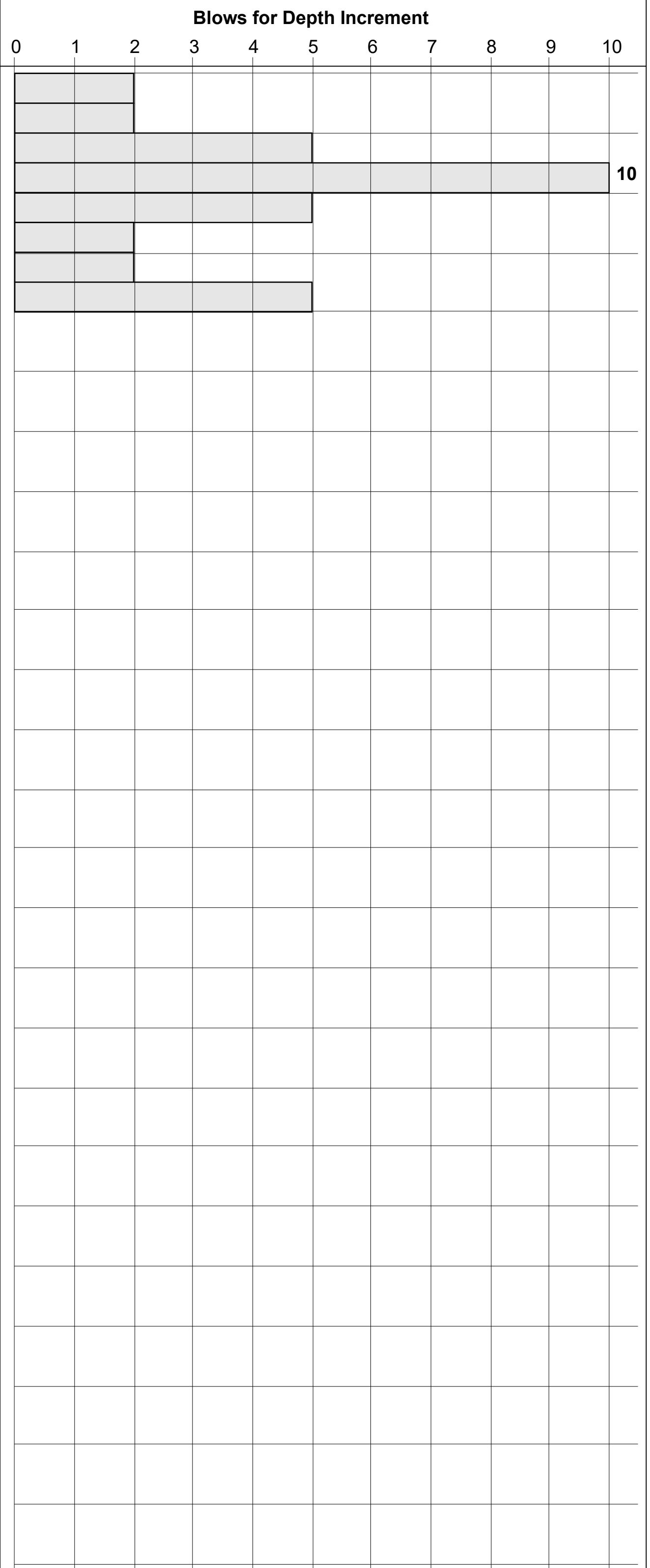
Figure No.
10477-03-21.DPH22

Ground Investigations Ireland Ltd www.gii.ie	Site: Blackglen Road	Probe Number: DPH24

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	43.7mm	151.46	OCSC	10477-03-21
	Location	**Dates**	**Engineer**	**Sheet**
	717617.9 E 725199.1 N	09/04/2021		1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	2	
0.10-0.20	2	
0.20-0.30	5	
0.30-0.40	10	
0.40-0.50	5	
0.50-0.60	2	
0.60-0.70	2	
0.70-0.80	5	

Level (mOD)	Depth (m)
151.46	0.00
150.96	0.50
150.46	1.00
149.96	1.50
149.46	2.00
148.96	2.50
148.46	3.00
147.96	3.50
147.46	4.00
146.96	4.50
146.46	5.00



Remarks
Refusal at 0.80m BGL 25 blows for 50mm

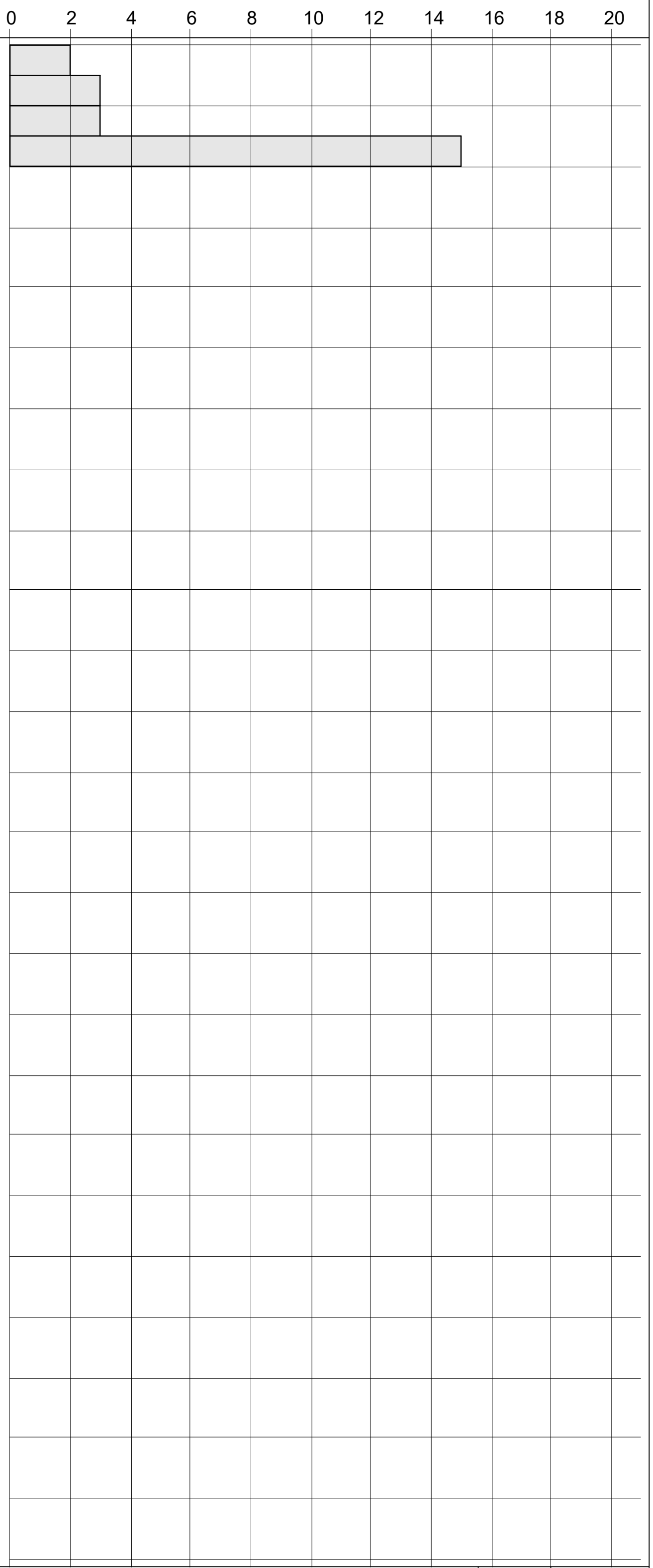
Scale (approx)	Logged By
1:25	CF

Figure No. 10477-03-21.DPH24

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH26
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions**: 43.7mm	**Ground Level (mOD)**: 152.10	**Client**: OCSC	**Job Number**: 10477-03-21
	Location: 717599.5 E 725199.9 N	**Dates**: 09/04/2021	**Engineer**:	**Sheet**: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	2		152.10	0.00
0.10-0.20	3			
0.20-0.30	3			
0.30-0.40	15			
			151.60	0.50
			151.10	1.00
			150.60	1.50
			150.10	2.00
			149.60	2.50
			149.10	3.00
			148.60	3.50
			148.10	4.00
			147.60	4.50
			147.10	5.00

Blows for Depth Increment



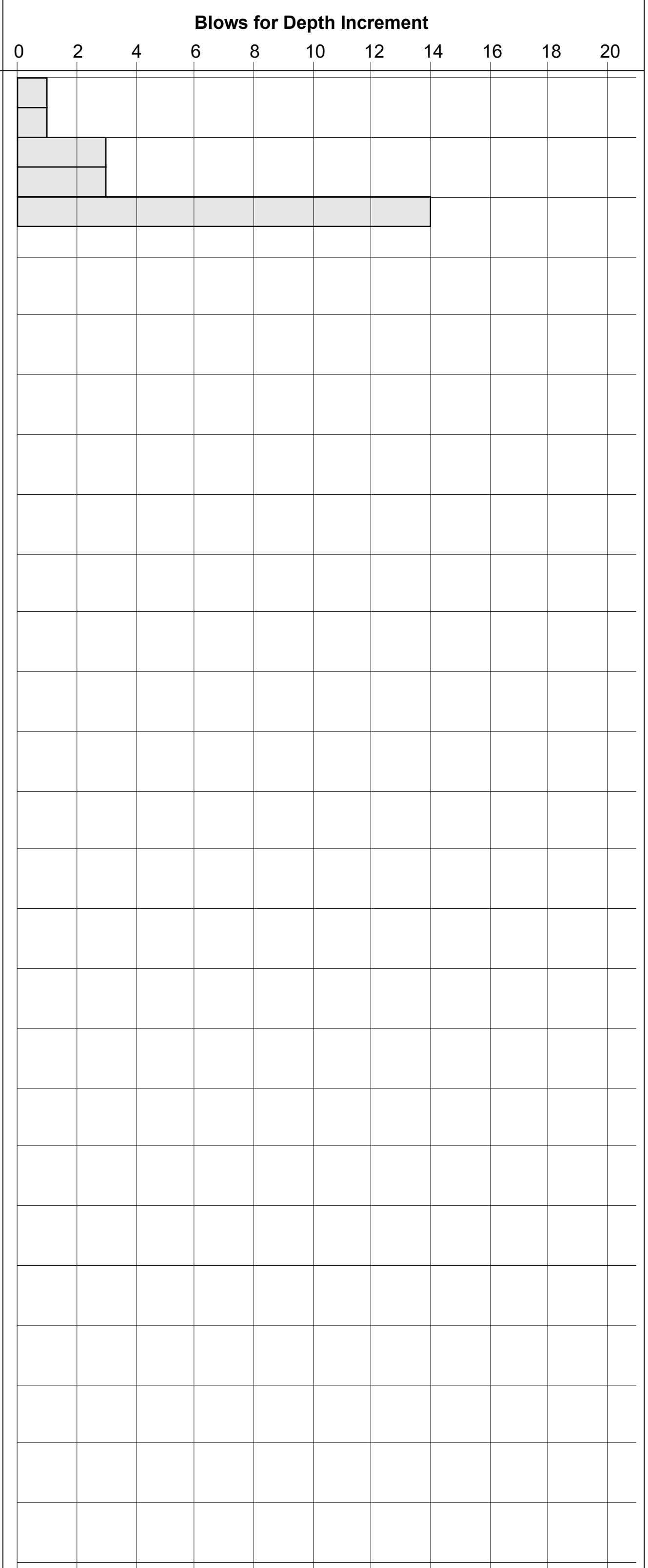
Remarks
Refusal at 0.40m BGL 25 blows for 50mm

Scale (approx)	Logged By
1:25	CF

Figure No. 10477-03-21.DPH26

Ground Investigations Ireland Ltd www.gii.ie		Site: Blackglen Road	Probe Number: DPH27
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions**: 43.7mm	**Ground Level (mOD)**: 152.49	**Client**: OCSC	**Job Number**: 10477-03-21
	Location: 717582.9 E 725224.2 N	**Dates**: 12/04/2021	**Engineer**:	**Sheet**: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	1		152.49	0.00
0.10-0.20	1			
0.20-0.30	3			
0.30-0.40	3			
0.40-0.50	14			
			151.99	0.50
			151.49	1.00
			150.99	1.50
			150.49	2.00
			149.99	2.50
			149.49	3.00
			148.99	3.50
			148.49	4.00
			147.99	4.50
			147.49	5.00



Remarks
Refusal at 0.50m BGL for 25 blows

Scale (approx)	Logged By
1:25	CF

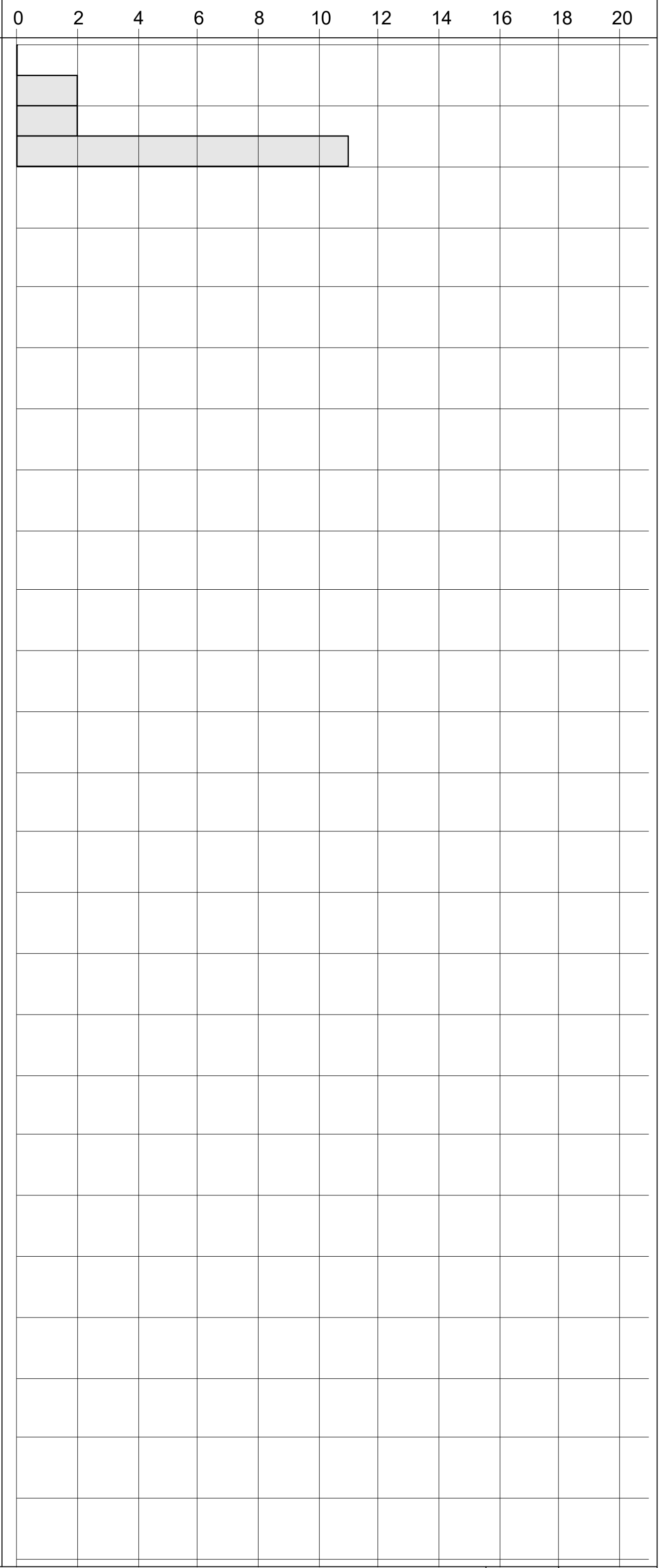
Figure No. 10477-03-21.DPH27

Ground Investigations Ireland Ltd www.gii.ie			Site Blackglen Road	Probe Number **DPH28**
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 153.39	**Client** OCSC	**Job Number** 10477-03-21
	Location 717582.5 E 725196.3 N	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	2	
0.20-0.30	2	
0.30-0.40	11	

Level (mOD)	Depth (m)
153.39	0.00
152.89	0.50
152.39	1.00
151.89	1.50
151.39	2.00
150.89	2.50
150.39	3.00
149.89	3.50
149.39	4.00
148.89	4.50
148.39	5.00

Blows for Depth Increment



Remarks
Refusal at 0.40m BGL for 25 blows

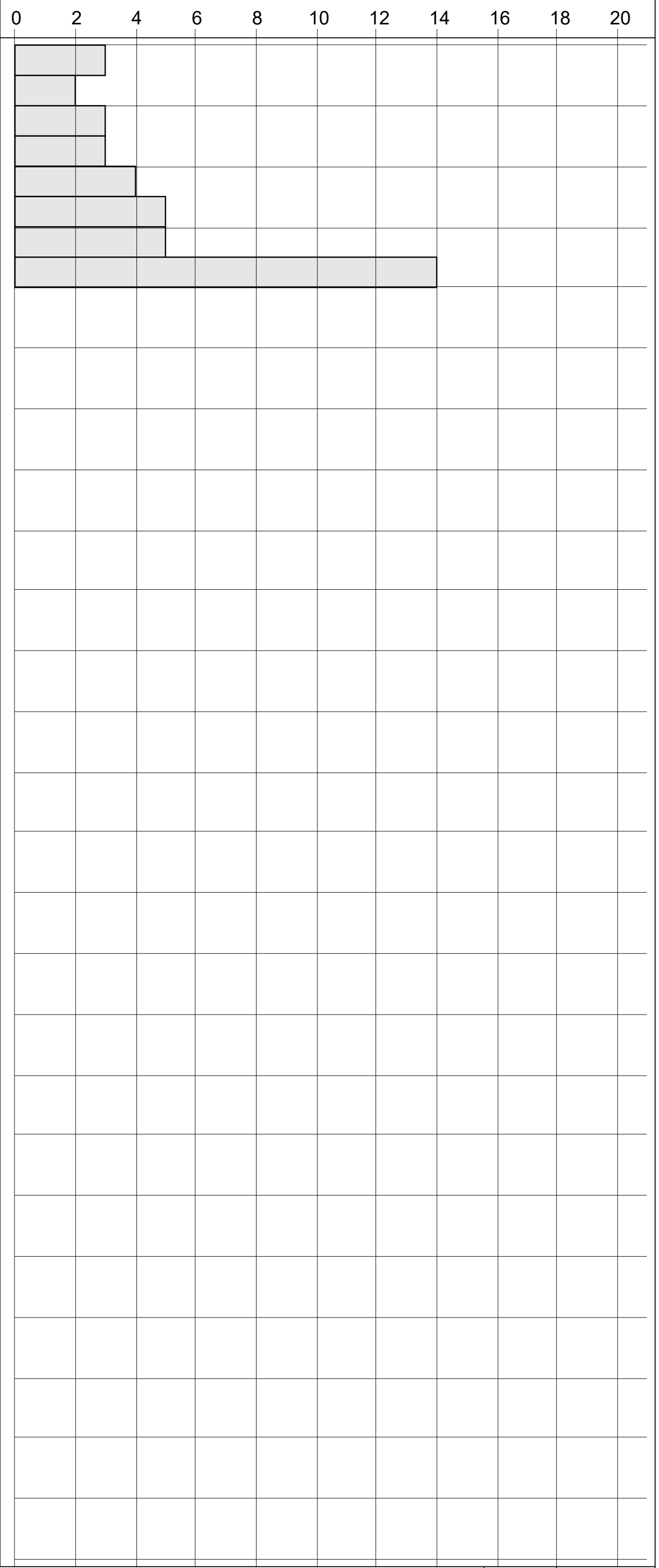
Scale (approx)	Logged By
1:25	CF

Figure No.
10477-03-21.DPH28

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH29
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	Cone Dimensions: 43.7mm	Ground Level (mOD): 153.74	Client: OCSC	Job Number: 10477-03-21
	Location: 717580.3 E 725181.3 N	Dates: 09/04/2021	Engineer:	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		153.74	0.00
0.10-0.20	2			
0.20-0.30	3			
0.30-0.40	3			
0.40-0.50	4			
0.50-0.60	5		153.24	0.50
0.60-0.70	5			
0.70-0.80	14			
			152.74	1.00
			152.24	1.50
			151.74	2.00
			151.24	2.50
			150.74	3.00
			150.24	3.50
			149.74	4.00
			149.24	4.50
			148.74	5.00

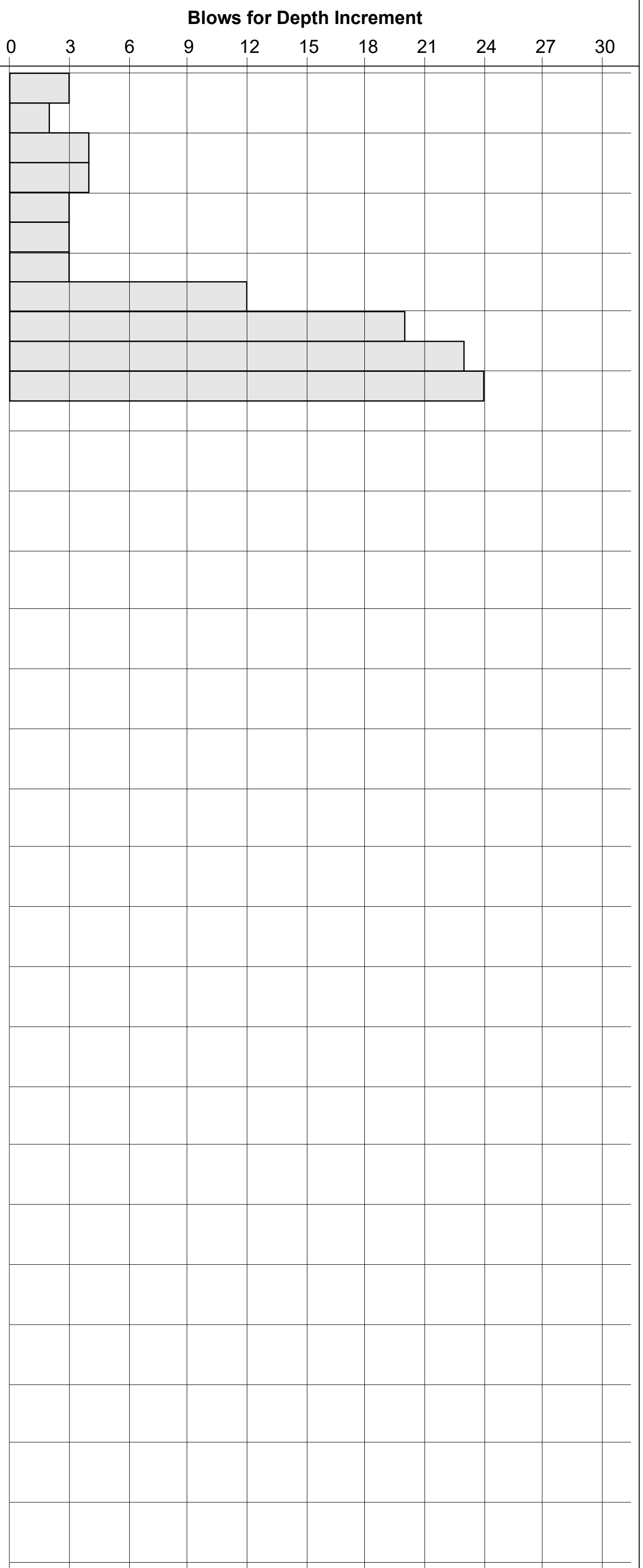
Blows for Depth Increment



Remarks	Scale (approx)	Logged By
Refusal at 0.80m BGL 25 blows for 50mm	1:25	CF
	Figure No. 10477-03-21.DPH29	

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH30
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 153.14	**Client** OCSC	**Job Number** 10477-03-21
	Location 717560 E 725198.5 N	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		153.14	0.00
0.10-0.20	2			
0.20-0.30	4			
0.30-0.40	4			
0.40-0.50	3			
0.50-0.60	3		152.64	0.50
0.60-0.70	3			
0.70-0.80	12			
0.80-0.90	20			
0.90-1.00	23			
1.00-1.10	24		152.14	1.00
			151.64	1.50
			151.14	2.00
			150.64	2.50
			150.14	3.00
			149.64	3.50
			149.14	4.00
			148.64	4.50
			148.14	5.00

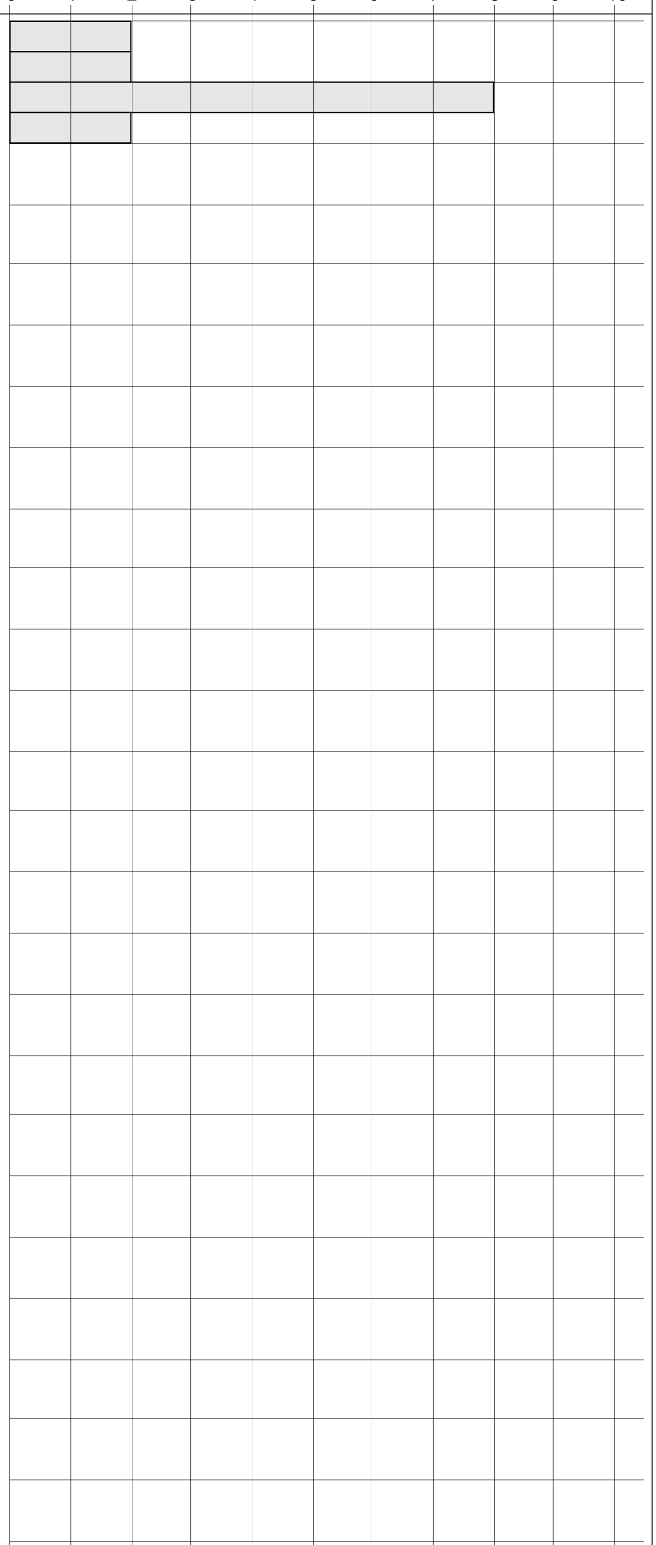


Remarks	Scale (approx)	Logged By
	1:25	CF
	Figure No. 10477-03-21.DPH30	

Ground Investigations Ireland Ltd www.gii.ie			Site Blackglen Road	Probe Number **DPH32**
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 153.72	**Client** OCSC	**Job Number** 10477-03-21
	Location 717544.9 E 725201.2 N	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	2		153.72	0.00
0.10-0.20	2			
0.20-0.30	8			
0.30-0.40	2			
			153.22	0.50
			152.72	1.00
			152.22	1.50
			151.72	2.00
			151.22	2.50
			150.72	3.00
			150.22	3.50
			149.72	4.00
			149.22	4.50
			148.72	5.00

Blows for Depth Increment



Remarks
Refusal at 0.40m BGL for 25 blows

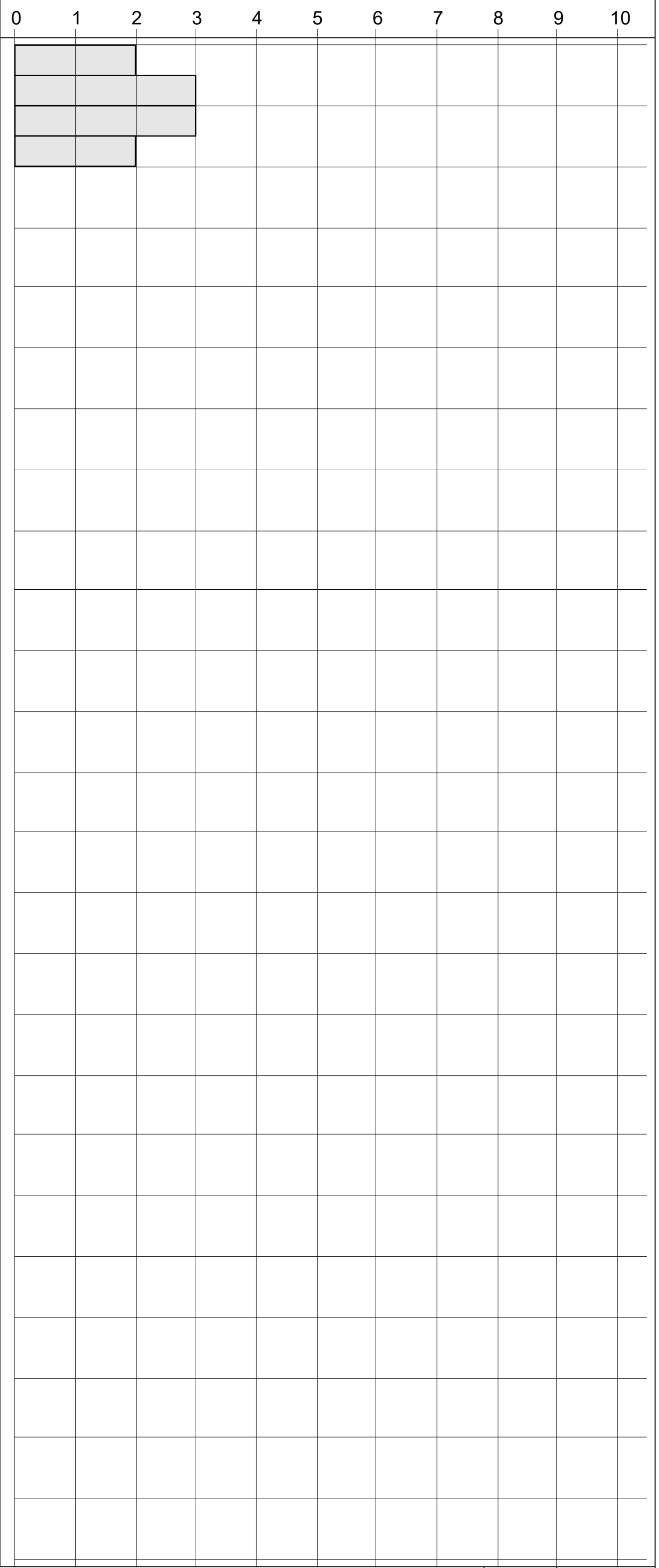
Scale (approx)	Logged By
1:25	CF

Figure No.
10477-03-21.DPH32

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH36
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	Cone Dimensions: 43.7mm	Ground Level (mOD):	Client: OCSC	Job Number: 10477-03-21
	Location: 717519.4 E 725140 N	Dates: 09/04/2021	Engineer:	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	2			0.00
0.10-0.20	3			
0.20-0.30	3			
0.30-0.40	2			
				0.50
				1.00
				1.50
				2.00
				2.50
				3.00
				3.50
				4.00
				4.50
				5.00

Blows for Depth Increment



Remarks	Scale (approx)	Logged By
Refusal at 0.40m BGL for 25 blows	1:25	CF

Figure No. 10477-03-21.DPH36

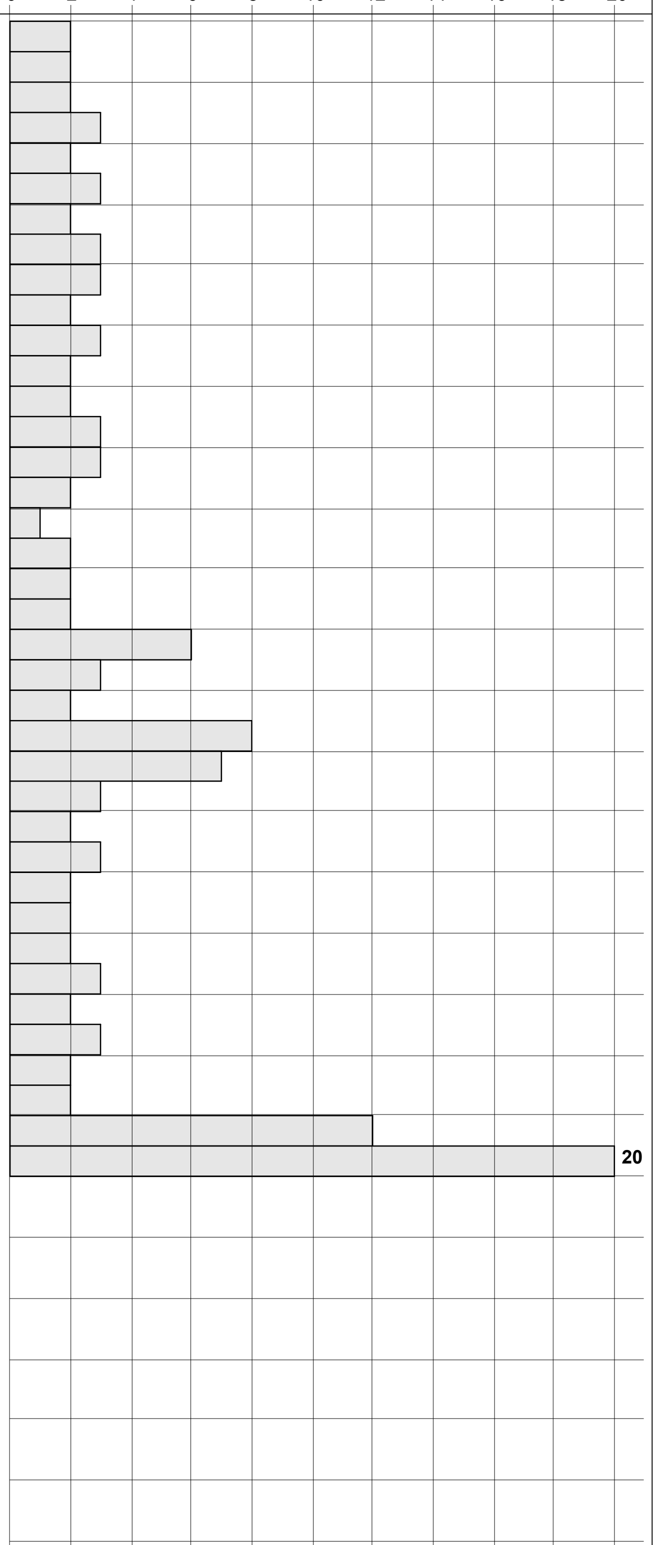
Ground Investigations Ireland Ltd
www.gii.ie

Site	Probe Number
Blackglen Road	DPH38

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	43.7mm	154.42	OCSC	10477-03-21
	Location	**Dates**	**Engineer**	**Sheet**
	717559.8 E 725138.7 N	09/04/2021		1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	2		154.42	0.00
0.10-0.20	2			
0.20-0.30	2			
0.30-0.40	3			
0.40-0.50	2			
0.50-0.60	3		153.92	0.50
0.60-0.70	2			
0.70-0.80	3			
0.80-0.90	3			
0.90-1.00	2			
1.00-1.10	3		153.42	1.00
1.10-1.20	2			
1.20-1.30	2			
1.30-1.40	3			
1.40-1.50	3			
1.50-1.60	2		152.92	1.50
1.60-1.70	1			
1.70-1.80	2			
1.80-1.90	2			
1.90-2.00	2			
2.00-2.10	6		152.42	2.00
2.10-2.20	3			
2.20-2.30	2			
2.30-2.40	8			
2.40-2.50	7			
2.50-2.60	3		151.92	2.50
2.60-2.70	2			
2.70-2.80	3			
2.80-2.90	2			
2.90-3.00	2			
3.00-3.10	2		151.42	3.00
3.10-3.20	3			
3.20-3.30	2			
3.30-3.40	3			
3.40-3.50	2			
3.50-3.60	2		150.92	3.50
3.60-3.70	12			
3.70-3.80	20			
			150.42	4.00
			149.92	4.50
			149.42	5.00

Blows for Depth Increment



Remarks
Refusal at 3.80m BGL for 25 blows

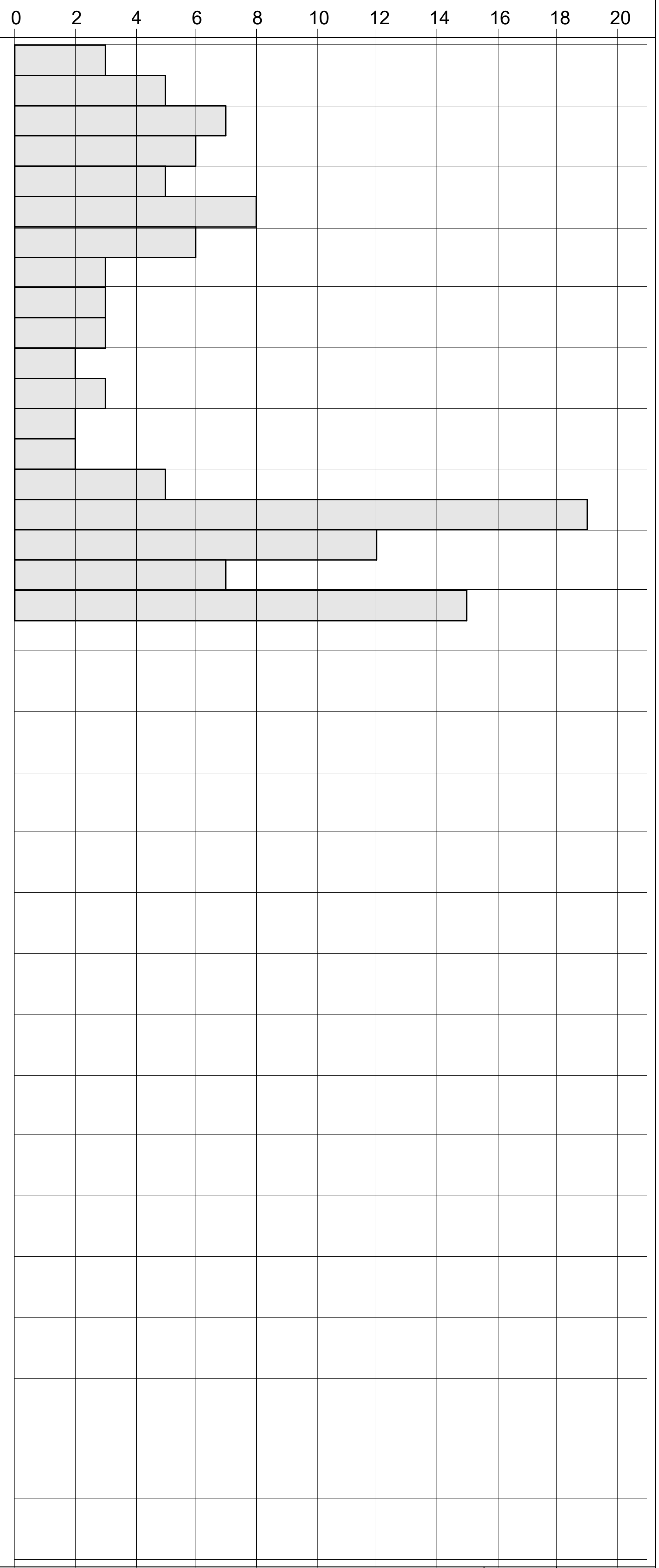
Scale (approx)	Logged By
1:25	CF

Figure No.
10477-03-21.DPH38

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH39
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 154.89	**Client** OCSC	**Job Number** 10477-03-21
	Location 717580.6 E 725138.9 N	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		154.89	0.00
0.10-0.20	5			
0.20-0.30	7			
0.30-0.40	6			
0.40-0.50	5			
0.50-0.60	8		154.39	0.50
0.60-0.70	6			
0.70-0.80	3			
0.80-0.90	3			
0.90-1.00	3			
1.00-1.10	2		153.89	1.00
1.10-1.20	3			
1.20-1.30	2			
1.30-1.40	2			
1.40-1.50	5			
1.50-1.60	19		153.39	1.50
1.60-1.70	12			
1.70-1.80	7			
1.80-1.90	15			
			152.89	2.00
			152.39	2.50
			151.89	3.00
			151.39	3.50
			150.89	4.00
			150.39	4.50
			149.89	5.00

Blows for Depth Increment



Remarks
Refusal at 1.90m BGL for 25 blows

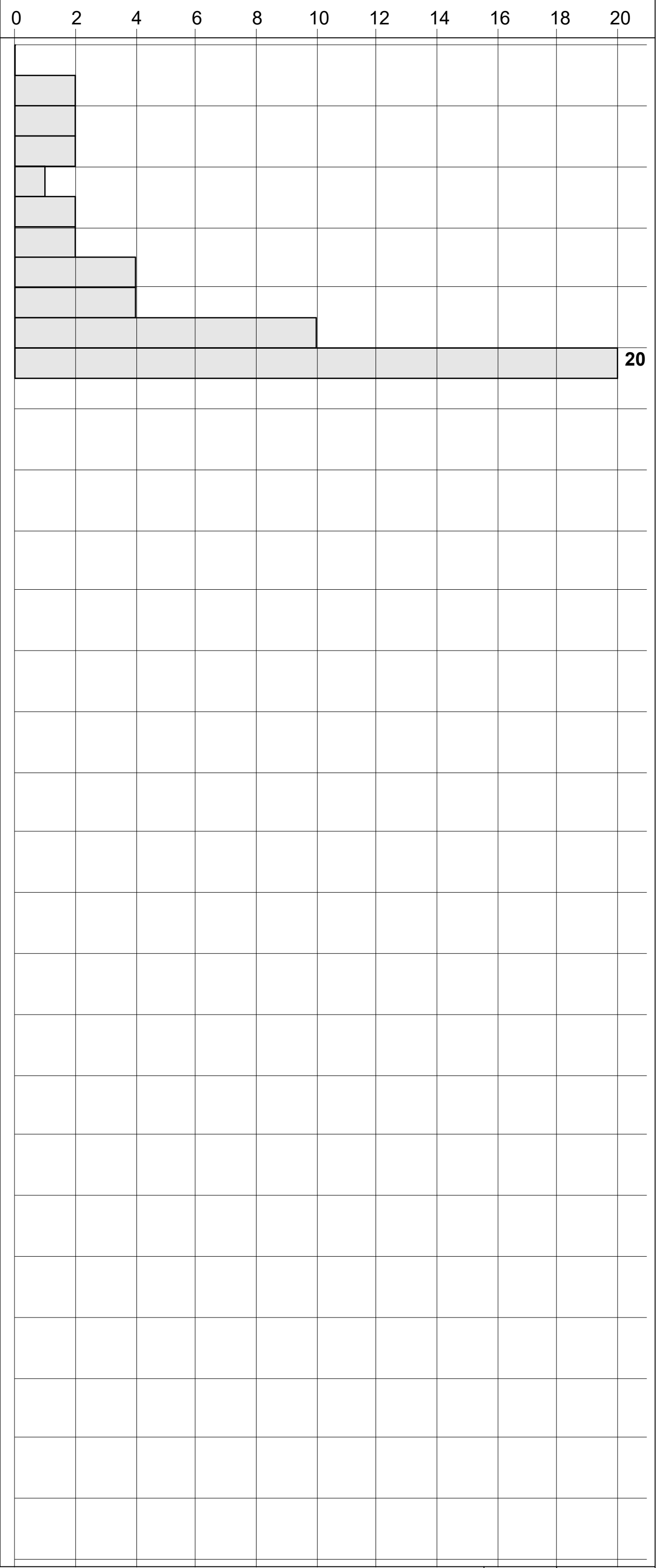
Scale (approx)	Logged By
1:25	CF

Figure No. 10477-03-21.DPH39

Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Probe Number: DPH40
Method Dynamic Probe DPH, Fall Height 500mm, Hammer wt 50Kg.	**Cone Dimensions** 43.7mm	**Ground Level (mOD)** 153.43	**Client** OCSC	**Job Number** 10477-03-21
	Location 717546.4 E 725123.3 N	**Dates** 09/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		153.43	0.00
0.10-0.20	2			
0.20-0.30	2			
0.30-0.40	2			
0.40-0.50	1			
0.50-0.60	2		152.93	0.50
0.60-0.70	2			
0.70-0.80	4			
0.80-0.90	4			
0.90-1.00	10			
1.00-1.10	20		152.43	1.00
			151.93	1.50
			151.43	2.00
			150.93	2.50
			150.43	3.00
			149.93	3.50
			149.43	4.00
			148.93	4.50
			148.43	5.00

Blows for Depth Increment



Remarks
Refusal at 1.10m BGL for 28 blows

Scale (approx)	Logged By
1:25	CF

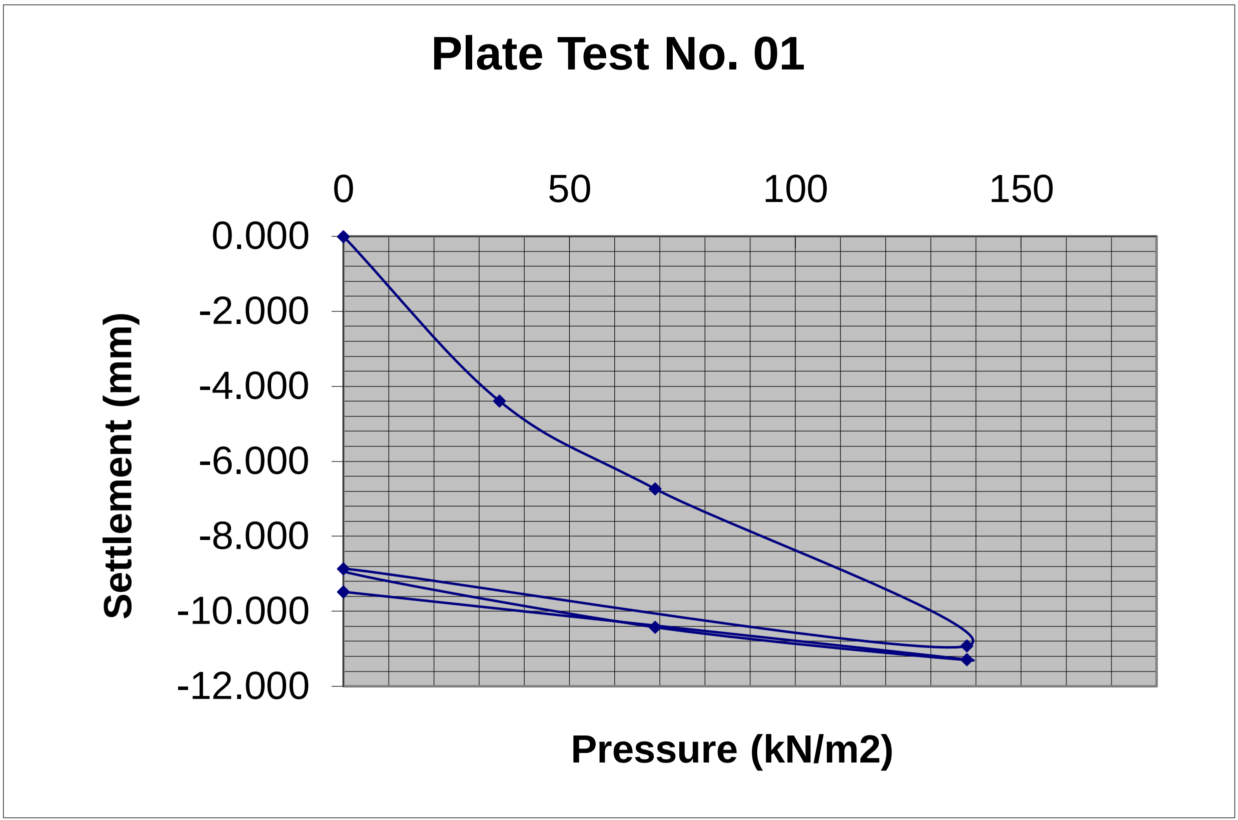
Figure No.
10477-03-21.DPH40

APPENDIX 5 –Plate Testing Records

Applied Load	Gauge settlement
0	**0.000**
34.5	-4.39
69	-6.735
138	-10.925
0	-8.865
69	-10.425
138	-11.285
0	-9.48

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Blackglen Road	**MATERIAL**	Brown gravelly CLAY with subanguar cobbles, plastic, red brick, tubing fragments
CONTRACT NO.	10477-03-21		
DATE	09/04/2021		
CLIENT	OCSC	**DEPTH**	0.45m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR-01	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **6.92 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **29.89 MN/m2/m**

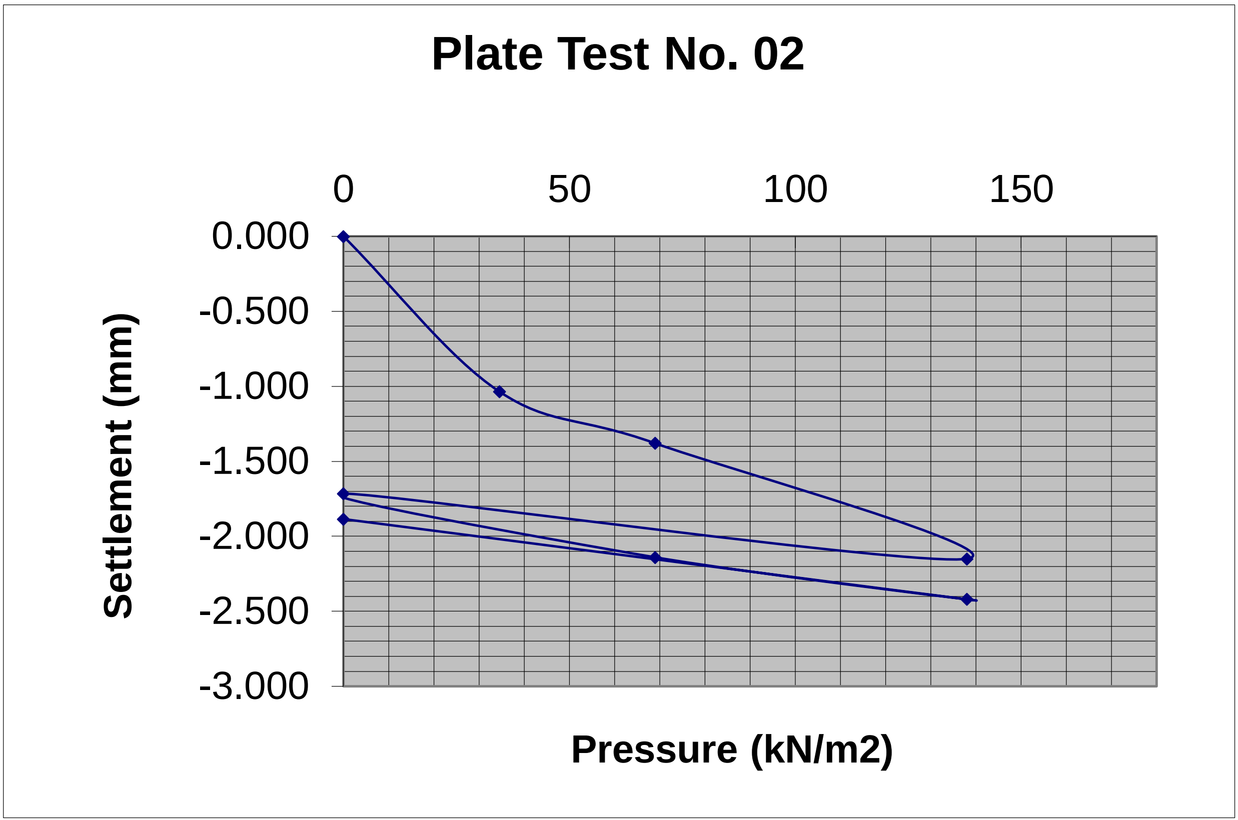
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.28 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **3.48 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-1.035
69	-1.38
138	-2.15
0	-1.715
69	-2.14
138	-2.42
0	-1.885

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Blackglen Road	**MATERIAL**	MG Light brown gravelly CLAY with plastic fragment and roots
CONTRACT NO.	10477-03-21		
DATE	09/04/2021		
CLIENT	OCSC	**DEPTH**	0.45m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR-02	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **33.79 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **109.70 MN/m2/m**

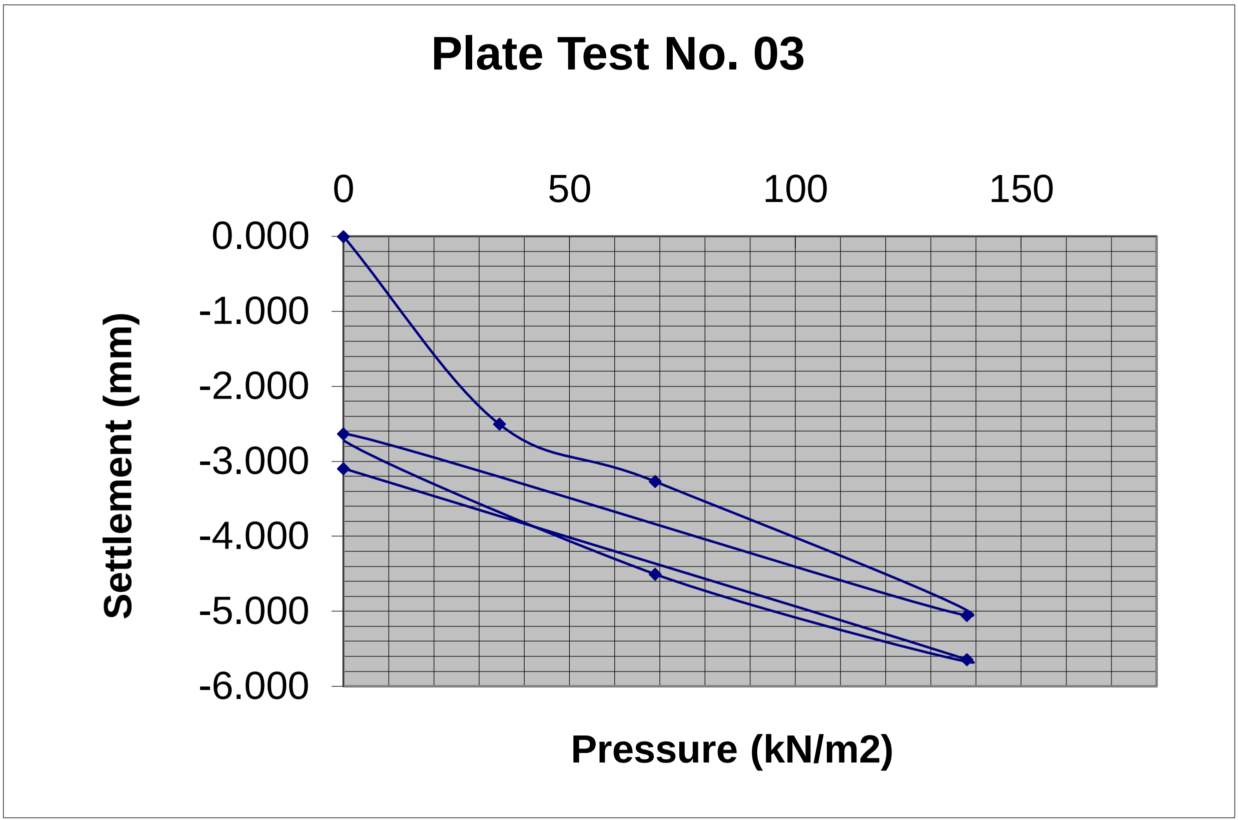
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **4.30 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **33.11 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-2.505
69	-3.27
138	-5.055
0	-2.63
69	-4.505
138	-5.645
0	-3.095

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Blackglen Road	**MATERIAL**	Brown gravelly CLAY
CONTRACT NO.	10477-03-21		
DATE	09/04/2021		
CLIENT	OCSC	**DEPTH**	0.45m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR-03	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **14.26 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **24.87 MN/m2/m**

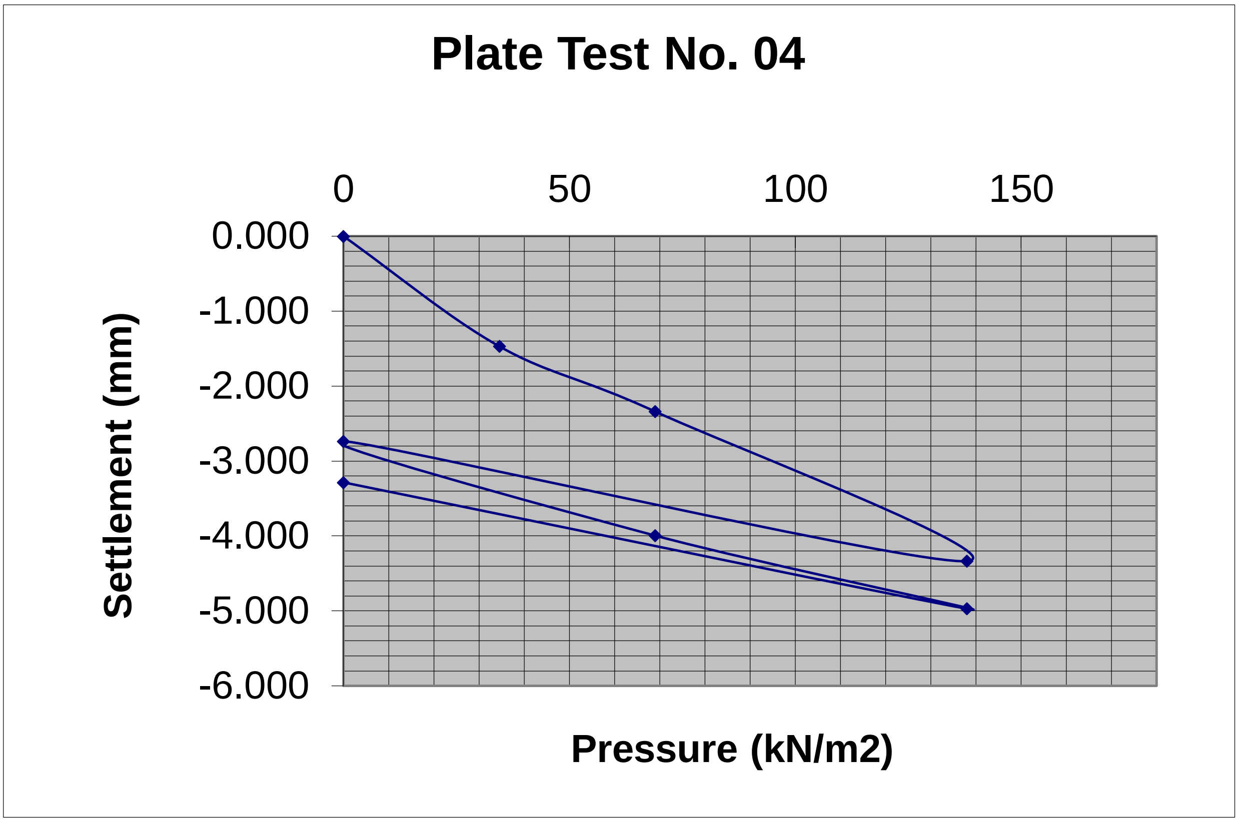
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.96 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **2.53 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-1.47
69	-2.34
138	-4.335
0	-2.735
69	-3.995
138	-4.97
0	-3.285

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Blackglen Road	**MATERIAL**	Brown gravelly CLAY
CONTRACT NO.	10477-03-21		
DATE	09/04/2021		
CLIENT	OCSC	**DEPTH**	0.45m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR-04	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **19.92 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **37.00 MN/m2/m**

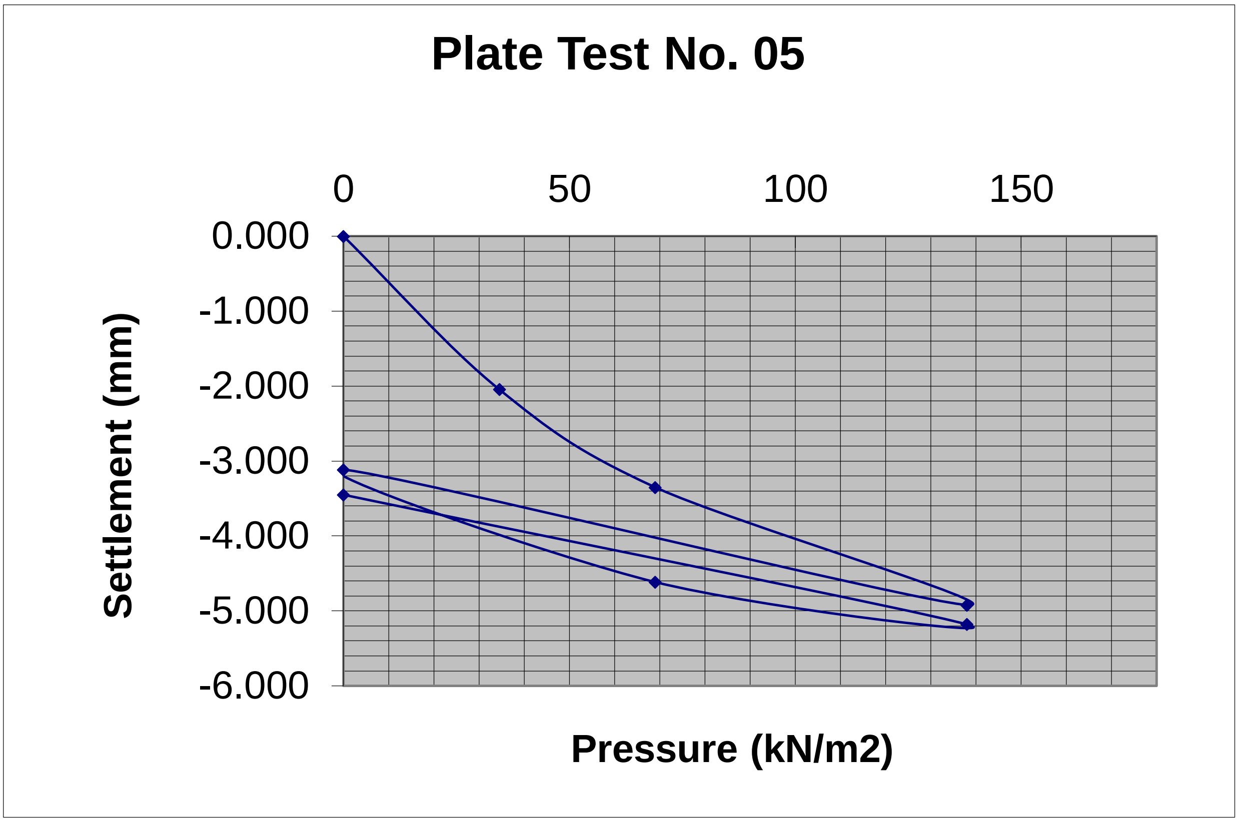
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **1.72 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **5.04 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-2.045
69	-3.35
138	-4.92
0	-3.115
69	-4.615
138	-5.18
0	-3.45

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Blackglen Road	**MATERIAL**	Soft brown gravelly CLAY with some angular to sub-angular cobbles
CONTRACT NO.	10477-03-21		
DATE	09/04/2021		
CLIENT	OCSC	**DEPTH**	0.45m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR-05	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **13.92 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **31.08 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.92 %**

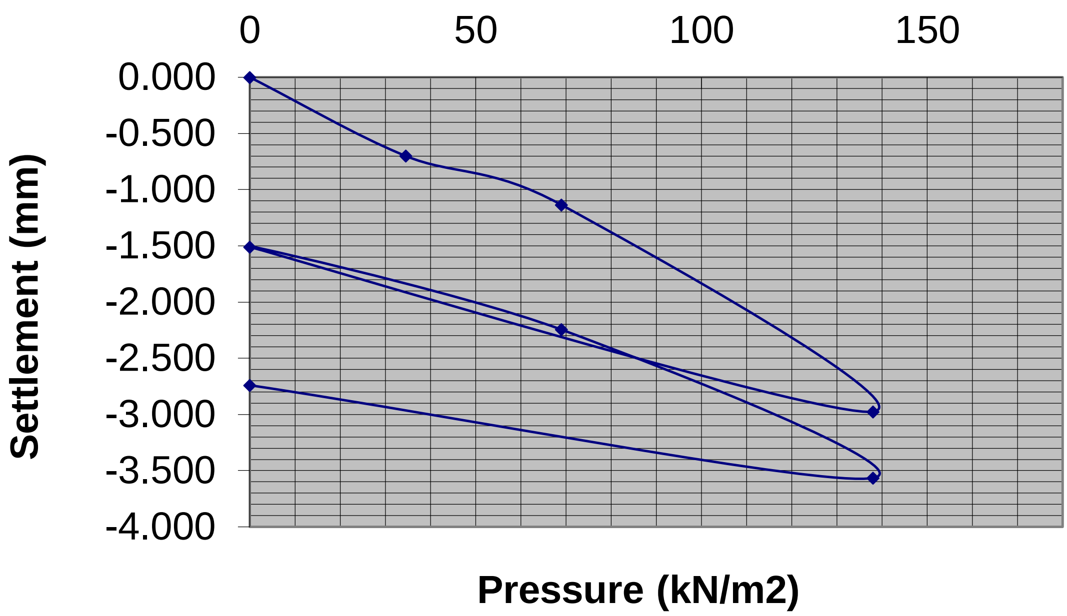
Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **3.72 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-0.7
69	-1.135
138	-2.975
0	-1.51
69	-2.245
138	-3.565
0	-2.74

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Blackglen Road	**MATERIAL**	Brown gravelly CLAY with some angular to sub-angular cobbles
CONTRACT NO.	10477-03-21		
DATE	09/04/2021		
CLIENT	OCSC	**DEPTH**	0.45m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	CBR-06	**SAMPLES**	

Plate Test No. 06



Modulus of subgrade reaction, K (Initial) = **41.08 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **63.43 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **6.04 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **12.82 %**

APPENDIX 6 - Rotary Borehole Records

Ground Investigations Ireland Ltd www.gii.ie			Site Blackglen Road	Borehole Number **RC01**
Machine : Beretta T41 **Flush :** Water **Core Dia:** 64 mm **Method :** Rotary Cored	**Casing Diameter** 98mm cased to 8.00m	**Ground Level (mOD)** 146.32	**Client** OCSC	**Job Number** 10477-03-21
	Location 717650.4 E 725282.6 N	**Dates** 18/04/2021	**Engineer**	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	19	-					(0.40)	OVERBURDEN: Brown slightly sandy gravelly CLAY. Driller notes Clay and pebbles			
						145.92	0.40	Possible Weathered Rock: Grey slightly sandy subangular to subrounded fine to coarse GRAVEL. Driller notes Clay and Gravels			
1.50 1.50-1.95	37	-			6,5/6,8,6,8 SPT(C) N=28		(2.20)				
2.50	97	97	67								
2.60				3		143.72	2.60	Recovery consists of medium strong to strong massive grey crystalline fine to coarse grained GRANITE with distinct weathering 1 fracture set. F1: Dipping 10-30 degrees stepped rough close to medium spacing with some clay smearing			
3.00				7							
4.00	100	89	76	5			(4.40)	2 fracture sets. F1: Dipping 10-30 degrees stepped rough close to medium spaced with some clay smearing. F2: Dipping 65-85 degrees stepped rough medium spaced with some clay smearing			
5.00				5							
5.50	100	80	77								
6.00				5							
7.00	95	95	88	2		139.32	7.00 (1.00)	Recovery consists of strong massive grey crystalline fine to coarse grained GRANITE with partial weathering. Driller notes harder Bedrock 1 fracture set. F1: Dipping 10-30 degrees stepped rough		∇1	
8.00					Water strike(1) at 8.00m.	138.32	8.00	Complete at 8.00m			

Remarks
Groundwater encountered at 8.00m BGL
Borehole complete at scheduled depth
Standpipe installed in borehole upon completion. Plain pipe with bentonite seal from GL to 4.00m BGL, slotted pipe with geosock and pe-gravel surround from 4.00m to 8.00m BGL, finished with a raised cover.

Scale (approx)	Logged By
1:50	M.Sheehan

Figure No.
10477-03-21.RC01

Ground Investigations Ireland Ltd
www.gii.ie

Site	Borehole Number
Blackglen Road	RC02

Machine / Flush / Core Dia / Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Machine: Beretta T41; Flush: Water; Core Dia: 64 mm; Method: Rotary Cored	100mm cased to 8.50m	139.88	OCSC	10477-03-21

Location	Dates	Engineer	Sheet
717698.9 E 725291.3 N	14/04/2021		1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
	53	-					(1.50)	OVERBURDEN: Dense brown slightly clayey gravelly fine to medium SAND. Driller notes Clay into Sand and Gravels
1.50 1.50-1.68	100	-			6,7/50 SPT(C) 50/30	138.38	1.50 (0.80)	Weathered Rock: Grey/brown slightly clayey slightly sandy subangular to rounded fine to coarse GRAVEL. Driller notes weathered Granite
2.00 2.30 2.50	100	78	69	3 4		137.58	2.30	Recovery consists of medium strong massive grey crystalline fine to coarse GRANITE with distinct weathering 1 fracture set. F1: Dipping 10-30 degrees close to medium spaced stepped rough with clay smearing
3.50	100	78	70	4			(2.70)	1 fracture set. F1: Dipping 20-40 degrees close to medium spacing stepped rough with clay smearing
4.50				6				2 fracture sets. F1: Dipping 60-80 degrees medium to wide spacing stepped rough with clay smearing. F2: Dipping 10-30 degrees medium to wide spacing stepped rough with clay smearing
5.00 5.50	100	61	61	6		134.88	5.00 (1.10)	Recovery consists of medium strong to strong massive grey crystalline fine to coarse grained GRANITE with distinct weathering
6.10 6.35	52	27	27	NI 1		133.78 133.53	6.10 (0.25) 6.35	Recovery consists of weak to medium strong massive grey crystalline fine to coarse grained GRANITE with destructured weathering. Driller notes soft weathered Rock Non intact
							(0.95)	Recovery consists of medium strong to strong massive grey crystalline fine to coarse grained GRANITE with distinct weathering 1 fracture set. F1: Dipping 20-40 degrees stepped rough spacing with clay smearing
7.30	44	0	0	NI		132.58	7.30 (0.80)	Poor recovery. Recovery consists of weak to medium strong massive grey crystalline fine to coarse grained GRANITE with destuctured weathering. Driller notes sand weathered Rock Non intact
8.10 8.50	100	70	50	1		131.78 131.38	8.10 (0.40) 8.50	Recovery consists of medium strong to strong massive grey crystalline fine to coarse grained GRANITE with distinct weathering 1 fracture set. F1: Dipping 50-70 degrees stepped rough close spacing with some clay smearing
								Complete at 8.50m

Remarks
No groundwater encountered
Borehole complete at scheduled depth
Standpipe installed in borehole upon completion. Plain pipe with bentonite seal from GL to 3.00m BGL, slotted pipe with geosock and pe-gravel surround from 3.00m to 8.50m BGL, finished with a raised cover.

Scale (approx)	Logged By
1:50	M.Sheehan

Figure No. 10477-03-21.RC02

Ground Investigations Ireland Ltd www.gii.ie	Site: Blackglen Road	Borehole Number: RC03

Machine : Beretta T41	Casing Diameter	Ground Level (mOD)	Client	Job Number
Flush : Water	100mm cased to 7.90m	153.86	OCSC	10477-03-21
Core Dia: 64 mm	**Location**	**Dates**	**Engineer**	**Sheet**
Method : Rotary Cored	717557.5 E 725220.3 N	18/04/2021		1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
	50	-					(1.10)	OVERBURDEN: Dark grey brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium. Driller notes Clay
1.10				3		152.76	1.10	Recovery consists of strong massive grey crystalline fine to coarse grained GRANITE with partial weathering. Driller notes extremely hard Bedrock
1.40				NI				1 fracture set. F1: Dipping 10-30 degrees close spacing stepped rough with some clay smearing
1.50	100	80	73	1	25,25/50			Non intact
1.50-1.50					SPT(C) 50*/0 50/0			2 fracture sets. F1: Dipping 10-30 degrees close to medium spaced stepped rough with clay smearing. F2: Dipping 50-70 degrees medium spaced stepped rough with clay smearing
2.00				7			(2.60)	
2.50	100	60	47					
3.00				7				
						150.16	3.70	Recovery consists of medium strong to strong massive grey crystalline fine to coarse grained GRANITE with distinct weathering
4.00	100	60	53	8			(1.90)	
5.00				6				
5.50						148.26	5.60	Recovery consists of strong massive grey crystalline fine to coarse grained GRANITE with partial weathering. Driller notes extremely hard Bedrock
6.00	100	90	90	4			(2.30)	2 fracture sets. F1: Dipping 10-30 degrees close to medium spaced stepped rough with clay smearing. F2: Dipping 70-90 degrees medium to wide spacing stepped rough with some clay smearing
7.00	100	42	33	6				
7.90						145.96	7.90	Complete at 7.90m

Legend | Water | Instr

Remarks
No groundwater encountered
Borehole complete at scheduled depth
Standpipe installed in borehole upon completion. Plain pipe with bentonite seal from GL to 2.00m BGL, slotted pipe with geosock and pe-gravel surround from 2.00m to 7.90m BGL, finished with a raised cover.

Scale (approx)	Logged By
1:50	M.Sheehan

Figure No. 10477-03-21.RC03

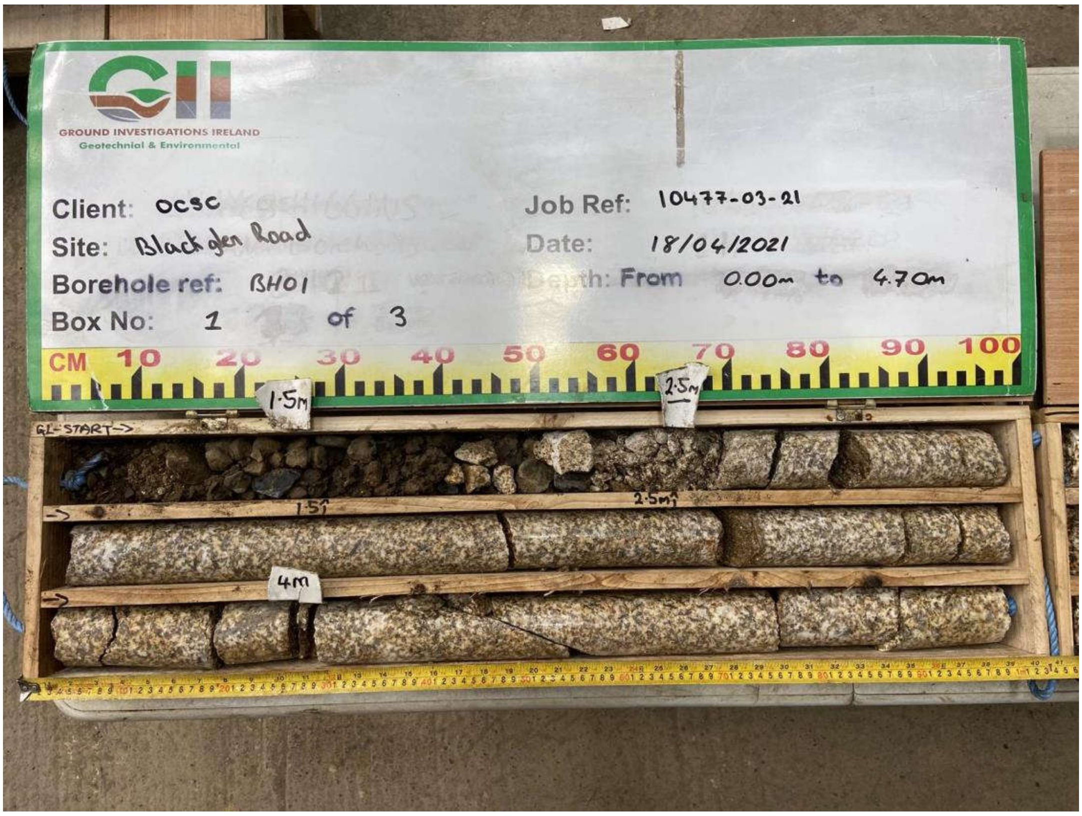
Ground Investigations Ireland Ltd www.gii.ie			Site: Blackglen Road	Borehole Number: RC04
Machine : Beretta T41 Flush : Water Core Dia: 64 mm Method : Rotary Cored	Casing Diameter: 100mm cased to 8.30m	Ground Level (mOD): 143.71	Client: OCSC	Job Number: 10477-03-21
	Location: 717658.4 E 725158.4 N	Dates: 18/04/2021	Engineer:	Sheet: 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	24	-					(1.50)	Poor recovery. Driller notes Clay and Boulders			
1.50 1.50-1.95	18	-			8,6/8,10,10,12 SPT(C) N=40	142.21	1.50 (1.00)	Poor recovery: Recovery consists of brown slightly sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse. Driller notes soft Clay and pebbles			
2.50	26	-				141.21	2.50 (1.70)	Poor recovery: Recovery consists of grey subangular to subrounded fine to coarse GRAVEL. Driller notes soft Clays			
4.00 4.00-4.15 4.20	67	67	67	9	25,25/50 SPT(C) 50/0	139.51	4.20 (2.15)	Recovery consisting of medium strong to strong massive grey crystalline fine to coarse grained GRANITE with distinct weathering 2 fracture sets. F1: Dipping 20-40 degrees stepped rough close spacing with some clay smearing. F2: Dipping 70-90 degrees stepped rough medium spacing with some clay smearing			
5.50 5.65	90	42	42	NI 5				Non intact			
6.50				1		137.36	6.35 (1.95)	Recovery consists of strong massive grey crystalline fine to coarse grained GRANITE with partial weathering 1 fracture set. F1: Dipping 30-50 degrees stepped rough medium to wide spacing with some clay smearing			
7.00 7.50	100	92	92	1							
8.30						135.41	8.30	Complete at 8.30m			

Remarks
No groundwater encountered
Borehole complete at scheduled depth
Standpipe installed in borehole upon completion. Plain pipe with bentonite seal from GL to 4.30m BGL, slotted pipe with geosock and pe-gravel surround from 4.30m to 8.30m BGL, finished with a raised cover.

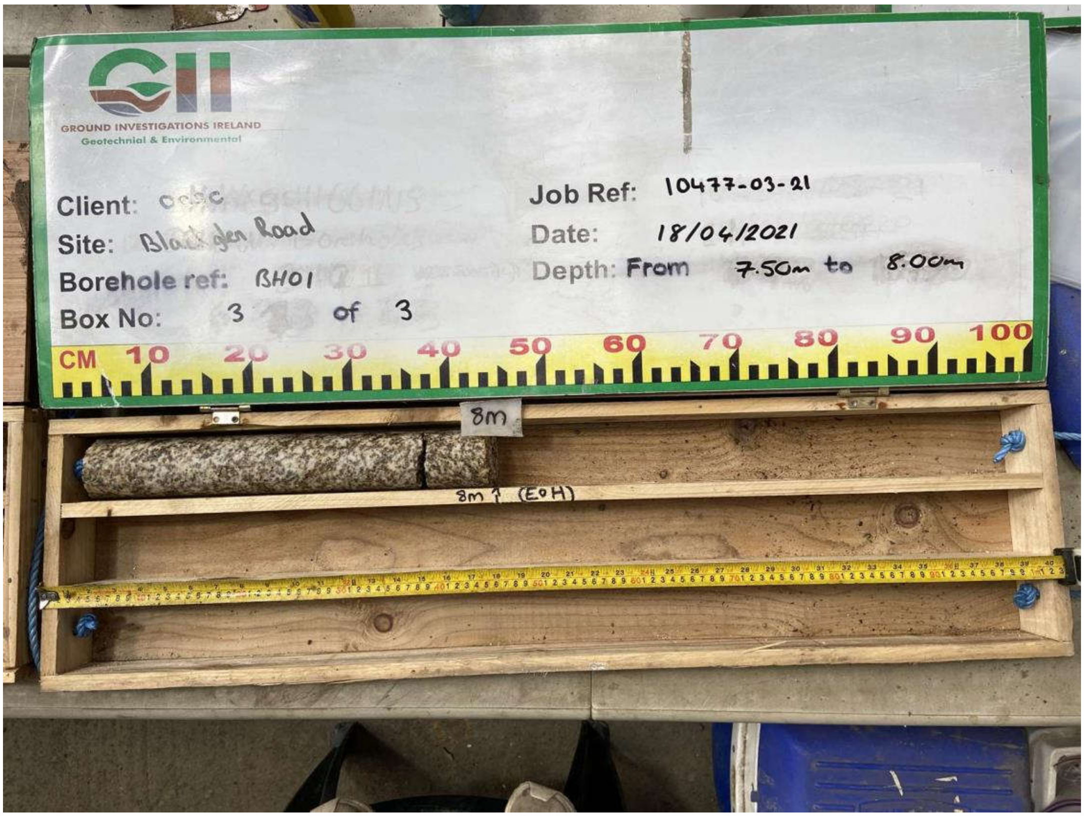
Scale (approx): 1:50
Logged By: M.Sheehan
Figure No.: 10477-03-21.RC04

Blackglen Road Rotary Core Photographs

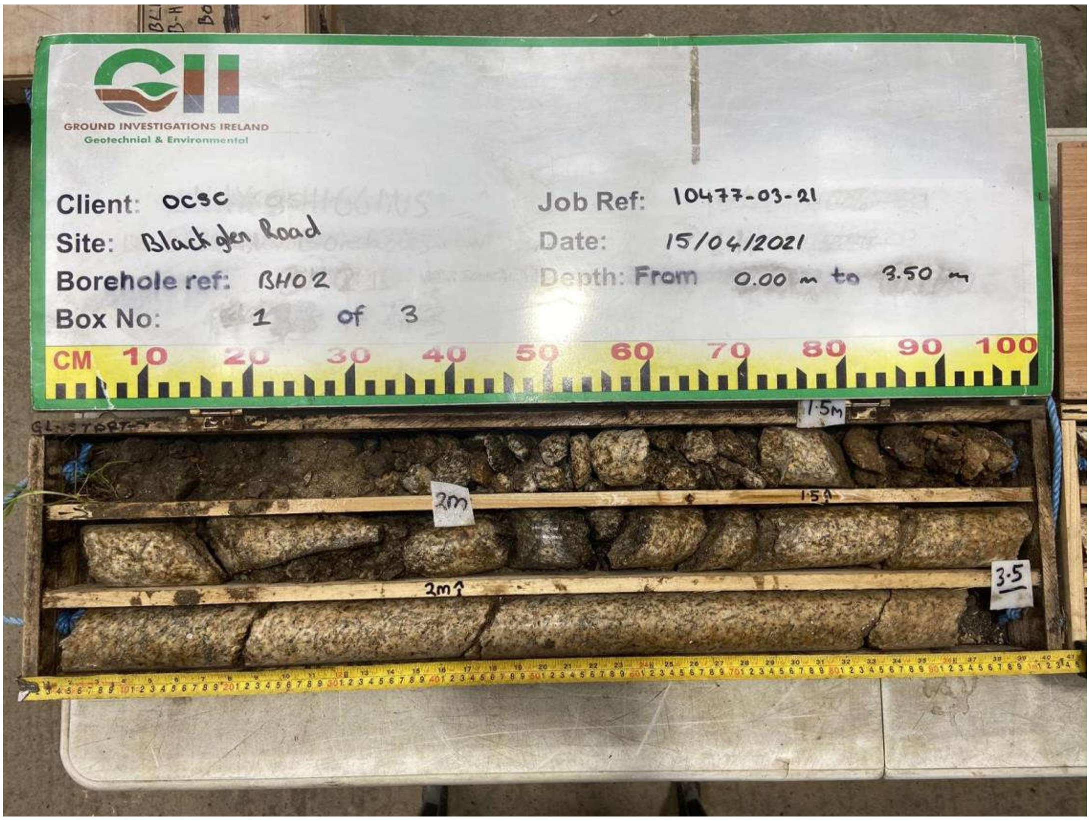


BH01

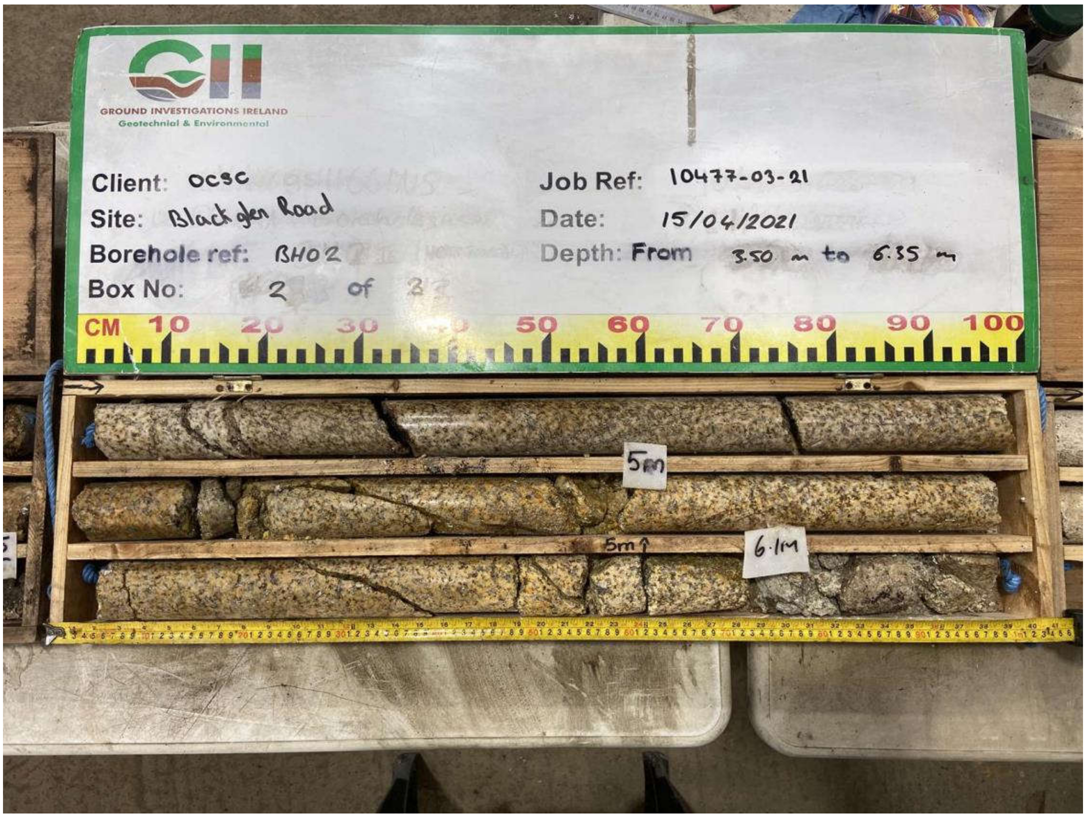
BH01


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client:
Site: Blackglen Road
Borehole ref: BH01
Box No: 3 of 3
Job Ref: 10477-03-21
Date: 18/04/2021
Depth: From 7.50m to 8.00m
CM 10 20 30 40 50 60 70 80 90 100
8m
8m (EOH)

BH01


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: OCSC
Site: Blackglen Road
Borehole ref: BH02
Box No: 1 of 3
Job Ref: 10477-03-21
Date: 15/04/2021
Depth: From 0.00 m to 3.50 m

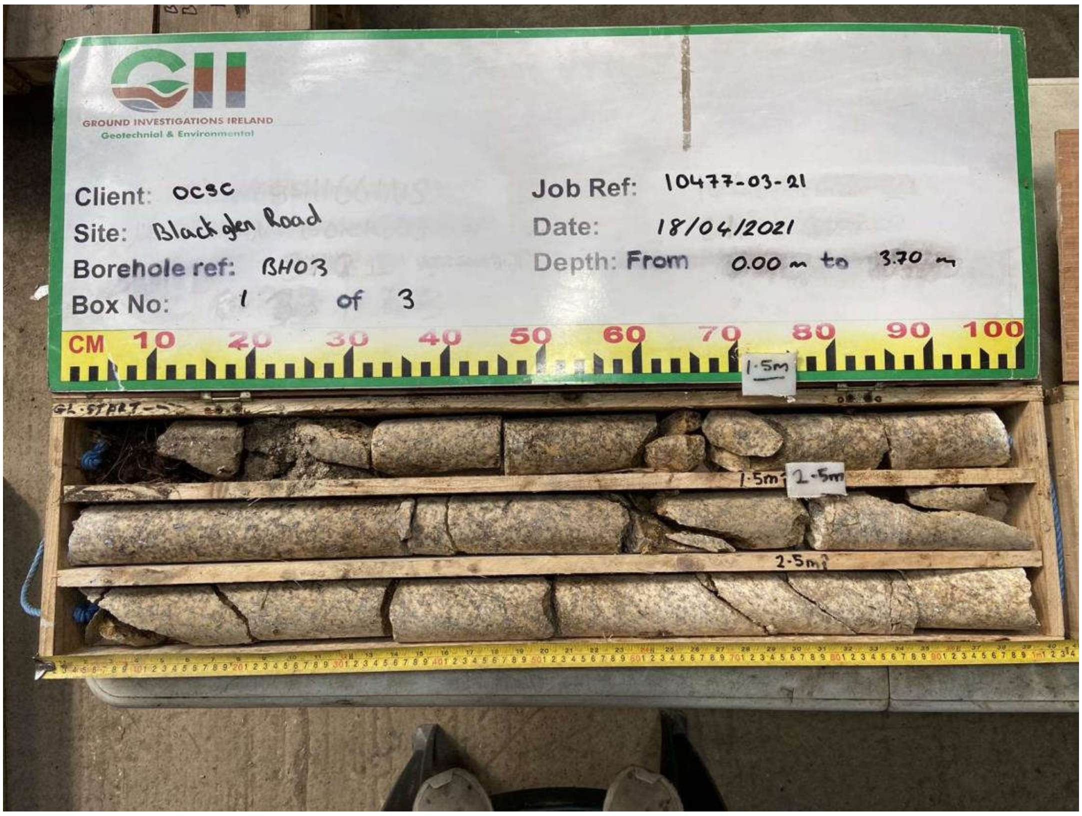
BH02


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: OCSC
Site: Blackglen Road
Borehole ref: BH02
Box No: 2 of 3
Job Ref: 10477-03-21
Date: 15/04/2021
Depth: From 3.50 m to 6.35 m

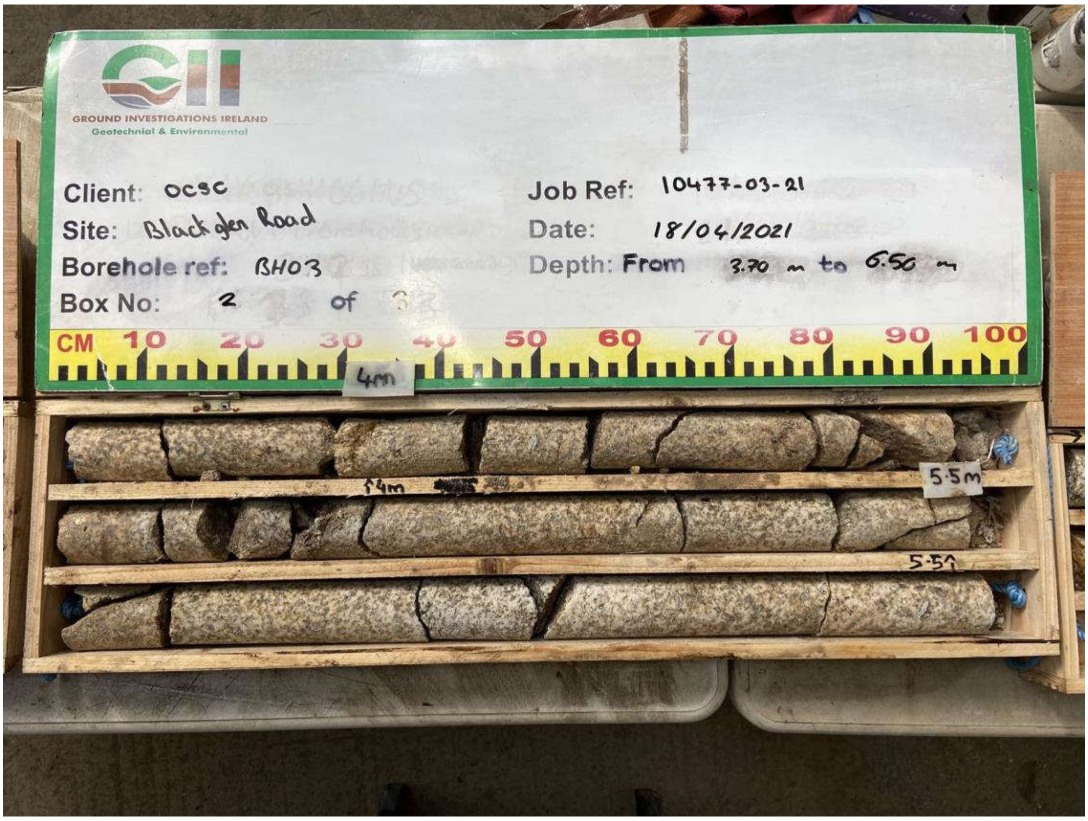
BH02


GROUND INVESTIGATIONS IRELAND
Geotechnial & Environmental
Client:
Job Ref: 10477-03-21
Site:
Date: 15/04/2021
Borehole ref: BH02
Depth: From 6.35 m to 8.50 m
Box No: 3 of 3
CM 10 20 30 40 50 60 70 80 90 100
7.3
8.5

BH02


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: OCSC
Site: Blackglen Road
Borehole ref: BH03
Box No: 1 of 3
Job Ref: 10477-03-21
Date: 18/04/2021
Depth: From 0.00 m to 3.70 m
1.5m
2.5m

BH03


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: OCSC
Site: Blackglen Road
Borehole ref: BH03
Box No: 2 of
Job Ref: 10477-03-21
Date: 18/04/2021
Depth: From 3.70 m to 6.50 m
4m
5.5m

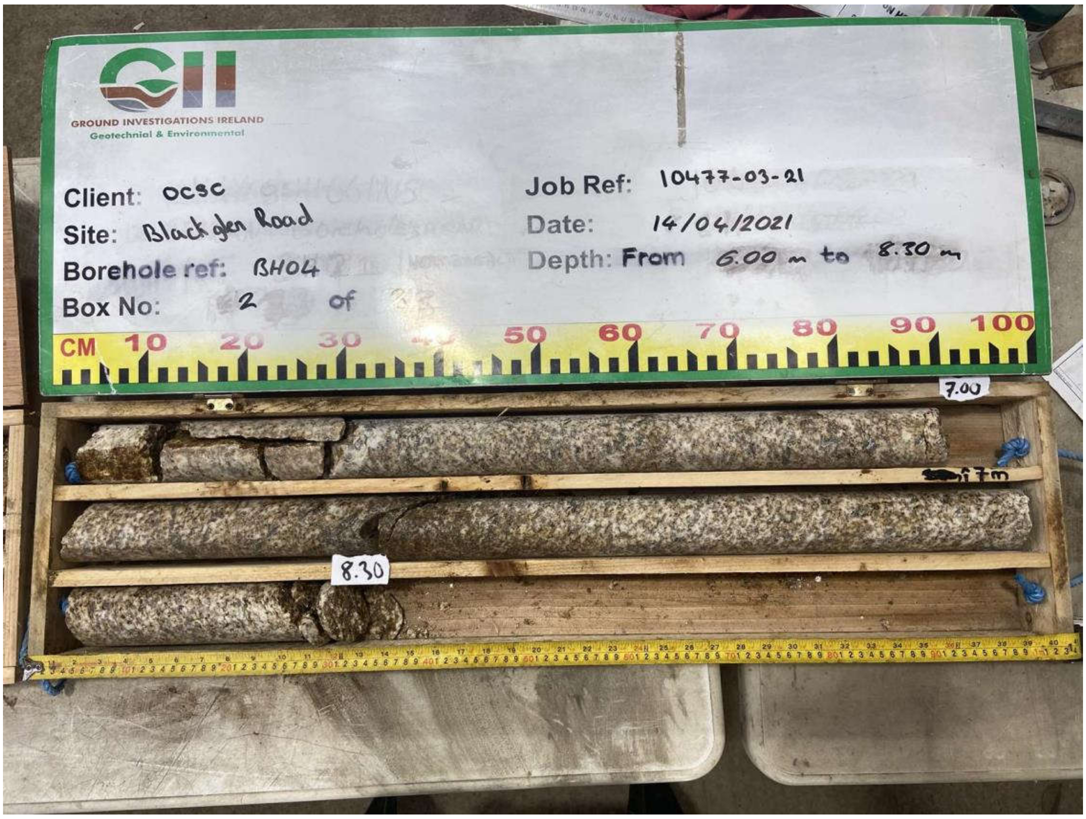
BH03


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: OCSC
Job Ref: 10477-03-21
Site: Blackglen Road
Date: 18/04/2021
Borehole ref: BH03
Depth: From 6.50 m to 7.90 m
Box No: 3 of 3
CM 10 20 30 40 50 60 70 80 90 100
7m

BH03


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: OCSC
Job Ref: 10477-03-21
Site: Blackglen Road
Date: 14/04/2021
Borehole ref: BH04
Depth: From 0.00 m to 6.00 m
Box No: 1 of 2
1.50
2.5m
4.00
5.50

BH04


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: OCSC
Job Ref: 10477-03-21
Site: Blackglen Road
Date: 14/04/2021
Borehole ref: BH04
Depth: From 6.00 m to 8.30 m
Box No: 2 of
7.00
8.30

BH04

APPENDIX 7 – Laboratory Testing

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

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W: www.element.com

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

Attention :	Conor Finnerty
Date :	30th April, 2021
Your reference :	10477-03-21
Our reference :	Test Report 21/5988 Batch 1
Location :	Blackglen Road
Date samples received :	22nd April, 2021
Status :	Final report
Issue :	1

Two samples were received for analysis on 22nd April, 2021 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.
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:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/5988

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4	LOD/LOR	Units	Method No.
Sample ID	TP01	TP06			
Depth	1.00	0.50			
COC No / misc					
Containers	V J T	T			
Sample Date	01/04/2021	01/04/2021			
Sample Type	Soil	Soil			
Batch Number	1	1			
Date of Receipt	22/04/2021	22/04/2021			
Antimony	2	-	<1	mg/kg	TM30/PM15
Arsenic #	19.7	-	<0.5	mg/kg	TM30/PM15
Barium #	97	-	<1	mg/kg	TM30/PM15
Cadmium #	2.5	-	<0.1	mg/kg	TM30/PM15
Chromium #	73.9	-	<0.5	mg/kg	TM30/PM15
Copper #	37	-	<1	mg/kg	TM30/PM15
Lead #	71	-	<5	mg/kg	TM30/PM15
Mercury #	0.3	-	<0.1	mg/kg	TM30/PM15
Molybdenum #	5.5	-	<0.1	mg/kg	TM30/PM15
Nickel #	28.6	-	<0.7	mg/kg	TM30/PM15
Selenium #	2	-	<1	mg/kg	TM30/PM15
Zinc #	134	-	<5	mg/kg	TM30/PM15
PAH MS					
Naphthalene #	<0.04	-	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	-	<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 #	0.17	-	<0.03	mg/kg	TM4/PM8
Anthracene #	0.07	-	<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.44	-	<0.03	mg/kg	TM4/PM8
Pyrene #	0.39	-	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.37	-	<0.06	mg/kg	TM4/PM8
Chrysene #	0.28	-	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.73	-	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.42	-	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	0.35	-	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	0.07	-	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.30	-	<0.04	mg/kg	TM4/PM8
Coronene	0.08	-	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	2.24	-	<0.22	mg/kg	TM4/PM8
PAH 17 Total	3.67	-	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.53	-	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.20	-	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	-	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	86	-	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	-	<30	mg/kg	TM5/PM8/PM16

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/5988

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4											
Sample ID	TP01	TP06											
Depth	1.00	0.50											
COC No / misc													
Containers	V J T	T											
Sample Date	01/04/2021	01/04/2021											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	22/04/2021	22/04/2021									LOD/LOR	Units	Method No.
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) #	19	-									<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	-									<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	-									<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	-									<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	-									<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	16	-									<10	mg/kg	TM5/PM8/PM16
Aromatics													
>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) #	13	-									<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) #	100	-									<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	60	-									<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	173	-									<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	173	-									<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)	88	-									<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
m/p-Xylene #	<5	-									<5	ug/kg	TM36/PM12
o-Xylene #	<5	-									<5	ug/kg	TM36/PM12
PCB 28 #	<5	-									<5	ug/kg	TM17/PM8
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: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/5988

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4			
Sample ID	TP01	TP06			
Depth	1.00	0.50			
COC No / misc					
Containers	V J T	T			
Sample Date	01/04/2021	01/04/2021			
Sample Type	Soil	Soil			
Batch Number	1	1			
Date of Receipt	22/04/2021	22/04/2021	LOD/LOR	Units	Method No.
Natural Moisture Content	15.9	-	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	13.7	-	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	-	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0158	0.0102	<0.0015	g/l	TM38/PM20
Chromium III	73.9	-	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	1.19	-	<0.02	%	TM21/PM24
pH #	8.24	6.75	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1096	-		kg	NONE/PM17
Mass of dried test portion	0.09	-		kg	NONE/PM17

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/5988

Report : **CEN 10:1 1 Batch**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3										LOD/LOR	Units	Method No.
Sample ID	TP01												
Depth	1.00												
COC No / misc													
Containers	V J T												
Sample Date	01/04/2021												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	22/04/2021												
Dissolved Antimony #	<0.002										<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02										<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	0.0043										<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	0.043										<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.005										<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.05										<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005										<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005										<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015										<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015										<0.015	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 #	0.007										<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.07										<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 #	<0.003										<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03										<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
Phenol	<0.01										<0.01	mg/l	TM26/PM0
Phenol	<0.1										<0.1	mg/kg	TM26/PM0
Fluoride	0.4										<0.3	mg/l	TM173/PM0
Fluoride	4										<3	mg/kg	TM173/PM0
Sulphate as SO4 #	0.7										<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	7										<5	mg/kg	TM38/PM0
Chloride #	0.3										<0.3	mg/l	TM38/PM0
Chloride #	<3										<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	5										<2	mg/l	TM60/PM0
Dissolved Organic Carbon	50										<20	mg/kg	TM60/PM0
pH	8.05										<0.01	pH units	TM73/PM0
Total Dissolved Solids #	69										<35	mg/l	TM20/PM0
Total Dissolved Solids #	690										<350	mg/kg	TM20/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/5988

Report : EN12457_2

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3						
Sample ID	TP01						
Depth	1.00						
COC No / misc							
Containers	V J T						
Sample Date	01/04/2021						
Sample Type	Soil						
Batch Number	1						
Date of Receipt	22/04/2021	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Solid Waste Analysis							
Total Organic Carbon #	1.19	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	2.24	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	3.67	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate							
Arsenic #	0.043	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.05	20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	0.5	10	70	<0.015	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 #	0.07	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 #	<0.03	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	690	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	50	500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	82.1	-	-	-	<0.1	%	NONE/PM4
pH #	8.24	-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	4	-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	7	1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	800	15000	25000	<3	mg/kg	TM38/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland

Reference: 10477-03-21

Location: Blackglen Road

Contact: Conor Finnerty

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
21/5988	1	TP01	1.00	1-3	PAH's, Possible tarmac/bitumen & Possible lubricaitng oil

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty

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
21/5988	1	TP01	1.00	2	23/04/2021	**General Description (Bulk Analysis)**	soil.stones
					23/04/2021	**Asbestos Fibres**	NAD
					23/04/2021	**Asbestos ACM**	NAD
					23/04/2021	**Asbestos Type**	NAD
					23/04/2021	**Asbestos Level Screen**	NAD

Element Materials Technology

Notification of Deviating Samples

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
21/5988	1	TP01	1.00	1-3	EPH, GRO, PAH, PCB	Sample holding time exceeded prior to receipt

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.: 21/5988

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 HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above 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
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

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

EMT Job No: 21/5988

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	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.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
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

EMT Job No: 21/5988

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	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) – All anions comparable to BS ISO 15923-1: 2013l	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: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
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: 2013l	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

EMT Job No: 21/5988

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
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
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.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
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	

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Ground Investigations Ireland
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Ireland

Attention :	Conor Finnerty
Date :	30th June, 2021
Your reference :	10477-03-21
Our reference :	Test Report 21/9397 Batch 1
Location :	Blackglen Road
Date samples received :	21st June, 2021
Status :	Final report
Issue :	1

Fifteen samples were received for analysis on 21st June, 2021 of which fifteen 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:

Phil Sommerton BSc
Senior Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/9397

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	ENV TP07	ENV TP08	ENV TP05	ENV TP05	ENV TP04	ENV TP01	ENV TP01	ENV TP02	ENV TP02	ENV TP02			
Depth	0.00-1.00	0.00-1.00	0.00-1.00	1.00-2.00	0.00-1.00	0.00-1.00	1.00-7.00	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021			
Antimony	<1	<1	<1	2	<1	1	1	2	2	1	<1	mg/kg	TM30/PM15
Arsenic #	25.7	14.5	76.9	22.9	21.5	176.4	418.8$_{AA}$	24.2	47.0	22.9	<0.5	mg/kg	TM30/PM15
Barium #	22	13	27	57	15	205	72	74	80	58	<1	mg/kg	TM30/PM15
Cadmium #	<0.1	<0.1	<0.1	1.2	<0.1	2.1	<0.1	0.9	1.5	1.1	<0.1	mg/kg	TM30/PM15
Chromium #	49.5	45.9	65.2	63.6	58.7	61.3	56.8	59.5	61.0	57.2	<0.5	mg/kg	TM30/PM15
Copper #	10	6	6	28	6	25	16	26	29	22	<1	mg/kg	TM30/PM15
Lead #	22	9	14	22	10	21	19	23	21	17	<5	mg/kg	TM30/PM15
Mercury #	<0.1	<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 #	4.0	3.7	5.1	4.5	4.4	6.3	4.9	3.2	3.6	4.0	<0.1	mg/kg	TM30/PM15
Nickel #	7.2	7.0	9.5	42.3	9.1	56.4	32.6	48.3	49.2	34.5	<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1	<1	3	<1	3	1	<1	<1	<1	<1	mg/kg	TM30/PM15
Total Sulphate as SO4 #	388	227	227	340	101	184	91	128	115	136	<50	mg/kg	TM50/PM29
Water Soluble Boron #	0.5	0.2	0.4	0.5	0.1	0.3	0.2	0.4	0.3	0.3	<0.1	mg/kg	TM74/PM32
Zinc #	39	36	59	81	40	82	67	87	91	74	<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	<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	<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	<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	<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<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	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<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	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<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	<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	<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	<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	<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	<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	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	<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	<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	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	92	103	106	101	91	104	94	98	87	90	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	10477-03-21		
Location:	Blackglen Road	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Conor Finnerty		
EMT Job No:	21/9397		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	ENV TP07	ENV TP08	ENV TP05	ENV TP05	ENV TP04	ENV TP01	ENV TP01	ENV TP02	ENV TP02	ENV TP02			
Depth	0.00-1.00	0.00-1.00	0.00-1.00	1.00-2.00	0.00-1.00	0.00-1.00	1.00-7.00	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021			
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<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
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<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	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	<0.1 SV	<0.1	<0.1	<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	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<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_CU_1D_AR)#	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	<7	11	<7	<7	<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	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	<26	<26	<26	<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	<52	<52	<52	<52	<52	<52	<52	<52	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
MTBE#	<5	<5 SV	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
Benzene#	<5	<5 SV	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
Toluene#	<5	<5 SV	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	<5 SV	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	<5 SV	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
o-Xylene#	<5	<5 SV	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
PCB 28#	<5	<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	<5	ug/kg	TM17/PM8
PCB 101#	<5	<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	<5	ug/kg	TM17/PM8
PCB 138#	<5	<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	<5	ug/kg	TM17/PM8
PCB 180#	<5	<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	<35	ug/kg	TM17/PM8

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/9397

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	ENV TP07	ENV TP08	ENV TP05	ENV TP05	ENV TP04	ENV TP01	ENV TP01	ENV TP02	ENV TP02	ENV TP02			
Depth	0.00-1.00	0.00-1.00	0.00-1.00	1.00-2.00	0.00-1.00	0.00-1.00	1.00-7.00	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021			
Phenol #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM26/PM21B
Natural Moisture Content	29.6	25.3	19.6	26.8	16.5	17.7	20.8	21.8	20.4	16.3	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	22.9	20.2	16.4	21.1	14.1	15.0	17.2	17.9	16.9	14.0	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Chromium III	49.5	45.9	65.2	63.6	58.7	61.3	56.8	59.5	61.0	57.2	<0.5	mg/kg	NONE/NONE
Total Cyanide #	<0.5	<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 #	1.45	0.79	0.37	0.18	0.12	0.17	0.14	0.49	0.23	0.21	<0.02	%	TM21/PM24
Sulphide	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM107/PM45
Elemental Sulphur	<1	2	<1	<1	<1	2	<1	9	1	<1	<1	mg/kg	TM108/PM114
pH #	4.34	6.02	5.88	5.78	5.43	8.10	7.85	7.90	8.56	8.57	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1156	0.1193	0.1033	0.106	0.1072	0.1185	0.1075	0.1107	0.107	0.1045		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	0.09		kg	NONE/PM17

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/9397

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	31-33	34-36	37-39	40-42	43-45						LOD/LOR	Units	Method No.
Sample ID	ENV TP02	ENV TP03	ENV TP03	ENV ST01	ENV ST01								
Depth	3.00-3.60	0.00-1.00	1.00-2.00	0.00-1.00	1.00-2.00								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021								
Antimony	<1	1	<1	1	1						<1	mg/kg	TM30/PM15
Arsenic #	20.6	27.3	25.1	25.1	25.1						<0.5	mg/kg	TM30/PM15
Barium #	28	74	61	56	52						<1	mg/kg	TM30/PM15
Cadmium #	1.0	0.5	1.2	0.8	0.7						<0.1	mg/kg	TM30/PM15
Chromium #	49.2	64.7	77.8	53.3	65.9						<0.5	mg/kg	TM30/PM15
Copper #	17	20	22	20	19						<1	mg/kg	TM30/PM15
Lead #	11	27	19	56	33						<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM30/PM15
Molybdenum #	3.5	4.0	4.7	4.3	5.1						<0.1	mg/kg	TM30/PM15
Nickel #	22.9	31.9	41.9	22.2	20.7						<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1	<1	<1	<1						<1	mg/kg	TM30/PM15
Total Sulphate as SO4 #	165	306	113	279	428						<50	mg/kg	TM50/PM29
Water Soluble Boron #	0.3	1.1	0.4	0.6	0.5						<0.1	mg/kg	TM74/PM32
Zinc #	47	82	83	92	81						<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	<0.03	0.21	0.04						<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	<0.03	0.36	0.08						<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	0.32	0.08						<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	0.21	0.09						<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	0.25	0.06						<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	0.40	0.12						<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	0.21	0.07						<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	0.17	0.05						<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	0.05	<0.04						<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	0.20	0.05						<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04						<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	<0.22	1.34	0.37						<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	2.38	0.64						<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	0.29	0.09						<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	0.11	0.03						<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1						<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	93	90	87	102	93						<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	<30	<30	<30	<30						<30	mg/kg	TM5/PM8/PM16

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	10477-03-21		
Location:	Blackglen Road	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Conor Finnerty		
EMT Job No:	21/9397		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	31-33	34-36	37-39	40-42	43-45						LOD/LOR	Units	Method No.
Sample ID	ENV TP02	ENV TP03	ENV TP03	ENV ST01	ENV ST01								
Depth	3.00-3.60	0.00-1.00	1.00-2.00	0.00-1.00	1.00-2.00								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021								
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL) #	<0.1	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) #	<0.1	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1						<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	<7	21	15						<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/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<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	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	<10	<10	23	16						<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR) #	<0.1	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) #	<0.1	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #	<0.1	<0.1	<0.1	<0.1	<0.1						<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	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<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	<52	<52	<52						<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR) #	<0.1	<0.1	<0.1	<0.1	<0.1						<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	<10	<10	<10						<10	mg/kg	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	<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	ug/kg	TM36/PM12
o-Xylene #	<5	<5	<5	<5	<5						<5	ug/kg	TM36/PM12
PCB 28 #	<5	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5						<5	ug/kg	TM17/PM8
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						<35	ug/kg	TM17/PM8

Element Materials Technology

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	10477-03-21		
Location:	Blackglen Road	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Conor Finnerty		
EMT Job No:	21/9397		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	31-33	34-36	37-39	40-42	43-45						LOD/LOR	Units	Method No.
Sample ID	ENV TP02	ENV TP03	ENV TP03	ENV ST01	ENV ST01								
Depth	3.00-3.60	0.00-1.00	1.00-2.00	0.00-1.00	1.00-2.00								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021								
Phenol #	<0.01	<0.01	<0.01	<0.01	<0.01						<0.01	mg/kg	TM26/PM21B
Natural Moisture Content	14.7	28.2	22.0	15.6	16.7						<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.8	22.0	18.1	13.5	14.3						<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3						<0.3	mg/kg	TM38/PM20
Chromium III	49.2	64.7	77.8	53.3	65.9						<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 #	0.22	1.57	0.22	0.86	0.75						<0.02	%	TM21/PM24
Sulphide	<10	<10	<10	<10	<10						<10	mg/kg	TM107/PM45
Elemental Sulphur	7	11	4	2	2						<1	mg/kg	TM108/PM114
pH #	8.60	7.94	8.32	8.36	8.40						<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1014	0.1255	0.114	0.1036	0.1055							kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09							kg	NONE/PM17

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/9397

Report : **CEN 10:1 1 Batch**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	ENV TP07	ENV TP08	ENV TP05	ENV TP05	ENV TP04	ENV TP01	ENV TP01	ENV TP02	ENV TP02	ENV TP02			
Depth	0.00-1.00	0.00-1.00	0.00-1.00	1.00-2.00	0.00-1.00	0.00-1.00	1.00-7.00	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021			
Dissolved Antimony #	<0.002	<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) #	<0.02	<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 Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.0401	<0.0025	<0.0025	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.401	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.005	<0.003	<0.003	<0.003	0.004	<0.003	0.056	<0.003	<0.003	0.004	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.05	<0.03	<0.03	<0.03	0.04	<0.03	0.56	<0.03	<0.03	0.04	<0.03	mg/kg	TM30/PM17
Dissolved Boron #	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	mg/l	TM30/PM17
Dissolved Boron (A10) #	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	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	<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	<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	<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	<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	<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	<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	<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	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.005	<0.002	0.003	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	<0.02	0.03	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	0.004	<0.002	<0.002	0.006	0.004	<0.002	<0.002	<0.002	0.003	0.003	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	0.04	<0.02	<0.02	0.06	0.04	<0.02	<0.02	<0.02	0.03	0.03	<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<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 Selenium (A10) #	<0.03	<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 Zinc #	0.013	<0.003	<0.003	0.005	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.13	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	0.00002	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 #	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	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	<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	<3	<3	<3	<3	3	<3	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	1.7	5.7	3.7	2.6	3.9	7.0	1.8	5.9	1.2	0.8	<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	17	57	37	26	39	70	18	59	12	8	<5	mg/kg	TM38/PM0
Chloride #	1.1	2.3	1.4	<0.3	<0.3	2.3	1.1	1.2	1.1	1.9	<0.3	mg/l	TM38/PM0
Chloride #	11	23	14	<3	<3	23	11	12	11	19	<3	mg/kg	TM38/PM0
Ammoniacal Nitrogen as N #	0.04	0.03	0.04	<0.03	0.03	<0.03	0.05	<0.03	<0.03	0.03	<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	0.4	<0.3	0.4	<0.3	0.3	<0.3	0.5	<0.3	<0.3	0.3	<0.3	mg/kg	TM38/PM0
Dissolved Organic Carbon	26	29	10	5	<2	10	9	8	4	4	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	260	290	100	50	<20	100	90	80	40	40	<20	mg/kg	TM60/PM0
Total Dissolved Solids #	48	41	<35	<35	<35	<35	55	<35	50	45	<35	mg/l	TM20/PM0
Total Dissolved Solids #	480	410	<350	<350	<350	<350	550	<350	500	450	<350	mg/kg	TM20/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/9397

Report : **CEN 10:1 1 Batch**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	31-33	34-36	37-39	40-42	43-45			
Sample ID	ENV TP02	ENV TP03	ENV TP03	ENV ST01	ENV ST01			
Depth	3.00-3.60	0.00-1.00	1.00-2.00	0.00-1.00	1.00-2.00			
COC No / misc								
Containers	V J T	V J T	V J T	V J T	V J T			
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021			
Sample Type	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021			
Dissolved Antimony #	0.003	<0.002	0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	0.0029	0.0047	0.0043	0.0035	0.0031	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	0.029	0.047	0.043	0.035	0.031	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	0.008	0.005	0.006	0.006	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	0.08	0.05	0.06	0.06	<0.03	mg/kg	TM30/PM17
Dissolved Boron #	<0.012	<0.012	<0.012	<0.012	0.013	<0.012	mg/l	TM30/PM17
Dissolved Boron (A10) #	<0.12	<0.12	<0.12	<0.12	0.13	<0.12	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
Dissolved Chromium #	0.0017	0.0038	<0.0015	<0.0015	0.0018	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	0.017	0.038	<0.015	<0.015	0.018	<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 #	0.021	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	0.21	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.002	<0.002	0.005	0.004	0.004	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	<0.02	<0.02	0.05	0.04	0.04	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	0.006	<0.002	<0.002	0.003	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	0.06	<0.02	<0.02	0.03	<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 #	0.008	0.016	<0.003	<0.003	0.007	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.08	0.16	<0.03	<0.03	0.07	<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
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM26/PM0
Fluoride	<0.3	0.6	0.7	0.4	0.4	<0.3	mg/l	TM173/PM0
Fluoride	<3	6	7	4	4	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	1.5	3.1	1.6	<0.5	0.9	<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	15	31	16	<5	9	<5	mg/kg	TM38/PM0
Chloride #	1.3	2.9	2.4	0.6	0.3	<0.3	mg/l	TM38/PM0
Chloride #	13	29	24	6	<3	<3	mg/kg	TM38/PM0
Ammoniacal Nitrogen as N #	<0.03	<0.03	0.03	0.03	0.03	<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	<0.3	<0.3	<0.3	0.3	<0.3	<0.3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	3	3	3	4	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	30	30	30	40	<20	mg/kg	TM60/PM0
Total Dissolved Solids #	43	53	68	85	93	<35	mg/l	TM20/PM0
Total Dissolved Solids #	430	530	680	850	930	<350	mg/kg	TM20/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/9397

Report : **EN12457_2**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30						
Sample ID	ENV TP07	ENV TP08	ENV TP05	ENV TP05	ENV TP04	ENV TP01	ENV TP01	ENV TP02	ENV TP02	ENV TP02						
Depth	0.00-1.00	0.00-1.00	0.00-1.00	1.00-2.00	0.00-1.00	0.00-1.00	1.00-7.00	0.00-1.00	1.00-2.00	2.00-3.00						
COC No / misc																
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1	1	1	1	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021						
Solid Waste Analysis																
Total Organic Carbon #	1.45	0.79	0.37	0.18	0.12	0.17	0.14	0.49	0.23	0.21	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025 SV	<0.025	<0.025	<0.025	<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	<0.035	<0.035	<0.035	<0.035	<0.035	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	<0.64	<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	<0.025	<0.025	<0.025	<0.025	0.401	<0.025	<0.025	<0.025	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.05	<0.03	<0.03	<0.03	0.04	<0.03	0.56	<0.03	<0.03	0.04	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	<0.005	0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<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	<0.07	<0.07	<0.07	<0.07	<0.07	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	0.0002	<0.0001	<0.0001	<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 #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	<0.02	0.03	<0.02	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	0.04	<0.02	<0.02	0.06	0.04	<0.02	<0.02	<0.02	0.03	0.03	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	<0.05	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	<0.02	<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	<0.03	<0.03	<0.03	<0.03	<0.03	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	0.13	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	480	410	<350	<350	<350	<350	550	<350	500	450	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	260	290	100	50	<20	100	90	80	40	40	500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	78.2	75.3	86.9	85.1	83.8	75.9	83.5	81.5	83.8	86.5	-	-	-	<0.1	%	NONE/PM4
pH #	4.34	6.02	5.88	5.78	5.43	8.10	7.85	7.90	8.56	8.57	-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	<3	<3	<3	<3	<3	<3	<3	3	<3	-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	17	57	37	26	39	70	18	59	12	8	1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	11	23	14	<3	<3	23	11	12	11	19	800	15000	25000	<3	mg/kg	TM38/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty
EMT Job No: 21/9397

Report : EN12457_2

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	31-33	34-36	37-39	40-42	43-45											
Sample ID	ENV TP02	ENV TP03	ENV TP03	ENV ST01	ENV ST01											
Depth	3.00-3.60	0.00-1.00	1.00-2.00	0.00-1.00	1.00-2.00											
COC No / misc																
Containers	V J T	V J T	V J T	V J T	V J T											
Sample Date	17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021											
Sample Type	Soil	Soil	Soil	Soil	Soil											
Batch Number	1	1	1	1	1						Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	21/06/2021	21/06/2021	21/06/2021	21/06/2021	21/06/2021											
Solid Waste Analysis																
Total Organic Carbon #	0.22	1.57	0.22	0.86	0.75						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 6 #	<0.22	<0.22	<0.22	1.34	0.37						-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64	2.38	0.64						100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	0.029	0.047	0.043	0.035	0.031						0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	0.08	0.05	0.06	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 #	0.017	0.038	<0.015	<0.015	0.018						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 #	<0.02	<0.02	0.05	0.04	0.04						0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	0.06	<0.02	<0.02	0.03						0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	0.21	<0.05	<0.05	<0.05	<0.05						0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	0.03	<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 #	0.08	0.16	<0.03	<0.03	0.07						4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	430	530	680	850	930						4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	30	30	30	40						500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	89.2	71.7	79.1	86.5	85.2						-	-	-	<0.1	%	NONE/PM4
pH #	8.60	7.94	8.32	8.36	8.40						-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1						1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	6	7	4	4						-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	15	31	16	<5	9						1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	13	29	24	6	<3						800	15000	25000	<3	mg/kg	TM38/PM0

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Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
21/9397	1	ENV TP07	0.00-1.00	1-3	No interpretation possible
21/9397	1	ENV TP08	0.00-1.00	4-6	No interpretation possible
21/9397	1	ENV TP05	0.00-1.00	7-9	No interpretation possible
21/9397	1	ENV TP05	1.00-2.00	10-12	No interpretation possible
21/9397	1	ENV TP04	0.00-1.00	13-15	No interpretation possible
21/9397	1	ENV TP01	0.00-1.00	16-18	No interpretation possible
21/9397	1	ENV TP01	1.00-7.00	19-21	No interpretation possible
21/9397	1	ENV TP02	0.00-1.00	22-24	No interpretation possible
21/9397	1	ENV TP02	1.00-2.00	25-27	No interpretation possible
21/9397	1	ENV TP02	2.00-3.00	28-30	No interpretation possible
21/9397	1	ENV TP02	3.00-3.60	31-33	No interpretation possible
21/9397	1	ENV TP03	0.00-1.00	34-36	No interpretation possible
21/9397	1	ENV TP03	1.00-2.00	37-39	No interpretation possible
21/9397	1	ENV ST01	0.00-1.00	40-42	No interpretation possible
21/9397	1	ENV ST01	1.00-2.00	43-45	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty

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
21/9397	1	ENV TP07	0.00-1.00	2	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP08	0.00-1.00	5	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP05	0.00-1.00	8	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP05	1.00-2.00	11	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP04	0.00-1.00	14	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP01	0.00-1.00	17	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP01	1.00-7.00	20	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/9397	1	ENV TP01	1.00-7.00	20	23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP02	0.00-1.00	23	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP02	1.00-2.00	26	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP02	2.00-3.00	29	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stone
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP02	3.00-3.60	32	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stones
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP03	0.00-1.00	35	23/06/2021	**General Description (Bulk Analysis)**	Soil/Stones
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV TP03	1.00-2.00	38	23/06/2021	**General Description (Bulk Analysis)**	soil
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV ST01	0.00-1.00	41	23/06/2021	**General Description (Bulk Analysis)**	soil
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD
21/9397	1	ENV ST01	1.00-2.00	44	23/06/2021	**General Description (Bulk Analysis)**	soil
					23/06/2021	**Asbestos Fibres**	NAD
					23/06/2021	**Asbestos ACM**	NAD
					23/06/2021	**Asbestos Type**	NAD
					23/06/2021	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 10477-03-21
Location: Blackglen Road
Contact: Conor Finnerty

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 21/9397						

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.: 21/9397

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 HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an 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
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above 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
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x5 Dilution

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: 21/9397

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	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.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
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

EMT Job No: 21/9397

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	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
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.	Yes		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: 2013l	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: 2013l	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
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.	Yes		AD	Yes

EMT Job No: 21/9397

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
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
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
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
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
TM107	Determination of Sulphide/Thiocyanate by Skalar Continuous Flow Analyser	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes
TM108	Determination of Elemental Sulphur by Reversed Phase High Performance Liquid Chromatography with Ultra Violet spectroscopy.	PM114	End over end extraction of dried and crushed soil samples for organic analysis. The solvent mix varies depending on analysis required			AD	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

EMT Job No: 21/9397

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
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	

APPENDIX 8 – Groundwater Monitoring

www.gii.ie

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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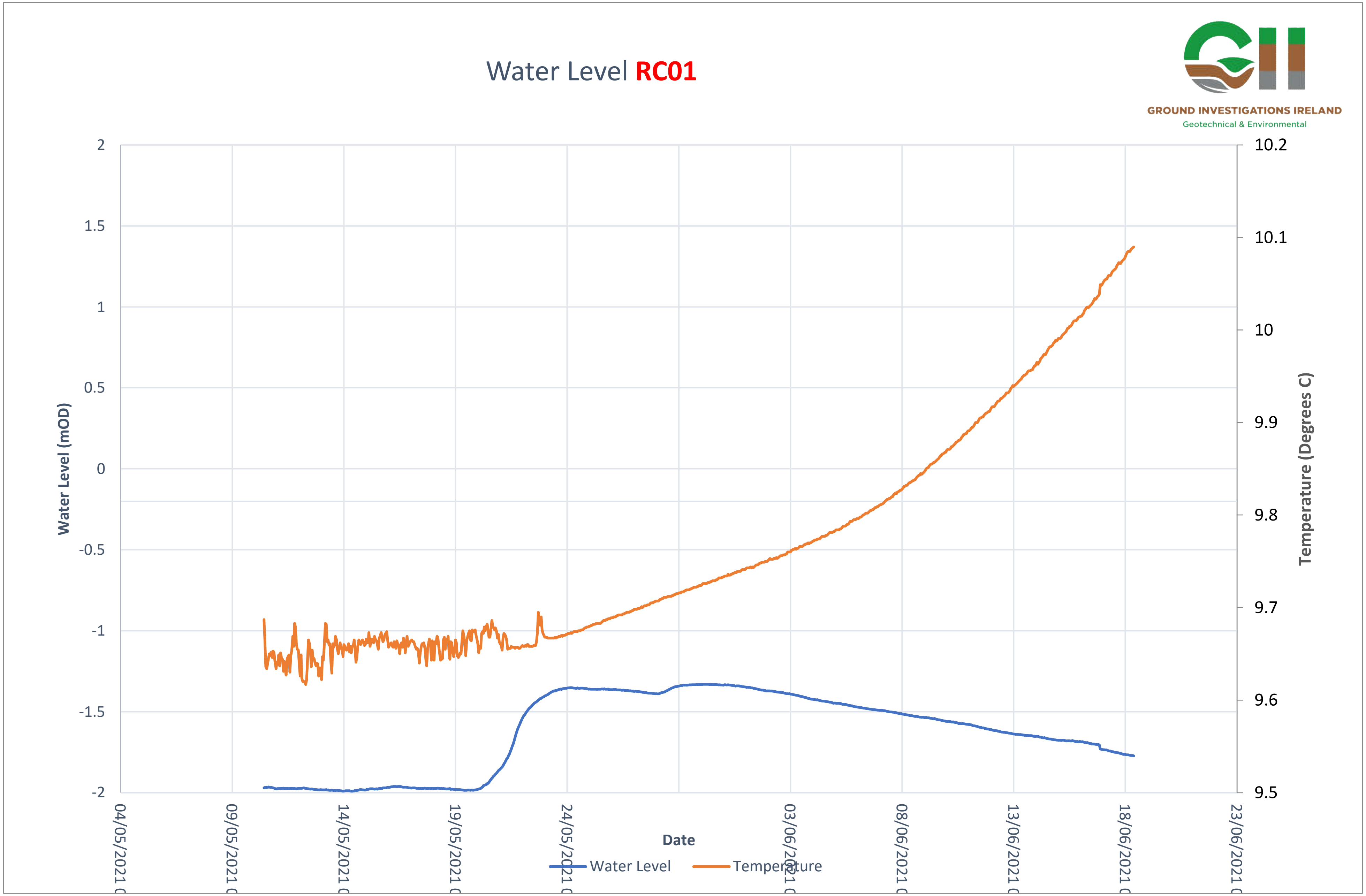
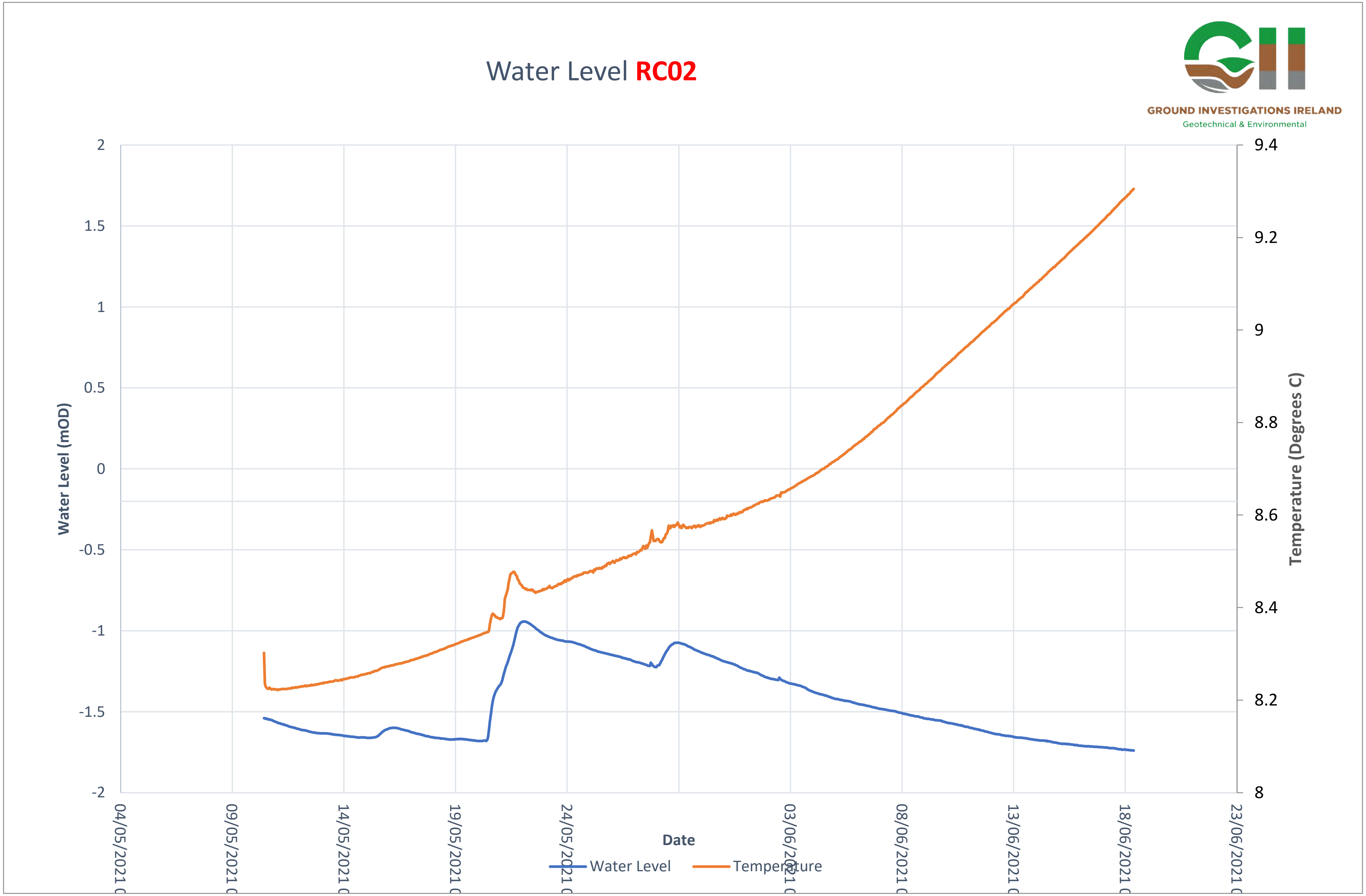
GROUNDWATER MONITORING

Blackglen Road

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
RC01	10/05/2021	9.30	1.97m BGL	Level logger installed
RC02	10/05/2021	9.39	1.54m BGL	Level logger installed
RC03	10/05/2021	9.13	2.43m BGL	Level logger & Baro logger installed
RC04	10/05/2021	9.51	2.96m BGL	Level logger installed


Water Level RC01
GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Water Level (mOD)
Temperature (Degrees C)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
10.2
10.1
10
9.9
9.8
9.7
9.6
9.5
04/05/2021 0
09/05/2021 0
14/05/2021 0
19/05/2021 0
24/05/2021 0
03/06/2021 0
08/06/2021 0
13/06/2021 0
18/06/2021 0
23/06/2021 0
Date
Water Level
Temperature



Water Level RC02
GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Water Level (mOD)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
Temperature (Degrees C)
9.4
9.2
9
8.8
8.6
8.4
8.2
8
04/05/2021
09/05/2021
14/05/2021
19/05/2021
24/05/2021
03/06/2021
08/06/2021
13/06/2021
18/06/2021
23/06/2021
Date
Water Level
Temperature


Water Level RC03
GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Water Level (mOD)
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
Temperature (Degrees C)
9.2
9.1
9
8.9
8.8
8.7
8.6
8.5
8.4
04/05/2021 0
09/05/2021 0
14/05/2021 0
19/05/2021 0
24/05/2021 0
03/06/2021 0
08/06/2021 0
13/06/2021 0
18/06/2021 0
23/06/2021 0
Date
Water Level
Temperature

Blackglen Road

10477-03-21