APPENDIX 3-4

INFRASTRUCTURE DESIGN REPORT

Project

Knocknacarra District Centre, Rahoon, Galway

Report Title

Infrastructure Design Report

Client

Glenveagh Living Limited

INFRASTRUCTURE

DBFL CONSULTING ENGINEERS

Glenveagh Living

OCTOBER 2019

Job Title: **Knocknacarra District Centre, Rahoon, Galway.**

Job Number: **180191**

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1.0 INTRODUCTION

1.1 Background

DBFL have been instructed to prepare an Infrastructure Design Report to accompany a planning application for the proposed mixed use development at Knocknacarra District Centre, Rahoon, Galway.

The proposed development comprises 332 residential units extending to a maximum of 7 floors with 2667 m^2 of commercial space including a 174 m^2 creche at ground floor level, together with associated car and bicycle parking facilities. The site will be dissected into Site 1 and Site 2 by the proposed diversion of the existing access road to the Gateway Retail Park, refer to Figure 1.1 below.

1.2 Location & Topography

The subject site is located to the North of the Western Distributor Road and is bounded to the west by the existing Gateway Retail Park, which is approximately 2.6 Km from Galway City Centre. The site's southern boundary immediately bounds an Aldi supermarket. The primary school Gaelscoil Mhic Amhlaigh is to the north and residential developments are to the east. The site is approximately 2.43 Ha and is currently greenfield, however a construction compound is located in the southern end.

The site is within the Specific Local Objective Area of 'Enterprise, Light Industry and Commercial' in the Galway City Council Development Plan 2017-2023.

Figure 1.1 - *Site Location (Site Boundary Indicative Only).*

The topography of the site is generally flat with a 2m fall from the north western corner to the south eastern corner in the northern half of the site, and a 2m fall from the eastern boundary to the western boundary in the southern half of the site as shown in Figure 1.2.

Figure 1.2 – *Site Topography.*

1.3 Proposals

The proposed development consists of the construction of 332 residential units up to 7 storeys with 2667 m^2 of commercial space including a 174 m^2 creche at ground floor level. The site will be dissected into Site 1 and Site 2 by the proposed diversion of the existing access road to the Gateway Retail Park, refer to Figure 1.2 below. A partially under-podium car parking facility will be constructed in Site 2 at ground floor level supplying 85 car parking spaces. A landscaped courtyard podium and a portion of the first floor will be constructed above the car park.

The proposals include the provision of a total of 291 surface cycle stand spaces located at ground level and 386 enclosed bicycle parking stands located at ground level.

1.4 Existing ground conditions

A site investigation was undertaken by Ground Investigations Ireland in October 2018 to ascertain the existing ground conditions on the subject site. The ground conditions generally consist of made ground to 0.4 - 1.7m deep from ground level over peat which ranged in thickness from 0.1m to 1.8m. Beneath the peat, granular deposits were encountered in some areas which were settled over sand in two locations. Soft cohesive

deposits were encountered at one location (TP05) between 2.8m and 3.8m below ground level. Presumed bedrock was encountered at an elevation of 28.46mOD in the northern section of the site to 25.78mOD in the southern section of the site.

Groundwater was encountered at a fast inflow in TP-01 1.3m BGL and seepages were noted in TP-04 (2.3m), TP-05 (2.3) and TP10 (1m).

A copy of the ground investigation report is provided in Appendix A.

1.5 Flood Risk

A separate Site Specific Flood Risk Assessment has been prepared as part of the application. Refer to DBFL report number 180191-REP-002.

1.6 Site Access and Road Layout

A separate report has been prepared by Atkins Global on Roads, Traffic and Transportation as part of the application.

2.0 EXISTING SERVICES

2.1 General

An existing drainage and watermain network provide service to the developments bounding the subject site. The sections below describe these existing services based on drainage and watermain records obtained from Galway City Council/Irish Water for the subject site.

2.2 Foul Sewer

A 225 mm diameter foul sewer runs to the west of Site 2 and crosses the subject site along the existing retail park access road before it discharges into a 300mm diameter foul sewer. This 300mm diameter foul sewer is located in the “Gort Ná Bró” road to the east of the site and flows towards the Western Distributor Road. In addition, a 225mm diameter foul sewer runs to the west of Site 1 and appears to enter the south-western corner of the site and run beneath the Aldi Supermarket. It is likely that the foul sewer was diverted as part of the Aldi Supermarket construction and it is not as shown on the records. See Figure 4.1 below for extract from Irish Water record map.

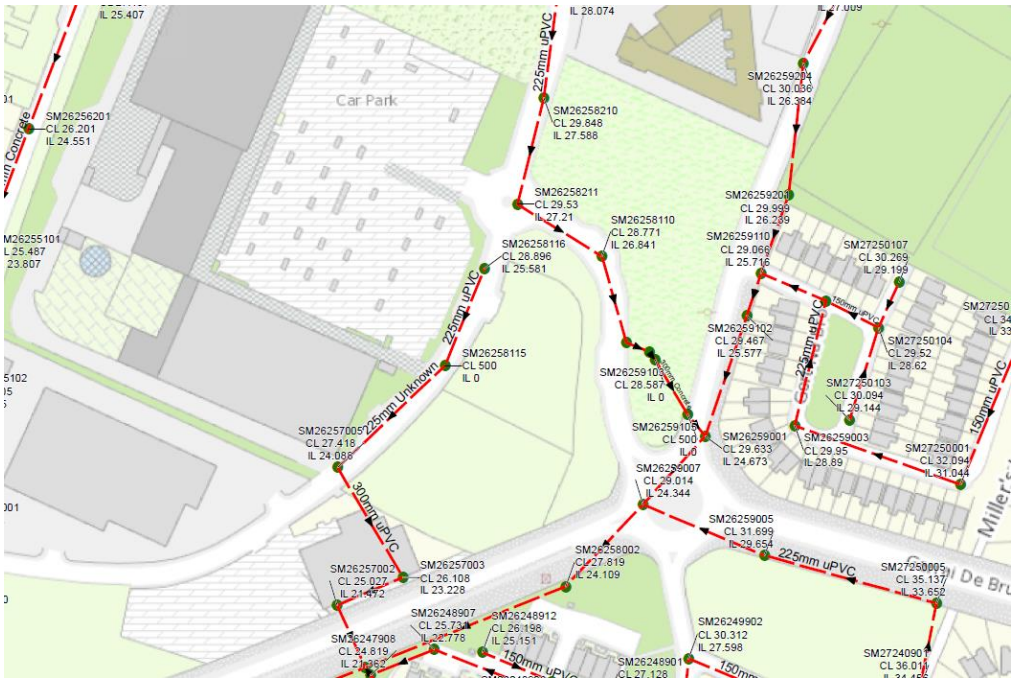

Figure 4.1 – *Extract of Irish Water Foul Sewer Records.*

2.3 Surface Water Drainage

A 375 mm diameter surface water sewer runs to the west of Site 2 and crosses the subject site along the existing retail park access road before it discharges into a 1500 mm diameter surface water sewer. This 1500mm diameter sewer is located in the “Gort Ná Bró” road to the east of the site and flows towards the Western Distributor Road. In addition, a 450mm diameter surface sewer runs to the west of Site 1 and appears to enter the south-western corner of the site running beneath the Aldi Supermarket. Similar to the foul sewer, it is likely that the surface water sewer was diverted as part of the Aldi Supermarket construction and is not as shown on the records. See Figure 4.2 below for extract from Irish Water record map.

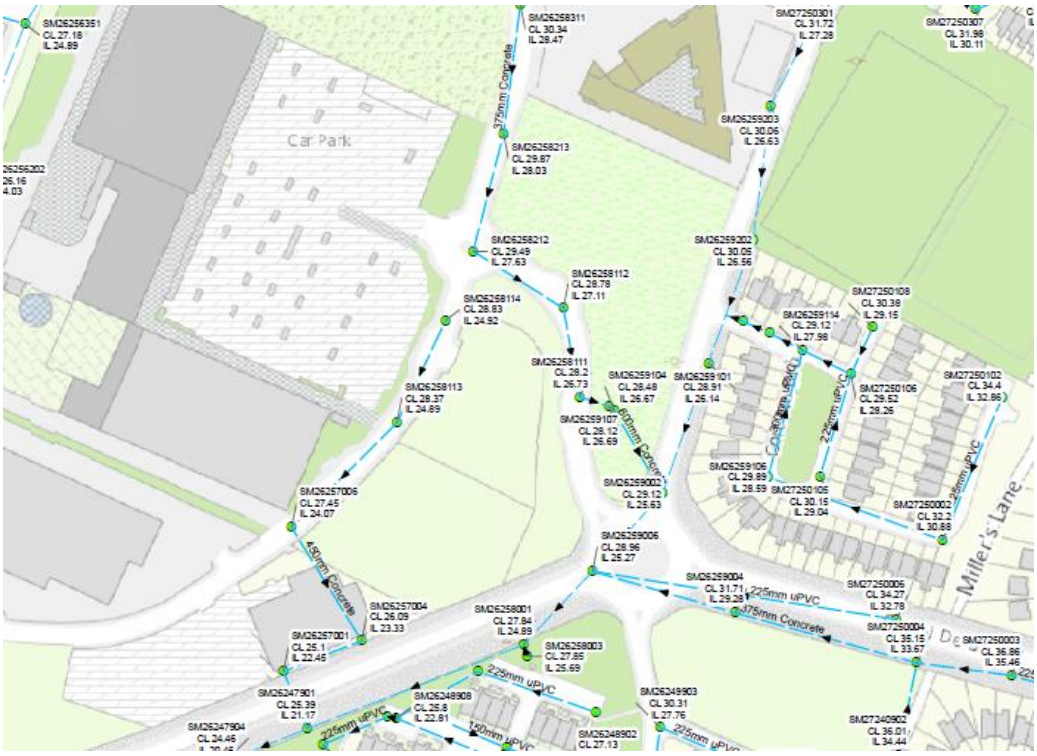

Figure 4.2 – *Extract of Irish Water Surface Sewer Records.*

2.4 Water Supply

There are 150 mm diameter watermains located on both the east and the west of the site. A 150 mm diameter watermain runs to the west of Site 2 and connects with the 150mm diameter watermain in the Western Distributor Road by extending through the existing access road to the Gateway Retail Park. The watermain to the east of the subject site serves the adjacent residential developments. A watermain of unknown diameter runs along the west of Site 1 and provides service to the Gateway Retail Park. See Figure 4.2 below for extract from Irish Water record map.

Figure 4.3 – *Extract of Irish Water main Records.*

3.0 PROPOSED SURFACE WATER DRAINAGE

3.1 Surface Water Policy

The management of surface water for the proposed development has been designed to comply with the policies and guidelines outlined in the Greater Dublin Strategic Drainage Study (GDSDS) and with the requirements of Galway City Council. The guidelines require the following 4 main criteria to be provided by the design;

- Criterion 1: River Water Quality Protection – satisfied by providing interception storage and treatment within the green podium in Site 2, and the porous asphalt within the civic plaza in Site 1.
- Criterion 2: River Regime Protection – satisfied by attenuating to greenfield run-off rates.
- Criterion 3: Level of Service (flooding) for the site – satisfied by the development's surface water drainage design, planned flood routing, run-off contained within site, flood storage and building set greater than 0.5m above 100-year flood level.
- Criterion 4: River flood protection – attenuation volume and discharge limit designed to greenfield run-off rates (long term storage not provided).

3.2 Surface Water Strategy

To meet the requirements of the surface water policy above the surface water strategy has been described in this section to give a clearer indication of how the design development has progressed to the submitted design.

It is proposed to divert the existing surface water sewers within the site to align the drainage layout with the proposed diversion of the existing access road to the Gateway Retail Park as represented on drawing 180191-3000. Both Site 1 and Site 2 of the proposed development will be provided with a surface water drainage network to collect surface water flows from the apartment blocks and commercial units. The Site 2 storm drainage will be constructed in the ground floor car park and attenuated outflows will connect with the existing 375mm diameter sewer to the north-west of the site. The Site 1 storm drainage will discharge attenuated outflows to the existing 450mm diameter sewer to the south-west of the site.

The surface water strategy incorporates attenuation of storm water to limit discharge from the site, although storage facilities and SUDs elements will be designed to allow infiltration or reduction of run-off volumes and rates where possible.

A graphical form of the catchment areas can be found on DBFL drawing 180191-3001.

Run-off from roofs and any additional run-off from the landscaped courtyard podium slab is designed to be conveyed to the surface water drainage network at ground floor level. Two underground surface water attenuation tanks will be provided for the development to attenuate surface water flows for the 100 year critical storm + 10% allowance for climate change in accordance with GDSDS. A concrete attenuation tank will be located beneath the ground floor car park in Site 2, a concrete tank is proposed due to the presence of structural columns in the vicinity of the tank. A Stormtech attenuation system will be located beneath the civic plaza in Site 1.

The podium (landscaped courtyard) consists mainly of green areas, soft landscaped areas and raised planters providing interception storage and treatment. The hard-standing area of the podium, which forms a north-south pedestrian link will consist of paving. A number of gullies at podium slab level will drain any residual runoff from the landscaped courtyard to the surface water network at ground level.

DBFL Consulting Engineers met with Galway City Council Drainage Department on the 30th of November 2018 to discuss the drainage strategy. The drainage strategy was agreed in principle.

The drainage network and attenuation in Site 1 have been sized to include the future district centre use site to the south.

3.3 SUDs

In accordance with the GDSDS it is proposed to provide sustainable urban drainage systems (SUDS) for managing storm-water from the facility. The aim of the SUDS strategy for the site will be to;

- Attenuate storm-water runoff.
- Reduce storm-water runoff.
- Reduce pollution impact.
- Replicate the natural characteristics of rainfall runoff for the site.

An assessment of the potential SUDS that could be incorporated within the site was conducted using the SUDS Manual, CIRIA 753. The SUDS elements which were found applicable to the proposed scheme design and layout include the following;

1. Porous asphalt paving on part of civic plaza within Site 1 to provide treatment, storage and reduce run-off rates.

3. Green podium with landscaped areas and raised planters to reduce run-off rates and total impermeable area.
4. Two attenuation storage systems for the attenuation of storm water up to the 100 year storm event + 10% allowance for climate change.
5. A Class 1 Bypass Separators to be provided on the outfall from each network.

The incorporation of the above SUDS elements will provide a sustainable manner in which to disperse surface water from the site and provide treatment of run-off and subsequent improvement of discharge quality.

3.4 Attenuation

Surface water run-off from the overall development will be attenuated to greenfield runoff rates (QBAR). This is calculated as 13.00 l/s using the Institute of Hydrology equation as recommended in the Greater Strategic Drainage Study (GDSDS) based on an area of 1.93 Ha which includes the future district centre use site to the south and excludes the road realignment.

Both Site 1 and Site 2 catchments will have independent attenuation systems and will be attenuated to 9.56 l/s and 3.44 l/s respectively as per QBAR calculations included in Appendix B.

The drainage design uses SOIL type 3 to calculate the site's QBAR greenfield run-off rate. To derive the soil type, table 4.5 of the Flood Studies Report was used as recommended by the GDSDS. The following is a summary of the site characteristics used in the selection of the pre-development soil value.

Drainage Group	2 - Commonly waterlogged within 60cm
Depth to impermeable layer	2 – 80-40cm
Permeability group (above 'impermeable' layers or to 80cm)	3 - Slow
Slope	1 – 0 -2°

Table 5.1 – *Summary of Site Characteristics*

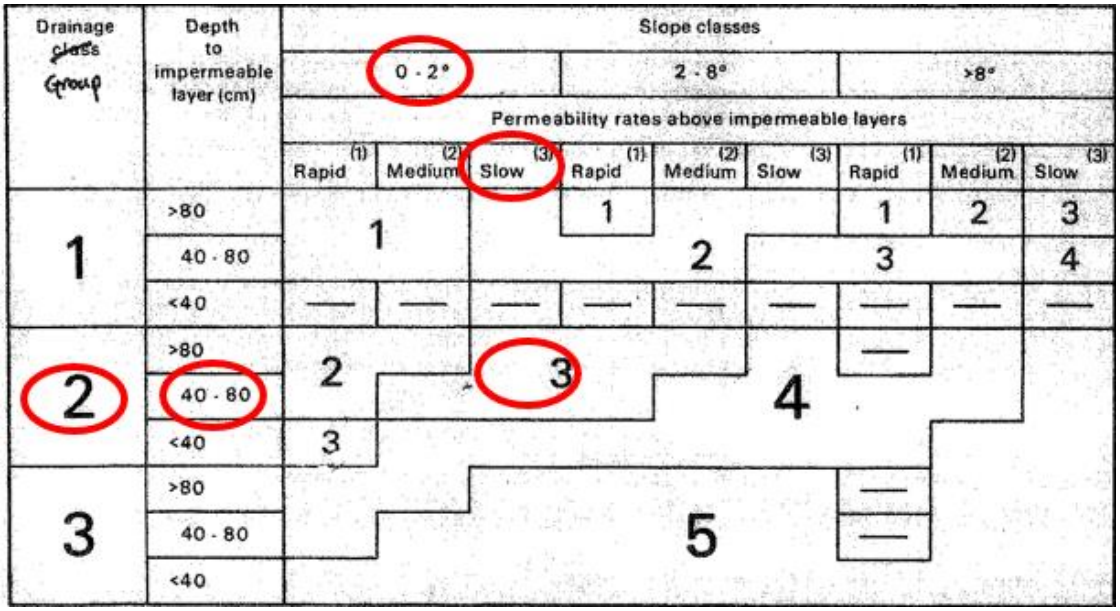

Figure 5.1 – *Extract of Table 4.5 for classification of SOIL type for the development*

Calculations can be found in Appendix B. Run-off from the new development and pavement is attenuated to a maximum discharge rate of QBAR in accordance with the requirements of the GDSDS, using a hydro-brake as a flow control device.

The impermeable areas contributing to the attenuation volume have had the following reduction factors applied:

- Flat impermeable roof and impermeable paved areas, a 5% reduction of the surface area is applied to take account of run-off not collected and stored within the micro and macro texture of the surfacing. Various sources recommend different reduction coefficients e.g. IS EN752 recommends Runoff Coefficient (C for the Rational Method) of 0.9 to 1.0 for impermeable areas and steeply sloping roofs. For flat roofs it recommends 0.5 to 1.0 depending on area).

- Landscaped podium, consists mainly of green areas, soft landscaped areas and raised planters. Planters will have an intensive build-up to facilitate planting and soft landscaping for larger shrubs and small trees. Green soft landscaped podium areas will have typical soil depths of up to 300mm to facilitate grassed areas, plants, shrubs and trees i.e. similar to a deep intensive green roof build up (refer to SUDS Manual & German FLL Guidelines for Green Roofs). The podium will also include some paved areas, and for this reason a reduction factor of 25% has been applied for runoff calculations.

- Porous asphalt in the civic plaza will be laid over an un-compacted granular material that will reduce the flow rate from these areas and allow infiltration to the existing sub-grade. Rainfall will percolate through the porous asphalt and the stone bed beneath which will provide attenuation of surface water and allow infiltration to the sub-grade. Surface water will only overflow to the main surface water sewer in intense storms. A reduction of 50% has been applied for these reasons which takes into account the depth of stone and infiltration to the sub-grade.

A concrete tank storage system and a Stormtech attenuation system will be installed in Site 2 and Site 1 respectively to provide the required attenuation for the 100-year storm event. A concrete attenuation tank is proposed for Site 2 due to the presence of structural columns in the vicinity of the tank. Calculations indicate that approximately 172m^3 and 361m^3 of storage volume for the 100 year event (+10% climate change) is required for Site 1 and Site 2 respectively.

Surface water attenuation calculations can be found in Appendix C.

3.5 Interception

To prevent pollutants or sediments discharging into water courses the GDSDS requires "interception storage" to be incorporated into the development. This interception storage is designed to receive the run-off for rainfall depths of 5mm up to 10mm if possible. The SUDS features including porous asphalt and landscaped podium will provide the necessary interception volume required by the GDSDS.

3.6 Design Standards

Storm-water drainage has been designed in accordance with the Greater Dublin Code of Practice for Drainage Works. The following design parameters are applicable to the design:

- All impermeable access roads, hard-standing, parking and footpaths assumed to be 95% impermeable if draining to gullies.
- For the landscaped podium a reduction factor of 25% has been applied due to the interception and evapotranspiration properties of the green areas.
- Porous asphalt reduction of 50% has been applied for the decrease of flow rate and infiltration to the existing sub-grade that will occur due to the permeable build-up beneath the asphalt.

- Time of entry: 4 minutes
- Pipe Friction (Ks): 0.6 mm
- Minimum Velocity: 1.0 m/s
- Standard Average Annual Rainfall: 1247mm
- M5-60: 16.00mm
- Ratio r (M5-60/M5-2D): 0.261
- Attenuation Tank Storm Return Event GDSDS Volume 2, p61, Criterion 3

  30 year no flooding on site.

  100 year check no internal property flooding. Flood routing plan. FFL freeboard above 100-year flood level. No flooding to adjacent areas.
- Climate Change 10% for rainfall intensities, as GDSDS

Surface water sewers have been designed in accordance with IS EN 752 and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).

The minimum pipe diameter for surface water sewers is 150mm.

Surface water sewer calculations are provided in Appendix D.

3.7 Climate Change

Surface water calculations for the development made use of rainfall values for the Galway area as provided by Met Eireann. Rainfall intensities were increased by a factor of 10% to take account of climate change, as required by the GDSDS for attenuation storage design.

3.8 Flooding Provision

The surface water network, attenuation storage and site levels are designed to accommodate a 100-year storm event and includes climate change provision, refer to Microdrainage calculations in Appendix C. For storms greater than the design storm of 100-year design event + climate change provision has been discussed in the Site Specific Flood Risk Assessment, DBFL Report 180191-Rep-002.

3.9 Surface Water Quality Impact

The type of development is low risk i.e. it does not present a high risk of run-off contamination. The development's design and layout further reduce the risk of contaminants entering the surface water network as part of the parking area will be

covered with a green podium. Soft and hard landscaped areas within the podium will drain via the soil and stone build up to a concrete attenuation tank.

The use of porous asphalt within the civic plaza enhances the infiltration of the surface water runoff to a draining subgrade material that will act as a filter enhancing water quality before infiltrating slowly to the existing subgrade. A Class 1 Bypass Separator is proposed on the outfall from each surface water network to remove silts and treat hydrocarbons.

All undercover car park incidental drainage is discharged separately via a Class 2 separator to the foul sewer. In this way it is considered that the development provides treatment of collected run-off, provides a SUDS treatment train approach and is low risk of pollutants.

The proposed surface water system has therefore been designed to incorporate SuDS techniques which naturally reduce pollutants and improve water quality.

4.0 PROPOSED FOUL DRAINAGE

4.1 Proposed Foul Layout

The proposed foul drainage layout for the development will be similar to the surface water drainage. It is proposed to divert the existing foul water sewers within the site to align the drainage layout with the proposed diversion of the existing access road to the Gateway Retail Park as shown on drawing 180191-3000. Both Site 1 and Site 2 of the proposed development will be provided with a foul drainage network to collect foul flows from the apartment blocks and commercial units. The Site 2 foul drainage will be constructed in the ground floor car park and will connect with the existing 225mm diameter sewer to the north-west of the site. The Site 1 foul drainage will discharge to the existing 225mm sewer to the south-west of the site. Foul sewer calculations are provided in Appendix E.

Car parking incidental drainage at ground floor level beneath the podium slab level, will gravitate to the lowest point before passing through an interceptor, where this will discharge to the foul network as required by GDSDS.

The proposed foul sewer design and layout is in accordance with the Irish Water Code of Practice for Wastewater Infrastructure and The Irish Water Infrastructure Standard Details. DBFL have received a Statement of Design Acceptance from Irish Water which is included in Appendix F.

An Irish Water Feedback form has been received outlining that a water connection can be facilitated for the proposed development. The feedback letter is provided in Appendix G.

DBFL have consulted with Irish Water's Diversions Department to agree the diversion agreement for the existing foul sewer.

4.2 Design Calculations

All new main foul sewers are designed to discharge by gravity. Minimum gradients and pipe diameters for collector and main sewers are designed in accordance with the Building Regulations and Irish Water's Code of Practice for wastewater infrastructure and Standard Details for wastewater infrastructure. The sewer network is designed in accordance with the principles and methods set out in IS EN 752 (2008), IS EN12056: Part 2. Design criteria are as follows:

Pipe Roughness Coefficient	1.5 mm
Minimum Velocity	0.75 m/s (self-cleansing)
Maximum Velocity	2.50 m/s

Estimated peak foul loading generated by the proposed development is provided in Table 6.1:

PREDICTED DEVELOPMENT FOUL FLOWS						
Use Type	**No. of Units / Area**	**Occupancy Rate**	**Population (P)**	**Loading (G) (l/day/person) ***	**Daily Loading (PG) (l/day)**	**Daily Loading (l/s))**
Residential	332 units	2.7 people/ dwelling	897	150	134,550	1.56
Commercial	2,667m^2	1 person / 18m^2	148	50	7,400	0.09
					Residential Loading (l/s)	**1.65**
					Growth Factor	1
					Infiltration @ 10% (as Cop App C 1.2.4)	0.165
					Dry Weather Flow l/s	**1.815**
					Residential Peaking factor (as CoP App C 1.2.5)	6
					Residential Design Foul Flow (l/s)	**10.89**
***Flow rates calculated using IW CoP for Wastewater Infrastructure**						

Table 6.1: Estimated Foul Loading

4.3 Wastewater Connection Timelines and Phasing

It is anticipated that a wastewater connection will be required for Phase 01 (Block E & F) in Q1 2021 and a connection will be required for Phase 02 (Block A, B, C & D) in Q2 2021.

5.0 WATER SUPPLY AND DISTRIBUTION

5.1 Proposed Water main and Supply

As part of the proposed development it is proposed to divert the existing watermains within the site, and utilise the existing 150mm diameter watermain to the north-west of the site to supply the development. The proposed watermain layout will connect to the existing 150mm watermain located in the 'Gort Ná Bró' road to the east of the site. The residential blocks will be supplied from two centralised water plantrooms located in blocks A and F, while the commercial units will have individual connections. Hydrants will be located on the proposed network, refer to DBFL drawing 180191-3005.

The proposed watermain design and layout is in accordance with the Irish Water Code of Practice for Water Infrastructure and the Irish Water Infrastructure Standard Details. DBFL have received a Statement of Design Acceptance from Irish Water which is included in Appendix F.

An Irish Water Feedback form has been received outlining that a water connection can be facilitated for the proposed development. The feedback letter is provided in Appendix G.

DBFL have consulted with Irish Water's Diversions Department to agree the diversion agreement for the existing watermain.

5.2 Water main Standards and Details

The internal water main layout for the development has been designed in accordance with building regulations and where possible in accordance with Irish Water's Code of Practice and Standard Details for water infrastructure. Public watermains have been designed in accordance with Irish Water's Code of Practice and Standard Details for water infrastructure.

5.3 Hydrants

Hydrants shall comply with the requirements of BS 750:2012 and shall be installed in accordance with Irish Water's Code of Practice and Standard Details.

5.4 Design Calculations

The water demand is designed in accordance with the principles and methods set out in Irish Water's Code of Practice for Water Infrastructure Connections and Developer Services Design & Construction Requirements for Self-Lay Developments December 2017, section 3.7.2, as outlined below:

Per-capita consumption domestic	150l/person/day
Per-capita consumption commercial	50l/person/day

Average day/week demand factor 1.25

Peak demand factor 5.0

Estimated water demand for the proposed development is provided in Table 7.1:

WATER DEMAND							
Use Type	**No. of units / Area**	**Occupancy Rate**	**Population (P)**	**Average daily domestic demand (l/day)**	**Average daily domestic demand (l/s)**	**Average day/peak week demand (l/s)**	**Peak hour water demand (l/s)**
Residential	332 units	2.7 per dwelling	897	134,460	1.56	1.95	9.75
Commercial	2,667m^2	1 person / 18m^2	148	7,400	0.09	0.113	0.563
						Peak hour water demand (l/s)	**10.32**

Table 7.1 Estimated water demand

5.5 Water Connection Timelines and Phasing

It is anticipated that a water connection will be required for Phase 01 (Block E & F) in Q1 2021 and a connection will be required for Phase 02 (Block A, B, C & D) in Q2 2021.

Appendix A

GII SITE INVESTIGATION REPORT

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Ground Investigations Ireland

Gateway, Phase 3

Ground Investigation Report

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CONTENTS

APPENDICES

1.0 Preamble

On the instructions of DBFL Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., in October 2017 at the site of the proposed shopping centre extension in Knocknacarra, Galway.

2.0 Overview

2.1. Background

It is proposed to construct a new commercial retails space adjacent to the exiting Gateway Shopping Centre. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

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:

- Carry out 14 No. Trial Pits to a maximum depth of 3.8m BGL
- Carry out 2 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Geotechnical 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 a 13T 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.

3.3. 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.

3.4. 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.

3.5. 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. The results of the environmental sampling are discussed in a separate Environmental Report for the site.
Geotechnical testing consisting of moisture content, Atterberg limits and Particle Size Distribution (PSD), hydrometer were carried out in NMTL's Geotechnical Laboratory in Carlow. These data were not available eat the time of writing this report.
Soluble sulphate and pH analysis were carried out by Jones Environmental Laboratory on the UK,
The results of the laboratory testing are included in Appendix 4 of this Report.

4.0 Ground Conditions

4.1. General

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

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

- Made Ground
- Peat
- Soft Cohesive Deposits
- Granular Deposits (Possible Weathered Bedrock)
- Presumed Bedrock

MADE GROUND: Made Ground deposits were encountered from ground level and was present to a minimum of 0.4m to a maximum depth of 1.7m BGL. These deposits were described as either Dark brown or grey slightly sandy slightly gravelly slightly clayey Peat with occasional cobbles and boulders of granite and rare plastic and wood fragments. The source of the made ground or the time period in which it was imported is not known.

PEAT: The fill material was underlain by PEAT which ranged in thickness from 0.1m to 1.8m. The peat is described as being *very soft dark brown slightly sandy slightly gravelly clayey PEAT* in some instances the peat has *frequent angular to sub-angular cobbles of granite and occasional boulders and lenses of grey sandy sub-angular to sub-rounded fine to coarse gravel*.

GRANULAR DEPOSITS: Where present beneath the peat the granular deposits encountered interbedded are described as *Grey very sandy sub-angular to sub-rounded fine to coarse GRAVEL and COBBLES of granite with rare granite boulders.* The material may be very heavily weathered bedrock. Sand was encountered at two locations beneath the granular materials.

SOFT COHESIVE DEPOSITS: Soft cohesive deposits described as *soft to firm grey slightly sandy silty CLAY* were encountered at one location (TP05) between 2.8m and 3.8m BGL.

PRESUMED ROCK: Presumed bedrock was encountered at an elevation of 28.46mOD in the northern section of the site to 25.78mOD in the southern section of the site.

4.2. Groundwater

Groundwater was encountered in a number of trial pits. A fast inflow of water was noted in IT-01 at 1.3m BGL. Seepages were noted in TP-04 (2.3), TP-05 (2.3m) and TP-10 (1m).

4.3. 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.
The results from the completed laboratory testing is included in Appendix 4 of this report.

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 100 kN/m^2 is recommended for conventional strip or pad foundations on the granular deposits encountered below the peat/soft cohesive deposits typically present at a depth of 0.7m to 2.2m BGL where encountered. This presumed weathered rock stratum should be capable of providing a higher allowable bearing capacity subject to verification of the underlying intact bedrock by rotary coring or the density of the granular deposits confirmed with dynamic probing. At the locations of TP5, TP6, TP9 and TP10 this presumed weathered bedrock stratum was not encountered and the depth to competent foundation stratum should be proven with further investigation. The presence of soft cohesive deposits at 2.8m to 3.8m BGL in TP05 should be further investigated due to the elevation of this stratum compared to the depth of the possible weathered rock deposits in adjacent trial pits.

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

The possibility for variation in the depth of the granular deposits 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.

The pH and sulphate testing completed on samples recovered from the trial pits indicates that the average pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. The lowest pH recorded was 4.58 and the highest 8.33. The low levels of pH within the groundwater should be further investigated in terms of the impact on concrete foundations.

5.3. 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.

Any excavations which penetrate the granular 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. Generally, where significant excavations are required

in water bearing granular deposits a cut-off wall may be more cost effective than extensive dewatering. An assessment by a specialist dewatering contractor is recommended to determine the most cost effective approach to the proposed excavation.

Excavations in the upper cohesive and granular/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. The 13T excavator was generally able to excavate to elevations of 28.46m (highest) to 25.7m OD (lowest) in TP1 and TP11 respectively below which excavation became difficult within the confines of the trial pit on encountering the more competent stratum below this level.

Any material to be removed off site should be disposed of to a suitably licenced landfill.

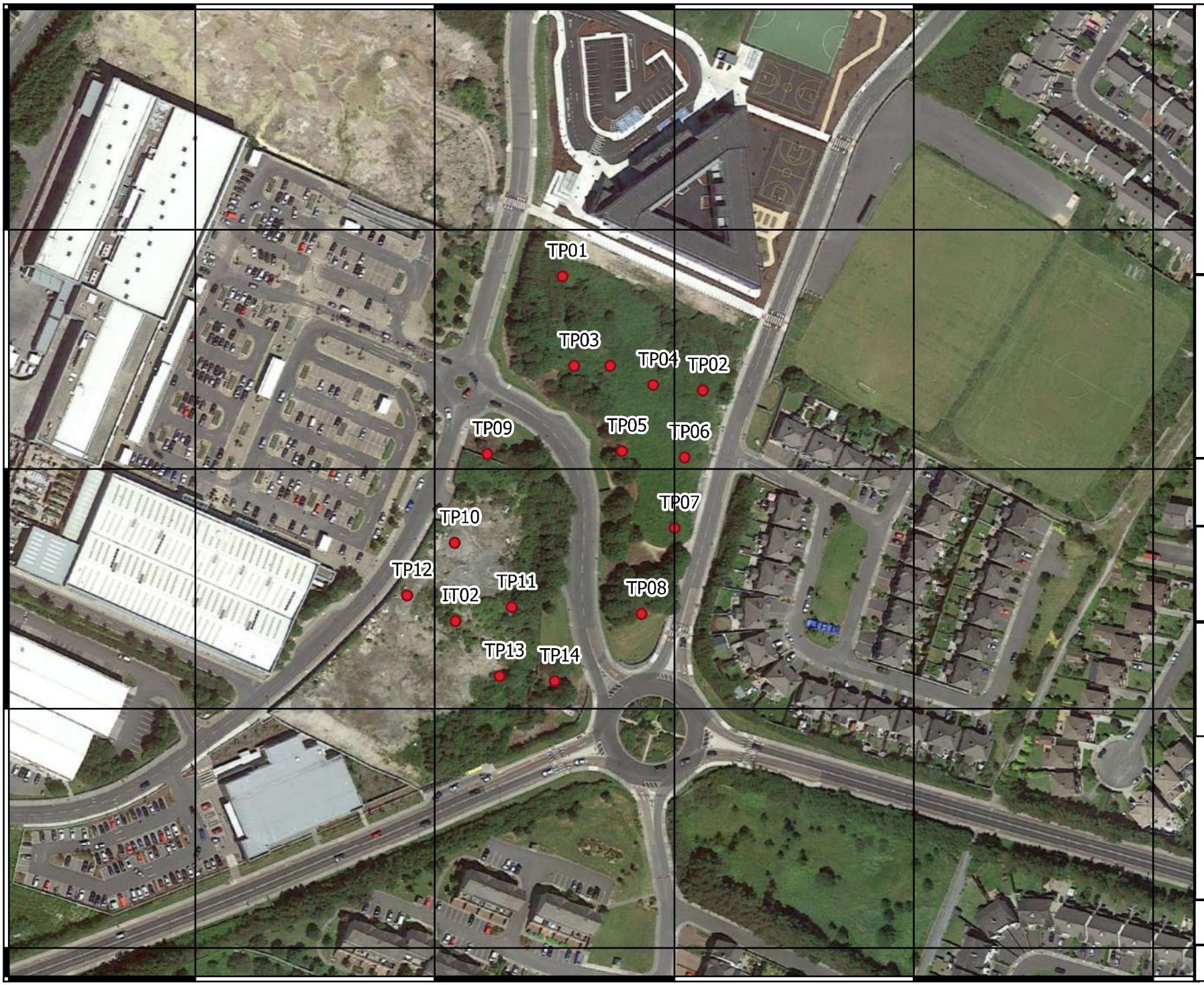
The environmental testing completed during the ground investigation is reported under the cover of a separate report GII Environmental Report.

5.4. Soakaway Design

An infiltration rate of f=5.05 x 10^{-5} m/s was calculated for the soakaway location IT-02. At the location of IT-01 shallow groundwater was encountered therefore not allow the calculation of 'f' the soil infiltration rate. The location of IT-01 is therefore not recommended as suitable for soakaway design and construction.

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



Trial Pit Locations

Client:

Project Code:
8165-10-18

Project Title:
Gateway Phase 3

Drawing Title:
Appendix 1 - Site Investigation Locations

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

0 15 30 45 60 75 90 m

Drawn By:	Date:
BS	20/11/2018

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd
www.gii.ie

Site Gateway Phase 3			**Trial Pit Number** IT01
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions** 1.70m X 1.10m X 1.30m	**Ground Level (mOD)** 28.51	**Client**	**Job Number** 8165-10-18
	Location 526873.2 E 725243.1 N	**Dates** 23/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	MADE GROUND: Dark brown slightly sandy slightly gravelly slightly clayey Peat with occasional boulders of granite and rare plastic fragments.		
				28.11	0.40	Soft grey slightly sandy slightly gravelly silty CLAY with peat lenses.		
					(0.90)			
				27.21	1.30	Trial pit terminated on encountering groundwater.		
						Complete at 1.30m		

Plan

Remarks

Groundwater encountered at 1.30m BGL - Fast Ingress
Trial pit stable
Infiltration test carried out in trial pit.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.IT01

Ground Investigations Ireland Ltd
www.gii.ie

Site Gateway Phase 3			**Trial Pit Number** IT02
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions** 2.30m X 1.20m X 2.00m	**Ground Level (mOD)** 28.94	**Client**	**Job Number** 8165-10-18
	Location 526808.6 E 725136.6 N	**Dates** 23/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15)	MADE GROUND: Grey sandy angular to sub-angular fine to coarse Gravel.(Crushed Rock fill)		
				28.79	0.15			
						MADE GROUND: Brown/grey sandy gravelly peaty clayey COBBLES of granite with occasional sub-angular boulder and fragments of plastic and wood.		
					(1.35)			
				27.44	1.50			
					(0.10)	Dark brown slightly sandy gravelly PEAT with occasional sub-angular cobbles of granite.		
				27.34	1.60			
					(0.40)	Light grey very sandy sub-angular to sub-rounded fine to coarse GRAVEL and COBBLES of granite with occasional sub-angular boulders.(Possible Weathered Rock)		
				26.94	2.00	Trial pit terminated at scheduled depth.		
						Complete at 2.10m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling.
Infiltration test carried out in trial pit.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.IT02

Ground Investigations Ireland Ltd
www.gii.ie

Site Gateway Phase 3			**Trial Pit Number** TP01
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 30.76	**Client**	**Job Number** 8165-10-18
	Location 526853.3 E 725280.5 N	**Dates** 24/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			T,J,V		(1.50)	MADE GROUND: Dark brown sandy gravelly clayey Peat with rare sub-angular cobbles and boulders of granite.		
1.20	B							
			T,J,V	29.26	1.50			
					(0.10)	Very soft dark brown slightly sandy slightly gravelly slightly clayey PEAT.		
				29.16	1.60			
					(0.70)	Light brownish grey very sandy sub-angular fine to coarse GRAVEL and COBBLES of granite.(Possible Weathered Rock)		
				28.46	2.30	Probable granite bedrock.		
						Complete at 2.30m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP01

Ground Investigations Ireland Ltd
www.gii.ie

Site	Trial Pit Number
Gateway Phase 3	TP02

Machine : 13T Excavator Method : Trial Pit	Dimensions	Ground Level (mOD) 29.36	Client	Job Number 8165-10-18
	Location 526911.9 E 725232.9 N	Dates 24/10/2018	Project Contractor Ground Investigations Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				29.16	(0.20) 0.20	Grey very sandy slightly peaty slightly clayey sub-angular to sub-rounded fine to coarse Gravel with rare fragments of metal and plastic.		
					(0.30)	MADE GROUND: Dark brown sandy gravelly slightly clayey Peat with rare fragments of plastic.		
			T,J,V	28.86	0.50 (0.20)	Very soft dark brown slightly sandy slightly gravelly slightly clayey PEAT.		
0.70	B			28.66	0.70	Light brownish grey very sandy slightly peaty slightly clayey sub-angular to sub-rounded fine to coarse GRAVEL and COBBLES of granite.(Possible Weathered Rock)		
			T,J,V		(1.50)			
				27.16	2.20	Probable granite bedrock.		
						Complete at 2.20m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP02

Ground Investigations Ireland Ltd
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Site Gateway Phase 3			**Trial Pit Number** TP03
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 29.28	**Client**	**Job Number** 8165-10-18
	Location 526858.1 E 725243.1 N	**Dates** 24/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	MADE GROUND: Dark brown sandy gravelly slightly clayey Peat with rare fragments of plastic.		
				28.88	0.40			
			T,J,V		(0.25)	Very soft dark brown slightly sandy slightly gravelly slightly clayey PEAT.		
0.70	B			28.63	0.65	Light brown grey very sandy angular to sub-rounded fine to coarse GRAVEL and COBBLES of granite.(Possible Weathered Rock)		
			T,J,V		(1.75)			
				26.88	2.40	Probable granite bedrock.		
						Complete at 2.40m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP03

Ground Investigations Ireland Ltd
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Site	Trial Pit Number
Gateway Phase 3	TP04

Machine : 13T Excavator Method : Trial Pit	Dimensions	Ground Level (mOD)	Client	Job Number
		28.50		8165-10-18
	Location	**Dates**	**Project Contractor**	**Sheet**
	526891.2 E 725235.1 N	24/10/2018	Ground Investigations Ireland	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.80)	Very soft dark brown slightly sandy slightly gravelly PEAT with frequent angular to sub-angular cobbles and rare boulders of granite.		
0.70	B		T,J,V	27.70	0.80			
					(1.40)	Grey very sandy clayey sub-angular to sub-rounded fine to coarse GRAVEL with occasional sub-angular cobbles.		
			T,J,V					
				26.30	2.20			
			Water strike(1) at 2.30m.		(0.20)	Light brown slightly sandy slightly clayey sub-angular to sub-rounded fine to coarse GRAVEL with occasional angular to sub-angular cobbles of granite.(Possible Weathered Rock)		▽1
				26.10	2.40	Probable granite bedrock.		
						Complete at 2.40m		

Plan

Remarks

Groundwater encountered at 2.30m BGL - Slow Ingress.
Trial pit sidewalls spalling.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP04

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Site	Trial Pit Number
Gateway Phase 3	TP05

Machine : 13T Excavator Method : Trial Pit	Dimensions	Ground Level (mOD)	Client	Job Number
		29.77		8165-10-18
	Location 526878.1 E 725207.5 N	Dates 24/10/2018	Project Contractor Ground Investigations Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	MADE GROUND: Brown slightly sandy slightly gravelly Clay with rare fragments of plastic.		
				29.57	0.20			
					(0.60)	MADE GROUND: Dark brown slightly sandy gravelly slightly clayey Peat with occasional sub-angular cobbles and boulders of granite.		
			T,J,V					
0.70	B			28.97	0.80	Very soft dark brown slightly sandy slightly gravelly PEAT.		
					(1.00)			
			T,J,V					
				27.97	1.80	Grey very sandy sub-angular to sub-rounded fine to coarse GRAVEL and COBBLES of granite with rare boulders.		
					(0.80)			
				27.17	2.60	Grey slightly gravelly slightly silty clayey medium to coarse SAND.		
					(0.20)			
				26.97	2.80	Soft to firm grey slightly sandy silty CLAY.		
					(1.00)			
				25.97	3.80	Probable granite bedrock.		
						Complete at 3.80m		

Plan

Remarks

Groundwater encountered at 3.75m BGL - Slow Ingress.
Trial pit sidewalls spalling.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP05

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Site Gateway Phase 3			**Trial Pit Number** TP06
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 29.05	**Client**	**Job Number** 8165-10-18
	Location 526904.3 E 725204.9 N	**Dates** 24/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TARMACADAM Slab (not laid in situ)		
				28.85	0.20	MADE GROUND: Dark brown sandy gravelly peaty Clay.		
			T,J,V		(0.50)			
0.70	B			28.35	0.70	Very soft dark brown slightly sandy slightly gravelly PEAT.		
					(0.65)			
				27.70	1.35	Light grey very sandy slightly clayey sub-angular to sub-rounded fine to coarse GRAVEL and COBBLES of granite.		
					(0.65)			
			T,J,V	27.05	2.00	Light grey slightly clayey slightly silty fine to medium SAND with rare sub-angular cobbles of granite.		
					(0.70)			
				26.35	2.70	Probable granite bedrock.		
						Complete at 2.70m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP06

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Site Gateway Phase 3			**Trial Pit Number** TP07
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 29.36	**Client**	**Job Number** 8165-10-18
	Location 526900.1 E 725175.4 N	**Dates** 24/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Dark brown slightly sandy slightly gravelly peaty TOPSOIL.		
				29.06	0.30	MADE GROUND: Greyish brown sandy gravelly Clay with occasional sub-angular cobbles and rare fragments of plastic.		
			T,J,V					
0.70	B				(1.30)			
			T,J,V					
				27.76	1.60	Dark brown sandy peaty gravelly COBBLES of granite.		
					(0.40)			
				27.36	2.00	Grey sandy silty clayey GRAVEL with occasional sub-angular cobbles of granite.(Possible Weathered Rock)		
					(0.70)			
				26.66	2.70	Probable granite bedrock.		
						Complete at 2.70m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP07

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Site	Trial Pit Number
Gateway Phase 3	TP08

Machine : 13T Excavator Method : Trial Pit	Dimensions	Ground Level (mOD)	Client	Job Number
		30.21		8165-10-18
	Location	**Dates**	**Project Contractor**	**Sheet**
	526886.3 E 725139.6 N	23/10/2018	Ground Investigations Ireland	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				30.11	(0.10) 0.10	Brown slightly sandy slightly gravelly TOPSOIL with roots.		
						MADE GROUND: Dark brown slightly sandy slightly gravelly clayey Peat with occasional sub-angular cobbles and boulders of granite and pieces of re-bar.		
			T,J,V					
					(1.60)			
1.20	B							
			T,J,V					
				28.51	1.70	Grey very sandy angular to sub-rounded fine to coarse GRAVEL and COBBLES or granite.(Possible Weathered Rock) Probable granite bedrock.		
				28.41	(0.10) 1.80			
						Complete at 2.10m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls collapsed below 0.80m
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP09

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Site	Trial Pit Number
Gateway Phase 3	TP09

Machine : 13T Excavator Method : Trial Pit	Dimensions	Ground Level (mOD)	Client	Job Number
		30.64		8165-10-18
	Location	**Dates**	**Project Contractor**	**Sheet**
	526821.9 E 725206.3 N	23/10/2018	Ground Investigations Ireland	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				30.54	(0.10) 0.10	MADE GROUND: Brown slightly sandy slightly gravelly Clay with tree roots and and occasional sub-rounded cobbles of granite.		
					(0.65)	MADE GROUND: Dark brown slightly sandy slightly gravel slightly clayey PEAT with occasional angular to sub-rounded cobbles and fragments of brick.		
			T,J,V	29.89	0.75	Very soft dark brown slightly sandy slightly gravelly clayey PEAT with frequent angular to sub-angular cobbles of granite and occasional boulders and lenses of grey sandy sub-angular to sub-rounded fine to coarse gravel.		
					(1.35)			
			T,J,V	28.54	2.10	Trial pit terminated due to side wall collapse.		
						Complete at 2.10m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls collapsed below 0.80m
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP09

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Site Gateway Phase 3			**Trial Pit Number** TP10
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 28.91	**Client**	**Job Number** 8165-10-18
	Location 526808.3 E 725169.2 N	**Dates** 23/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				28.81	(0.10) 0.10	MADE GROUND: Dark grey angular fine to coarse Gravel(Crushed Rock fill).		
				28.76	0.15	TARMACADAM		
			T,J,V		(0.65)	MADE GROUND: Grey sandy sandy gravelly Clay with fragments of concrete and occasional angular to sub-angular cobbles of granite.		
				28.11	0.80	Very soft dark brown slightly sandy slightly gravelly slightly clayey PEAT with occasional boulders of granite.		
			T,J,V		(1.40)			
				26.71	2.20	Probable granite bedrock.		
						Complete at 2.20m		

Plan

Remarks

Grounwater encountered at 1.0m BGL - Slight Seepage.
Trial pit sidewalls spalling
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP10

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Site	Trial Pit Number
Gateway Phase 3	TP11

Machine : 13T Excavator Method : Trial Pit	Dimensions	Ground Level (mOD)	Client	Job Number
		29.13		8165-10-18
	Location	**Dates**	**Project Contractor**	**Sheet**
	526832 E 725142.3 N	23/10/2018	Ground Investigations Ireland	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				29.03	(0.10) 0.10	MADE GROUND: Dark grey angular fine to coarse Gravel(Crushed Rock fill).		
			T,J,V		(1.05)	MADE GROUND: Light brownish grey very sandy slightly clayey sub-angular to sub-rounded fine to coarse Gravel with occasional angular cobbles of granite.		
				27.98	1.15	Soft dark brown sandy gravelly PEAT with occasional sub-angular cobbles and rare boulders of granite.		
				27.78	(0.20) 1.35	Light brownish grey very sandy slightly clayey sub-angular to sub-rounded fine to coarse GRAVEL and COBBLES of granite with occasional boulders.(Possible Weathered Rock)		
			T,J,V		(2.00)			
				25.78	3.35	Probable granite bedrock.		
						Complete at 3.35m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP11

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Site Gateway Phase 3			**Trial Pit Number** TP12
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 28.52	**Client**	**Job Number** 8165-10-18
	Location 526788.4 E 725147.3 N	**Dates** 23/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				28.42	(0.10) 0.10	MADE GROUND: Dark grey angular fine to coarse Gravel(Crushed Rock fill).		
			T,J,V			MADE GROUND: Brown very sandy angular fine to coarse Gravel with frequent angular cobbles and boulders.		
					(1.40)			
			T,J,V	27.02	1.50 (0.10)	Very soft dark brown sandy gravelly PEAT with frequent angular cobbles and occasional boulders of granite.		
				26.92	1.60 (0.20)	Light brown very gravelly slightly clayey medium to coarse SAND with frequent angular to sub-angular cobbles of granite.		
				26.72	1.80	Light brownish grey very sandy angular to sub-angular fine to coarse GRAVEL and COBBLES of granite with occasional boulders.(Possible Weathered Rock)		
					(0.90)			
				25.82	2.70	Probable granite bedrock.		
						Complete at 2.70m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP12

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Site Gateway Phase 3			**Trial Pit Number** TP13
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 29.08	**Client**	**Job Number** 8165-10-18
	Location 526827 E 725113.5 N	**Dates** 23/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				28.98	(0.10) 0.10	MADE GROUND: Dark grey angular fine to coarse Gravel(Crushed Rock fill).		
			T,J,V		(0.60)	MADE GROUND: Brown very gravelly medium to coarse SAND with frequent angular to sub-angular cobbles and rare boulders of granite with rare fragments of plastic.		
				28.38	0.70	Dark brown very sandy gravelly slightly clayey PEAT with frequent angular cobbles and rare boulders of granite.		
				28.08	(0.30) 1.00	Light brown slightly clayey gravelly medium to coarse SAND with frequent angular cobbles of granite.		
				27.88	(0.20) 1.20	Light brownish grey very sandy angular GRAVEL and COBBLES of granite.(Possible Weathered Rock)		
			T,J,V		(1.70)			
				26.18	2.90	Probable granite bedrock.		
						Complete at 2.90m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP13

Ground Investigations Ireland Ltd
www.gii.ie

Site Gateway Phase 3			**Trial Pit Number** TP14
Machine : 13T Excavator **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 29.64	**Client**	**Job Number** 8165-10-18
	Location 526850.1 E 725111.5 N	**Dates** 23/10/2018	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				29.54	(0.10) 0.10	MADE GROUND: Brown slightly sandy slightly gravelly Clay with tree roots and and occasional sub-rounded cobbles of granite.		
				29.39	(0.15) 0.25	Brown slightly sandy slightly gravelly TOPSOIL with occasional sub-angular cobbles of granite.		
			T,J,V			MADE GROUND: Dark brown slightly sandy gravelly slightly clayey Peat with occasional sub-rounded cobbles and boulders of granite and fragments of wood and plastic.		
					(1.45)			
			T,J,V					
				27.94	1.70	Light grey very sandy sub-angular to sub-rounded fine to coarse GRAVEL and COBBLES of granite with occasional sub-angular boulders.(Possible Weathered Rock)		
					(0.50)			
				27.44	2.20	Probable granite bedrock.		
						Complete at 2.20m		

Plan

Remarks

No Groundwater encountered.
Trial pit sidewalls spalling.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	Tmcl	8165-10-18.TP09

APPENDIX 3 – Infiltration Test Results

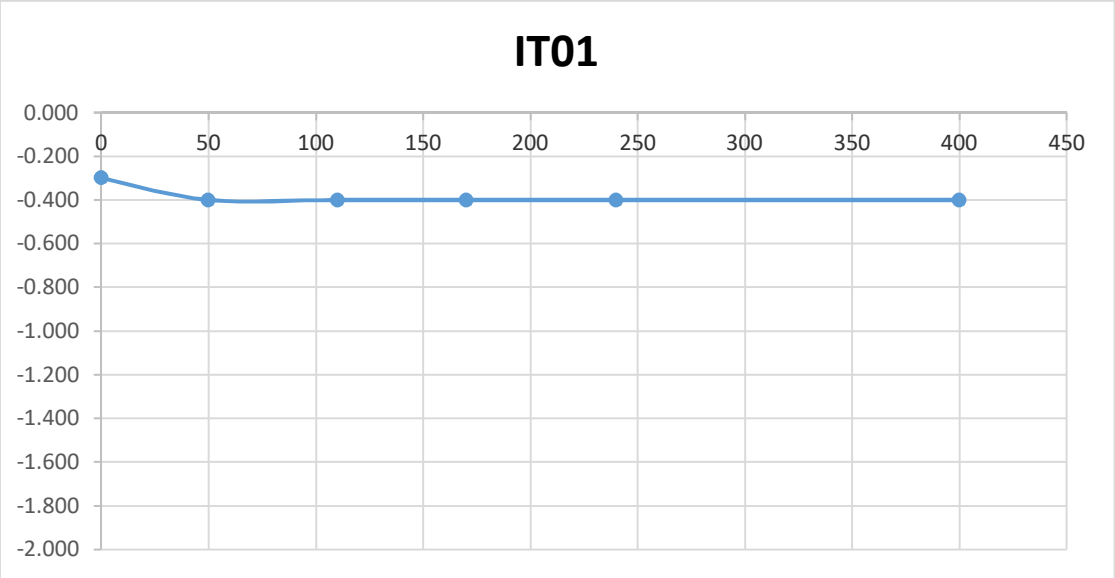
IT01

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.7m x 1.10m x 1.300m (L x W x D)

Date	Time	Water level (m bgl)
24/10/2018	0	-0.300
24/10/2018	50	-0.400
24/10/2018	110	-0.400
24/10/2018	170	-0.400
24/10/2018	240	-0.400
24/10/2018	400	-0.400

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.30	1.300	1.000	0.55	1.05



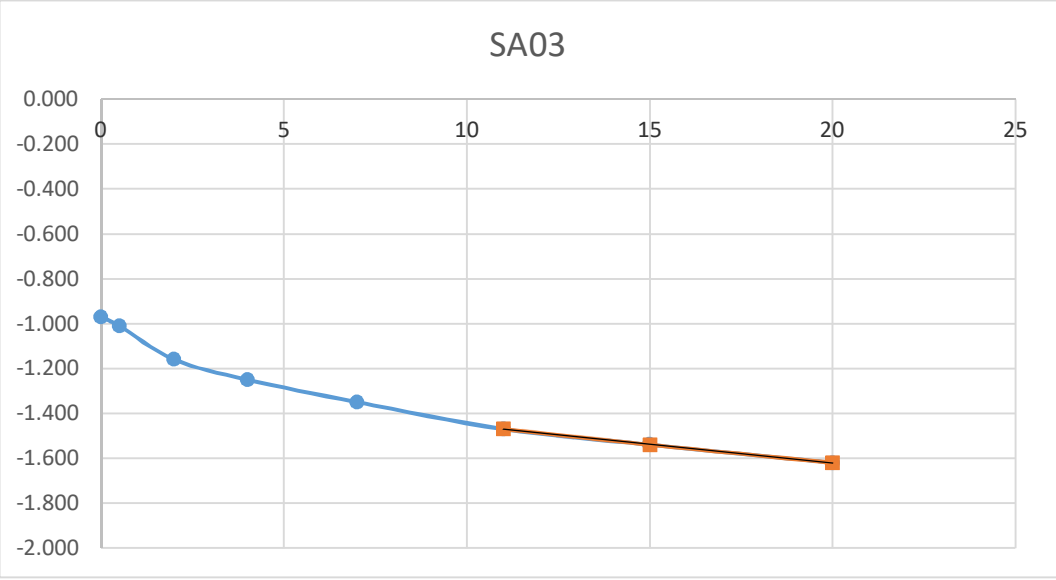
IT02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.30m x 1.20m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
24/10/2018	0	-0.970
24/10/2018	0.5	-1.010
24/10/2018	2	-1.160
24/10/2018	4	-1.250
24/10/2018	7	-1.350
24/10/2018	11	-1.470
24/10/2018	15	-1.540
24/10/2018	20	-1.620

Start depth	Depth of Pit		Diff	75% full	25%full
0.97	**2.000**		**1.030**	**1.2275**	**1.7425**

Length of pit (m)	Width of pit (m)		75-25Ht (m)	Vp75-25 (m3)
2.300	1.200		0.515	1.42
Tp75-25 (from graph) (s)		**1861**	50% Eff Depth	ap50 (m2)
			0.515	6.365
f =	**1.200E-04**	**m/s**		



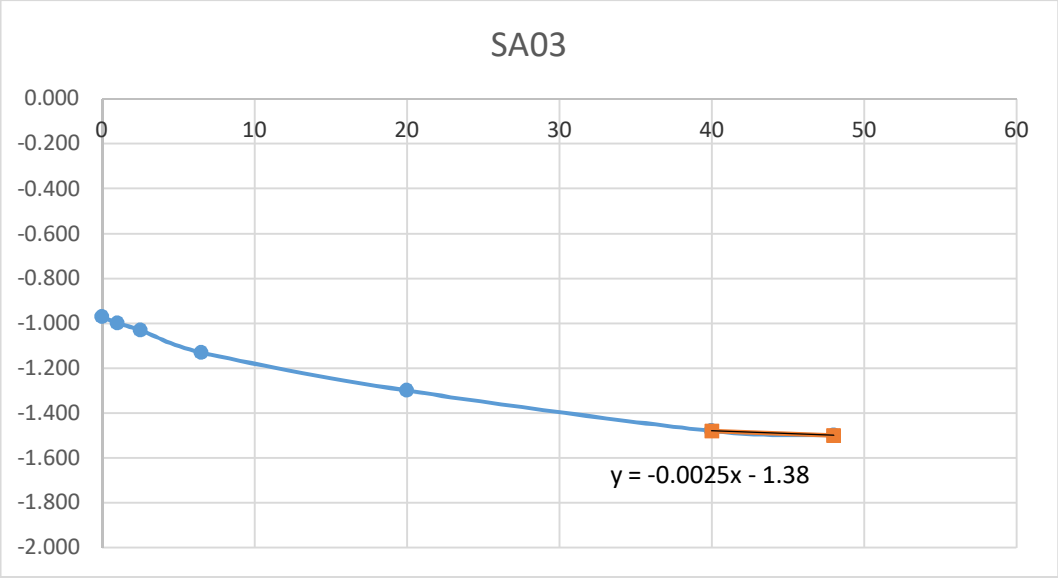
IT02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.30m x 1.20m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
24/10/2018	0	-0.970
24/10/2018	1	-1.000
24/10/2018	2.5	-1.030
24/10/2018	6.5	-1.130
24/10/2018	20	-1.300
24/10/2018	40	-1.480
24/10/2018	48	-1.500

Start depth	Depth of Pit		Diff	75% full	25%full
0.97	**2.000**		**1.030**	**1.2275**	**1.7425**

Length of pit (m)	Width of pit (m)		75-25Ht (m)	Vp75-25 (m3)
2.300	1.200		0.515	1.42
Tp75-25 (from graph) (s)		**12360**	50% Eff Depth	ap50 (m2)
			0.515	6.365
f =	**1.807E-05**	**m/s**		

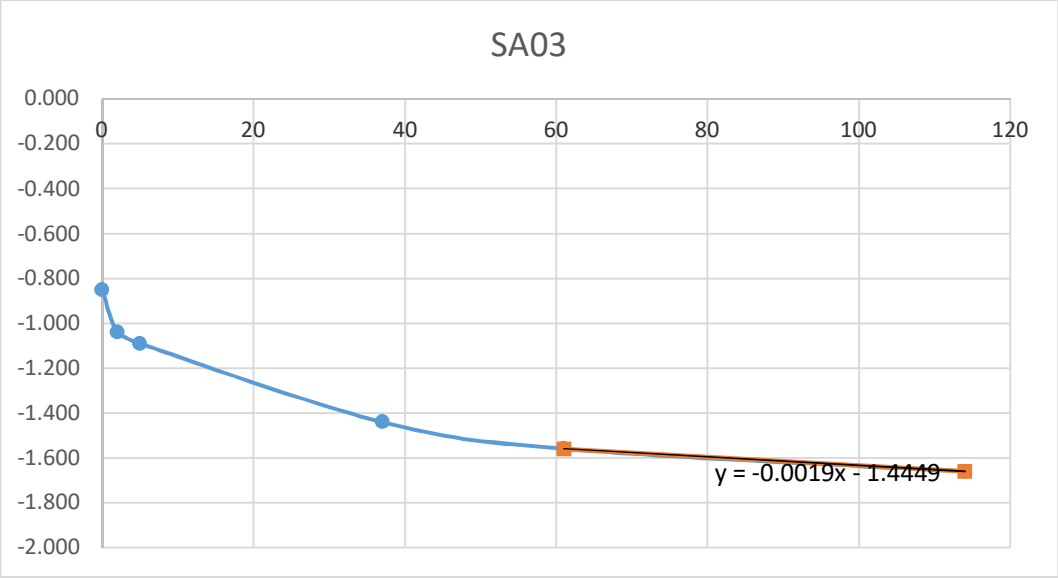


IT02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.30m x 1.20m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
24/10/2018	0	-0.850
24/10/2018	2	-1.040
24/10/2018	5	-1.090
24/10/2018	37	-1.440
24/10/2018	61	-1.560
24/10/2018	114	-1.660

Start depth	Depth of Pit		Diff	75% full	25%full
0.97	**2.000**		**1.030**	**1.2275**	**1.7425**
Length of pit (m)	Width of pit (m)			75-25Ht (m)	Vp75-25 (m3)
2.300	1.200			0.515	1.42
Tp75-25 (from graph) (s)		**16263**		50% Eff Depth	ap50 (m2)
				0.515	6.365
f =	**1.373E-05**	**m/s**			



APPENDIX 4 – Laboratory Results

Exova Jones Environmental

Registered Office: Exova Environmental UK Limited, 10 Lower Grosvenor Place, London, SW1W 0EN. Reg No. 11371415

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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
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Co. Dublin
Ireland

Attention :	Barry Sexton
Date :	13th November, 2018
Your reference :	8165-10-18
Our reference :	Test Report 18/17300 Batch 1
Location :	Gateway
Date samples received :	26th October, 2018
Status :	Final report
Issue :	1

Twenty eight samples were received for analysis on 26th October, 2018 of which twenty eight 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.

Where Waste Acceptance Criteria Suite (EC Decision of 19 December 2002 (2003/33/EC)) has been requested, all analyses have been performed using the relevant EN methods where they exist.

Compiled By:

Bruce Leslie
Project Co-ordinator

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : Solid

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

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	LOD/LOR	Units	Method No.
Sample ID	TP01	TP01	TP02	TP02	TP03	TP03	TP04	TP04	TP05	TP05			
Depth	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50			
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018			
Antimony	1	1	1	<1	<1	<1	<1	1	<1	<1	<1	mg/kg	TM30/PM15
Arsenic #	3.2	3.7	3.8	2.3	4.4	2.7	24.1	2.1	3.6	10.4	<0.5	mg/kg	TM30/PM15
Barium #	28	28	24	39	40	46	38	21	65	43	<1	mg/kg	TM30/PM15
Cadmium #	0.1	0.1	0.2	<0.1	0.3	<0.1	0.5	<0.1	0.8	0.7	<0.1	mg/kg	TM30/PM15
Chromium #	71.3	62.8	75.4	45.5	53.2	84.4	72.0	80.9	45.6	23.0	<0.5	mg/kg	TM30/PM15
Copper #	42	133	52	28	61	20	164	28	213	223	<1	mg/kg	TM30/PM15
Lead #	32	27	22	45	46	12	74	17	20	37	<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 #	4.4	4.7	1.7	2.6	7.8	6.3	15.3	4.8	7.0	10.3	<0.1	mg/kg	TM30/PM15
Nickel #	7.3	4.1	7.1	4.8	5.3	5.8	8.1	5.6	7.8	5.2	<0.7	mg/kg	TM30/PM15
Selenium #	2	5	1	<1	4	1	5	<1	4	8	<1	mg/kg	TM30/PM15
Zinc #	29	10	24	28	26	32	27	32	39	23	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.08 AA	<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	<0.06 AA	<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 #	<0.10 AA	<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 #	<0.08 AA	<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 #	<0.06 AA	<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 #	<0.08 AA	<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 #	<0.06 AA	<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 #	<0.06 AA	<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 #	<0.12 AA	<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 #	<0.04 AA	<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 #	<0.14 AA	<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 #	<0.08 AA	<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 #	<0.08 AA	<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 #	<0.08 AA	<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 #	<0.08 AA	<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	<0.08 AA	<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 #	<0.44 AA	<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	<1.28 AA	<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	<0.10 AA	<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	<0.04 AA	<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	<2 AA	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	102 AA	108	106	104	119	103	108	102	117	105	<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : Solid

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

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	LOD/LOR	Units	Method No.
Sample ID	TP01	TP01	TP02	TP02	TP03	TP03	TP04	TP04	TP05	TP05			
Depth	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50			
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018			
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C10-C12 #	<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 #	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	<7	<7	<7	22	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<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 #	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7	<7	<7	<7	29	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	25	157	<7	<7	329	34	242	<7	118	310	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	29	<7	<7	61	15	51	<7	<7	44	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	186	<26	<26	390	49	322	<26	118	354	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	186	<52	<52	390	<52	322	<52	118	354	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	<10	58	<10	<10	40	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	51	146	<10	<10	308	49	196	<10	103	267	<10	mg/kg	TM5/PM8/PM16
MTBE #	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5	ug/kg	TM31/PM12
Benzene #	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5	ug/kg	TM31/PM12
Toluene #	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5	ug/kg	TM31/PM12
Ethylbenzene #	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5	ug/kg	TM31/PM12
m/p-Xylene #	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5	ug/kg	TM31/PM12
o-Xylene #	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5 SV	<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5	<5	<5	<50 AB	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<50 AB	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<50 AB	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<50 AB	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<50 AB	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<50 AB	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<50 AB	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<350 AB	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : Solid

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

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	LOD/LOR	Units	Method No.
Sample ID	TP01	TP01	TP02	TP02	TP03	TP03	TP04	TP04	TP05	TP05			
Depth	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50			
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018			
Natural Moisture Content	23.9	120.9	33.8	11.2	134.8	23.0	141.9	10.9	87.9	265.2	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	19.3	54.7	25.3	10.0	57.4	18.7	58.7	9.8	46.8	72.6	<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
Sulphate as SO4 (2:1 Ext) #	-	0.0215	-	-	-	-	-	-	-	0.0642	<0.0015	g/l	TM38/PM20
Chromium III	71.3	62.8	75.4	45.5	53.2	84.4	72.0	80.9	45.6	23.0	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	3.60	10.03	4.19	0.62	21.04	3.59	16.28	0.17	17.83	29.57	<0.02	%	TM21/PM24
pH #	7.44	4.96	7.58	7.15	5.11	4.58	5.72	7.94	7.39	6.06	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1132	0.171	0.1358	0.1005	0.1959	0.1144	0.1582	0.1022	0.1894	0.2135		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

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : Solid

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

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48	49-51	52-54	55,57,59	56,58,60	LOD/LOR	Units	Method No.
Sample ID	TP06	TP06	TP07	TP07	TP08	TP08	TP09	TP09	TP10	TP10			
Depth	0.50	2.00	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50			
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018			
Antimony	<1	<1	<1	1	<1	<1	1	1	1	2	<1	mg/kg	TM30/PM15
Arsenic #	8.0	2.2	4.1	4.2	2.2	4.3	3.0	2.6	2.5	3.4	<0.5	mg/kg	TM30/PM15
Barium #	29	20	35	35	29	31	35	34	26	35	<1	mg/kg	TM30/PM15
Cadmium #	0.6	0.5	0.3	0.4	0.2	0.3	<0.1	<0.1	<0.1	0.3	<0.1	mg/kg	TM30/PM15
Chromium #	49.1	57.6	29.9	75.1	103.5	77.6	74.2	94.5	78.2	65.7	<0.5	mg/kg	TM30/PM15
Copper #	45	38	19	32	14	18	47	42	17	78	<1	mg/kg	TM30/PM15
Lead #	17	24	37	32	15	24	28	20	29	14	<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 #	4.9	3.1	2.8	5.4	6.8	6.0	6.0	6.8	2.4	3.3	<0.1	mg/kg	TM30/PM15
Nickel #	4.8	5.8	8.6	7.2	5.0	7.8	5.7	6.1	5.9	5.7	<0.7	mg/kg	TM30/PM15
Selenium #	2	<1	<1	<1	1	1	2	1	1	4	<1	mg/kg	TM30/PM15
Zinc #	33	37	52	43	14	25	32	36	21	14	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.40 AB	<0.04	<0.04	<0.04	<0.04	<0.04	<0.40 AB	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.30 AB	<0.03	<0.03	<0.03	<0.03	<0.03	<0.30 AB	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.50 AB	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50 AB	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.40 AB	<0.04	<0.04	<0.04	<0.04	<0.04	<0.40 AB	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.30 AB	<0.03	<0.03	<0.03	<0.03	<0.03	<0.30 AB	<0.03	0.20	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.40 AB	<0.04	<0.04	<0.04	<0.04	<0.04	<0.40 AB	<0.04	0.05	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.30 AB	<0.03	<0.03	<0.03	<0.03	<0.03	<0.30 AB	<0.03	0.25	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.30 AB	<0.03	<0.03	<0.03	<0.03	<0.03	<0.30 AB	<0.03	0.20	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.60 AB	<0.06	<0.06	<0.06	<0.06	<0.06	<0.60 AB	<0.06	0.11	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.20 AB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.20 AB	<0.02	0.13	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.70 AB	<0.07	<0.07	<0.07	<0.07	<0.07	<0.70 AB	<0.07	0.15	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.40 AB	<0.04	<0.04	<0.04	<0.04	<0.04	<0.40 AB	<0.04	0.08	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.40 AB	<0.04	<0.04	<0.04	<0.04	<0.04	<0.40 AB	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.40 AB	<0.04	<0.04	<0.04	<0.04	<0.04	<0.40 AB	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.40 AB	<0.04	<0.04	<0.04	<0.04	<0.04	<0.40 AB	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.40 AB	<0.04	<0.04	<0.04	<0.04	<0.04	<0.40 AB	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<2.20 AB	<0.22	<0.22	<0.22	<0.22	<0.22	<2.20 AB	<0.22	0.48	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<6.40 AB	<0.64	<0.64	<0.64	<0.64	<0.64	<6.40 AB	<0.64	1.17	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.50 AB	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50 AB	<0.05	0.11	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.20 AB	<0.02	<0.02	<0.02	<0.02	<0.02	<0.20 AB	<0.02	0.04	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<10 AB	<1	<1	<1	<1	<1	<10 AB	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	97 AB	102	99	100	96	97	94 AB	97	93	110	<0	%	TM4/PM8
Mineral Oil (C10-C40)	331	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : Solid

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

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48	49-51	52-54	55,57,59	56,58,60	LOD/LOR	Units	Method No.
Sample ID	TP06	TP06	TP07	TP07	TP08	TP08	TP09	TP09	TP10	TP10			
Depth	0.50	2.00	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50			
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018			
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1 SV	<0.1	<0.1	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1 SV	<0.1	<0.1	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1 SV	<0.1	<0.1	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C10-C12 #	<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 #	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	233	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C40	98	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	331	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10	<0.1 SV	<0.1	<0.1	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C10-C25	15	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35	212	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 #	<0.1 SV	<0.1	<0.1	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1 SV	<0.1	<0.1	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1 SV	<0.1	<0.1	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<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 #	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	567	<7	<7	<7	<7	<7	93	50	77	181	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	252	<7	<7	<7	<7	<7	18	<7	18	35	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	819	<26	<26	<26	<26	<26	111	50	95	216	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	1150	<52	<52	<52	<52	<52	111	<52	95	216	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 #	<0.1 SV	<0.1	<0.1	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC10-EC25	34	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	529	<10	<10	<10	<10	<10	95	50	80	174	<10	mg/kg	TM5/PM8/PM16
MTBE #	<5 SV	<5	<5	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5	ug/kg	TM31/PM12
Benzene #	<5 SV	<5	<5	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5	ug/kg	TM31/PM12
Toluene #	<5 SV	<5	<5	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	163 SV	<5	ug/kg	TM31/PM12
Ethylbenzene #	<5 SV	<5	<5	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5	ug/kg	TM31/PM12
m/p-Xylene #	<5 SV	<5	<5	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5	ug/kg	TM31/PM12
o-Xylene #	<5 SV	<5	<5	<5 SV	<5	<5 SV	<5 SV	<5 SV	<5	<5 SV	<5	ug/kg	TM31/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

Please see attached notes for all abbreviations and acronyms

Exova Jones Environmental

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : Solid

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

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48	49-51	52-54	55,57,59	56,58,60	LOD/LOR	Units	Method No.
Sample ID	TP06	TP06	TP07	TP07	TP08	TP08	TP09	TP09	TP10	TP10			
Depth	0.50	2.00	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50			
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018			
Natural Moisture Content	48.1	15.4	14.7	25.8	22.4	32.0	47.9	39.1	13.7	117.5	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	32.5	13.4	12.8	20.5	18.3	24.2	32.4	28.1	12.1	54.0	<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
Sulphate as SO4 (2:1 Ext) #	-	-	-	-	-	-	-	-	-	-	<0.0015	g/l	TM38/PM20
Chromium III	49.1	57.6	29.9	75.1	103.5	77.6	74.2	94.5	78.2	65.7	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	8.02	0.08	1.47	2.59	1.52	2.30	4.52	2.50	2.67	22.72	<0.02	%	TM21/PM24
pH #	7.35	7.94	8.01	7.99	8.04	7.55	5.83	6.53	7.41	6.86	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1305	0.104	0.1043	0.1165	0.1043	0.1143	0.12	0.1504	0.1123	0.1262		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

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : Solid

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

J E Sample No.	61-63	64-66	67-69	70-72	73-75	76-78	79-81	82-84			LOD/LOR	Units	Method No.
Sample ID	TP11	TP11	TP12	TP12	TP13	TP13	TP14	TP14					
Depth	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50					
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					
Sample Date	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018					
Antimony	<1	<1	<1	<1	2	2	4	<1			<1	mg/kg	TM30/PM15
Arsenic #	1.6	1.2	1.6	2.5	1.1	1.2	3.8	4.3			<0.5	mg/kg	TM30/PM15
Barium #	19	13	20	23	22	16	55	32			<1	mg/kg	TM30/PM15
Cadmium #	<0.1	<0.1	0.1	0.2	<0.1	<0.1	0.2	0.3			<0.1	mg/kg	TM30/PM15
Chromium #	66.6	66.6	31.1	42.6	91.8	113.9	189.6	43.0			<0.5	mg/kg	TM30/PM15
Copper #	23	15	27	9	19	18	29	45			<1	mg/kg	TM30/PM15
Lead #	16	16	15	15	15	21	18	28			<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM30/PM15
Molybdenum #	4.1	6.1	1.3	2.7	0.9	1.3	3.0	3.1			<0.1	mg/kg	TM30/PM15
Nickel #	5.1	5.7	5.5	5.8	6.2	7.6	8.9	7.2			<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1	<1	<1	<1	<1	1	2			<1	mg/kg	TM30/PM15
Zinc #	33	29	31	26	26	25	27	35			<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	mg/kg	TM4/PM8
Acenaphthylene	<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	mg/kg	TM4/PM8
Fluorene #	<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	0.04	<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	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	0.04	<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	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	0.03	<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	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	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	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	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	mg/kg	TM4/PM8
Coronene	<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	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	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	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	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1			<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	100	100	98	98	100	96	97	98			<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30	<30	<30	<30	<30	<30			<30	mg/kg	TM5/PM8/PM16

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : Solid

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

J E Sample No.	61-63	64-66	67-69	70-72	73-75	76-78	79-81	82-84			LOD/LOR	Units	Method No.
Sample ID	TP11	TP11	TP12	TP12	TP13	TP13	TP14	TP14					
Depth	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50					
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					
Sample Date	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018					
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 SV			<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 SV			<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 SV			<0.1	mg/kg	TM36/PM12
>C10-C12 #	<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 #	<4	<4	<4	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7	<7	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	<26	<26	<26	<26	<26			<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 SV			<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 SV			<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 SV			<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 SV			<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<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 #	<4	<4	<4	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	<7	<7	<7	<7	<7	<7	<7	80			<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7	<7	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26	<26	<26	<26	<26	<26	80			<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	<52	<52	<52	<52	<52	<52	80			<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 SV			<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10	<10	<10	<10	<10	<10	89			<10	mg/kg	TM5/PM8/PM16
MTBE #	<5	<5	<5	<5	<5	<5	<5	<5 SV			<5	ug/kg	TM31/PM12
Benzene #	<5	<5	<5	<5	<5	<5	<5	<5 SV			<5	ug/kg	TM31/PM12
Toluene #	<5	<5	<5	<5	<5	<5	<5	<5 SV			<5	ug/kg	TM31/PM12
Ethylbenzene #	<5	<5	<5	<5	<5	<5	<5	<5 SV			<5	ug/kg	TM31/PM12
m/p-Xylene #	<5	<5	<5	<5	<5	<5	<5	<5 SV			<5	ug/kg	TM31/PM12
o-Xylene #	<5	<5	<5	<5	<5	<5	<5	<5 SV			<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 180 #	<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	ug/kg	TM17/PM8

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : Solid

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

J E Sample No.	61-63	64-66	67-69	70-72	73-75	76-78	79-81	82-84			LOD/LOR	Units	Method No.
Sample ID	TP11	TP11	TP12	TP12	TP13	TP13	TP14	TP14					
Depth	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50					
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					
Sample Date	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018					
Natural Moisture Content	8.4	8.7	11.5	<0.1	7.0	8.0	19.8	45.9			<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	7.7	8.0	10.3	<0.1	6.5	7.4	16.5	31.4			<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3			<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	-	-	0.0284	-	-	-	-	-			<0.0015	g/l	TM38/PM20
Chromium III	66.6	66.6	31.1	42.6	91.8	113.9	189.6	43.0			<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.20	0.25	0.54	0.45	0.31	0.19	2.03	4.79			<0.02	%	TM21/PM24
pH #	6.05	7.76	7.93	8.33	7.98	7.95	7.31	7.53			<0.01	pH units	TM73/PM11
Mass of raw test portion	0.0966	0.0979	0.1008	0.0973	0.1003	0.0978	0.1061	0.1406				kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09				kg	NONE/PM17

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : CEN 10:1 1 Batch

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

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	LOD/LOR	Units	Method No.
Sample ID	TP01	TP01	TP02	TP02	TP03	TP03	TP04	TP04	TP05	TP05			
Depth	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50			
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018			
Dissolved Antimony #	<0.002	0.003	<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	0.03	<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	0.0028	<0.0025	<0.0025	0.0026	<0.0025	<0.0025	0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	0.028	<0.025	<0.025	0.026	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.004	0.006	0.010	0.003	0.008	0.008	0.005	0.005	0.022	0.009	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.04	0.06	0.10	0.03	0.08	0.08	0.05	0.05	0.22	0.09	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<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	0.031	0.008	0.014	0.013	<0.007	0.024	0.013	<0.007	0.015	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	0.31	0.08	0.14	0.13	<0.07	0.24	0.13	<0.07	0.15	<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 #	0.005	<0.002	0.004	0.005	<0.002	<0.002	0.008	0.009	0.019	0.015	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.05	<0.02	0.04	0.05	<0.02	<0.02	0.08	0.09	0.19	0.15	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<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 #	<0.003	0.006	<0.003	<0.003	0.005	<0.003	0.004	<0.003	0.003	0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	0.06	<0.03	<0.03	0.05	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<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 #	<0.05	<0.05	<0.05	<0.05	<0.05	3.22	<0.05	4.57	22.30	38.12	<0.05	mg/l	TM38/PM0
Sulphate as SO4 #	<0.5	<0.5	<0.5	<0.5	<0.5	32.2	<0.5	45.7	223.0	381.1	<0.5	mg/kg	TM38/PM0
Chloride #	0.9	1.9	2.0	0.7	4.6	0.6	2.8	0.4	2.1	3.1	<0.3	mg/l	TM38/PM0
Chloride #	9	19	20	7	46	6	28	4	21	31	<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	9	40	19	15	41	11	35	9	14	32	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	90	400	190	150	410	110	350	90	140	320	<20	mg/kg	TM60/PM0
pH	8.16	5.96	8.28	7.98	6.38	5.66	7.24	7.92	8.15	7.67	<0.01	pH units	TM73/PM0
Total Dissolved Solids #	118	113	221	128	125	65	175	162	184	147	<35	mg/l	TM20/PM0
Total Dissolved Solids #	1180	1130	2209	1280	1251	650	1749	1619	1840	1470	<350	mg/kg	TM20/PM0

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

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

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48	49-51	52-54	55,57,59	56,58,60	LOD/LOR	Units	Method No.
Sample ID	TP06	TP06	TP07	TP07	TP08	TP08	TP09	TP09	TP10	TP10			
Depth	0.50	2.00	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50			
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018			
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	<0.0025	<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	<0.025	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.010	<0.003	<0.003	<0.003	<0.003	<0.003	0.006	0.005	0.012	0.014	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.10	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	0.05	0.12	0.14	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<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	0.018	<0.007	<0.007	<0.007	<0.007	0.010	0.034	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	0.18	<0.07	<0.07	<0.07	<0.07	0.10	0.34	<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 #	0.006	<0.002	0.004	0.004	0.009	0.007	<0.002	0.020	0.013	0.015	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.06	<0.02	0.04	0.04	0.09	0.07	<0.02	0.20	0.13	0.15	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<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 #	0.004	0.005	<0.003	<0.003	<0.003	<0.003	0.003	<0.003	<0.003	0.007	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.04	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<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	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<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	0.4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	3	4	<3	<3	<3	<3	<3	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	<0.05	4.71	0.25	0.08	0.30	0.15	0.57	<0.05	13.70	28.69	<0.05	mg/l	TM38/PM0
Sulphate as SO4 #	<0.5	47.1	2.5	0.8	3.0	1.5	5.7	<0.5	137.1	286.9	<0.5	mg/kg	TM38/PM0
Chloride #	2.6	0.9	<0.3	<0.3	<0.3	0.6	1.4	2.0	1.2	2.4	<0.3	mg/l	TM38/PM0
Chloride #	26	9	<3	<3	<3	6	14	20	12	24	<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	16	5	6	7	5	9	13	26	32	25	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	160	50	60	70	50	90	130	260	320	250	<20	mg/kg	TM60/PM0
pH	8.02	7.82	8.05	8.07	8.12	8.19	7.28	7.49	8.16	7.74	<0.01	pH units	TM73/PM0
Total Dissolved Solids #	132	41	61	86	97	103	60	77	192	164	<35	mg/l	TM20/PM0
Total Dissolved Solids #	1319	410	610	860	970	1030	600	770	1921	1640	<350	mg/kg	TM20/PM0

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : CEN 10:1 1 Batch

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

J E Sample No.	61-63	64-66	67-69	70-72	73-75	76-78	79-81	82-84			LOD/LOR	Units	Method No.
Sample ID	TP11	TP11	TP12	TP12	TP13	TP13	TP14	TP14					
Depth	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50					
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					
Sample Date	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018					
Dissolved Antimony #	<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	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<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	<0.025	<0.025			<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	<0.003	0.005	<0.003	0.003	<0.003	0.009	0.009			<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	<0.03	0.05	<0.03	0.03	<0.03	0.09	0.09			<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005			<0.0005	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	mg/kg	TM30/PM17
Dissolved Chromium #	<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	mg/kg	TM30/PM17
Dissolved Copper #	0.014	0.007	<0.007	<0.007	<0.007	<0.007	0.009	<0.007			<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	0.14	<0.07	<0.07	<0.07	<0.07	<0.07	0.09	<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	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	mg/kg	TM30/PM17
Dissolved Molybdenum #	<0.002	0.010	0.003	0.002	0.012	0.005	0.012	0.015			<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	<0.02	0.10	0.03	0.02	0.12	0.05	0.12	0.15			<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002			<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<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	mg/kg	TM30/PM17
Dissolved Zinc #	0.003	<0.003	<0.003	0.004	<0.003	<0.003	0.004	0.004			<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.03	<0.03	<0.03	0.04	<0.03	<0.03	0.04	0.04			<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001			<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	mg/kg	TM61/PM0
Phenol	<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	mg/kg	TM26/PM0
Fluoride	<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	mg/kg	TM173/PM0
Sulphate as SO4 #	0.64	<0.05	10.60	0.35	13.10	5.85	<0.05	23.77			<0.05	mg/l	TM38/PM0
Sulphate as SO4 #	6.4	<0.5	106.0	3.5	131.1	58.5	<0.5	237.7			<0.5	mg/kg	TM38/PM0
Chloride #	<0.3	0.3	<0.3	<0.3	<0.3	<0.3	1.1	1.3			<0.3	mg/l	TM38/PM0
Chloride #	<3	<3	<3	<3	<3	<3	11	13			<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	3	15	6	4	4	7	18	16			<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30	150	60	40	40	70	180	160			<20	mg/kg	TM60/PM0
pH	7.92	7.98	8.00	7.96	7.94	7.97	7.05	8.12			<0.01	pH units	TM73/PM0
Total Dissolved Solids #	<35	154	97	54	119	95	134	215			<35	mg/l	TM20/PM0
Total Dissolved Solids #	<350	1540	970	540	1191	950	1339	2150			<350	mg/kg	TM20/PM0

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : EN12457_2

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

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	TP01	TP01	TP02	TP02	TP03	TP03	TP04	TP04	TP05	TP05						
Depth	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50						
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018	24/10/2018						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1	1	1	1						
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018						
Solid Waste Analysis																
Total Organic Carbon #	3.60	10.03	4.19	0.62	21.04	3.59	16.28	0.17	17.83	29.57	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025 SV	<0.025 SV	<0.025 SV	<0.025	<0.025 SV	<0.025 SV	<0.025 SV	<0.025	<0.025 SV	<0.025 SV	6	-	-	<0.025	mg/kg	TM31/PM12
Sum of 7 PCBs #	<0.035	<0.035	<0.035	<0.035	<0.350 BB	<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 #	<0.44 BA	<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	<1.28 BA	<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	0.028	<0.025	<0.025	0.026	<0.025	<0.025	<0.025	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.04	0.06	0.10	0.03	0.08	0.08	0.05	0.05	0.22	0.09	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	0.31	0.08	0.14	0.13	<0.07	0.24	0.13	<0.07	0.15	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<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 #	0.05	<0.02	0.04	0.05	<0.02	<0.02	0.08	0.09	0.19	0.15	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	0.03	<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 #	<0.03	0.06	<0.03	<0.03	0.05	<0.03	0.04	<0.03	<0.03	<0.03	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	1180	1130	2209	1280	1251	650	1749	1619	1840	1470	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	90	400	190	150	410	110	350	90	140	320	500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1132	0.171	0.1358	0.1005	0.1959	0.1144	0.1582	0.1022	0.1894	0.2135	-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	79.5	52.8	66.3	89.8	46.0	79.0	56.7	87.8	47.4	42.1	-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.877	0.82	0.854	0.89	0.795	0.876	0.831	0.887	0.8	0.776	-	-	-		l	NONE/PM17
Eluate Volume	0.8	0.65	0.82	0.78	0.8	0.82	0.7	0.82	0.85	0.95	-	-	-		l	NONE/PM17
pH #	7.44	4.96	7.58	7.15	5.11	4.58	5.72	7.94	7.39	6.06	-	-	-	<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 #	<0.5	<0.5	<0.5	<0.5	<0.5	32.2	<0.5	45.7	223.0	381.1	1000	20000	50000	<0.5	mg/kg	TM38/PM0
Chloride #	9	19	20	7	46	6	28	4	21	31	800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : EN12457_2

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

Please see attached notes for all abbreviations and acronyms

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48	49-51	52-54	55,57,59	56,58,60	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	TP06	TP06	TP07	TP07	TP08	TP08	TP09	TP09	TP10	TP10						
Depth	0.50	2.00	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50						
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	24/10/2018	24/10/2018	24/10/2018	24/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1	1	1	1						
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018						
Solid Waste Analysis																
Total Organic Carbon #	8.02	0.08	1.47	2.59	1.52	2.30	4.52	2.50	2.67	22.72	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025 SV	<0.025	<0.025	<0.025 SV	<0.025	<0.025 SV	<0.025 SV	<0.025 SV	<0.025	0.163 SV	6	-	-	<0.025	mg/kg	TM31/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	331	<30	<30	<30	<30	<30	<30	<30	<30	<30	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<2.20 BB	<0.22	<0.22	<0.22	<0.22	<0.22	<2.20 BB	<0.22	0.48	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<6.40 BB	<0.64	<0.64	<0.64	<0.64	<0.64	<6.40 BB	<0.64	1.17	<0.64	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.10	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	0.05	0.12	0.14	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	0.18	<0.07	<0.07	<0.07	<0.07	0.10	0.34	<0.07	<0.07	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.06	<0.02	0.04	0.04	0.09	0.07	<0.02	0.20	0.13	0.15	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	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 #	0.04	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.07	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	1319	410	610	860	970	1030	600	770	1921	1640	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	160	50	60	70	50	90	130	260	320	250	500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1305	0.104	0.1043	0.1165	0.1043	0.1143	0.12	0.1504	0.1123	0.1262	-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	68.9	86.1	86.5	77.4	86.1	78.8	75.3	59.9	80.0	71.5	-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.859	0.885	0.886	0.874	0.885	0.876	0.87	0.84	0.878	0.864	-	-	-		l	NONE/PM17
Eluate Volume	0.85	0.86	0.75	0.8	0.8	0.77	0.76	0.75	0.8	0.834	-	-	-		l	NONE/PM17
pH #	7.35	7.94	8.01	7.99	8.04	7.55	5.83	6.53	7.41	6.86	-	-	-	<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	4	<3	<3	<3	<3	<3	-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	<0.5	47.1	2.5	0.8	3.0	1.5	5.7	<0.5	137.1	286.9	1000	20000	50000	<0.5	mg/kg	TM38/PM0
Chloride #	26	9	<3	<3	<3	6	14	20	12	24	800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton
JE Job No.: 18/17300

Report : EN12457_2

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

Please see attached notes for all abbreviations and acronyms

J E Sample No.	61-63	64-66	67-69	70-72	73-75	76-78	79-81	82-84							
Sample ID	TP11	TP11	TP12	TP12	TP13	TP13	TP14	TP14							
Depth	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50							
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							
Sample Date	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018	23/10/2018							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1	1	1							
Date of Receipt	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018	26/10/2018			Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Solid Waste Analysis																
Total Organic Carbon #	0.20	0.25	0.54	0.45	0.31	0.19	2.03	4.79			3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025 [SV]			6	-	-	<0.025	mg/kg	TM31/PM12
Sum of 7 PCBs #	<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			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	mg/kg	TM4/PM8
PAH Sum of 17	<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	<0.025	<0.025			0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	<0.03	0.05	<0.03	0.03	<0.03	0.09	0.09			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			0.04	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			0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	0.14	<0.07	<0.07	<0.07	<0.07	<0.07	0.09	<0.07			2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<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	0.10	0.03	0.02	0.12	0.05	0.12	0.15			0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			0.4	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			0.5	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			0.06	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			0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	0.03	<0.03	<0.03	0.04	<0.03	<0.03	0.04	0.04			4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	<350	1540	970	540	1191	950	1339	2150			4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	30	150	60	40	40	70	180	160			500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.0966	0.0979	0.1008	0.0973	0.1003	0.0978	0.1061	0.1406			-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	93.7	91.9	89.7	92.8	89.6	92.2	84.5	63.9			-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.894	0.892	0.89	0.893	0.89	0.892	0.883	0.849			-	-	-		l	NONE/PM17
Eluate Volume	0.854	0.8	0.853	0.85	0.8	0.8	0.8	0.8			-	-	-		l	NONE/PM17
pH #	6.05	7.76	7.93	8.33	7.98	7.95	7.31	7.53			-	-	-	<0.01	pH units	TM73/PM11
Phenol	<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	mg/kg	TM173/PM0
Sulphate as SO4 #	6.4	<0.5	106.0	3.5	131.1	58.5	<0.5	237.7			1000	20000	50000	<0.5	mg/kg	TM38/PM0
Chloride #	<3	<3	<3	<3	<3	<3	11	13			800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland **Matrix : Solid**
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	EPH Interpretation
18/17300	1	TP01	0.50	1-3	No interpretation possible
18/17300	1	TP01	1.50	4-6	Naturally occurring compounds & Possible PAH's
18/17300	1	TP02	0.50	7-9	No interpretation possible
18/17300	1	TP02	1.50	10-12	No interpretation possible
18/17300	1	TP03	0.50	13-15	Naturally occurring compounds & Possible PAH's
18/17300	1	TP03	1.50	16-18	No interpretation possible
18/17300	1	TP04	0.50	19-21	Naturally occurring compounds
18/17300	1	TP04	1.50	22-24	No interpretation possible
18/17300	1	TP05	0.50	25-27	Naturally occurring compounds & Possible PAH's
18/17300	1	TP05	1.50	28-30	Naturally occurring compounds & Possible PAH's
18/17300	1	TP06	0.50	31-33	Tarmac/bitumen & Possible lubricating oil
18/17300	1	TP06	2.00	34-36	No interpretation possible
18/17300	1	TP07	0.50	37-39	No interpretation possible
18/17300	1	TP07	1.50	40-42	No interpretation possible
18/17300	1	TP08	0.50	43-45	No interpretation possible
18/17300	1	TP08	1.50	46-48	No interpretation possible
18/17300	1	TP09	0.50	49-51	Naturally occurring compounds & Possible PAH's
18/17300	1	TP09	1.50	52-54	Naturally occurring compounds
18/17300	1	TP10	0.50	55,57,59	Naturally occurring compounds
18/17300	1	TP10	1.50	56,58,60	Naturally occurring compounds & Possible PAH's
18/17300	1	TP11	1.50	61-63	No interpretation possible
18/17300	1	TP11	0.50	64-66	No interpretation possible
18/17300	1	TP12	1.50	67-69	No interpretation possible
18/17300	1	TP12	0.50	70-72	No interpretation possible
18/17300	1	TP13	1.50	73-75	No interpretation possible
18/17300	1	TP13	0.50	76-78	No interpretation possible
18/17300	1	TP14	1.50	79-81	No interpretation possible
18/17300	1	TP14	0.50	82-84	Naturally occurring compounds

Client Name: Ground Investigations Ireland
Reference: 18/10/8165
Location: Gateway
Contact: Barry Sexton

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 Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:

Ryan Butterworth
Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/17300	1	TP01	0.50	2	01/11/2018	**General Description (Bulk Analysis)**	soil/stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP01	1.50	5	01/11/2018	**General Description (Bulk Analysis)**	soil-stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP02	0.50	8	01/11/2018	**General Description (Bulk Analysis)**	soil.stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP02	1.50	11	01/11/2018	**General Description (Bulk Analysis)**	soil/stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP03	0.50	14	01/11/2018	**General Description (Bulk Analysis)**	soil.stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP03	1.50	17	01/11/2018	**General Description (Bulk Analysis)**	soil/stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP04	0.50	20	01/11/2018	**General Description (Bulk Analysis)**	Soil/Stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD

Client Name: Ground Investigations Ireland
Reference: 18/10/8165
Location: Gateway
Contact: Barry Sexton

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/17300	1	TP04	0.50	20	01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP04	1.50	23	01/11/2018	**General Description (Bulk Analysis)**	Soil/Stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP05	0.50	26	01/11/2018	**General Description (Bulk Analysis)**	soil-stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP05	1.50	29	01/11/2018	**General Description (Bulk Analysis)**	soil-stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP06	0.50	32	01/11/2018	**General Description (Bulk Analysis)**	soil-stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP06	2.00	35	01/11/2018	**General Description (Bulk Analysis)**	soil.stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP07	0.50	38	01/11/2018	**General Description (Bulk Analysis)**	soil-stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP07	1.50	41	01/11/2018	**General Description (Bulk Analysis)**	soil-stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP08	0.50	44	01/11/2018	**General Description (Bulk Analysis)**	soil-stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP08	1.50	47	01/11/2018	**General Description (Bulk Analysis)**	Soil/Stones
					01/11/2018	**Asbestos Fibres**	NAD

Client Name: Ground Investigations Ireland
Reference: 18/10/8165
Location: Gateway
Contact: Barry Sexton

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/17300	1	TP08	1.50	47	01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP09	0.50	50	01/11/2018	**General Description (Bulk Analysis)**	soil.stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP09	1.50	53	01/11/2018	**General Description (Bulk Analysis)**	soil/stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP10	0.50	57	01/11/2018	**General Description (Bulk Analysis)**	soil/stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP10	1.50	58	01/11/2018	**General Description (Bulk Analysis)**	soil.stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP11	1.50	62	01/11/2018	**General Description (Bulk Analysis)**	soil-stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP11	0.50	65	01/11/2018	**General Description (Bulk Analysis)**	Soil/Stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP12	1.50	68	01/11/2018	**General Description (Bulk Analysis)**	Soil/Stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP12	0.50	71	01/11/2018	**General Description (Bulk Analysis)**	Soil/Stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 18/10/8165
Location: Gateway
Contact: Barry Sexton

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/17300	1	TP13	1.50	74	01/11/2018	**General Description (Bulk Analysis)**	soil/stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP13	0.50	77	01/11/2018	**General Description (Bulk Analysis)**	soil/stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP14	1.50	80	01/11/2018	**General Description (Bulk Analysis)**	soil-stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD
18/17300	1	TP14	0.50	83	01/11/2018	**General Description (Bulk Analysis)**	soil.stones
					01/11/2018	**Asbestos Fibres**	NAD
					01/11/2018	**Asbestos ACM**	NAD
					01/11/2018	**Asbestos Type**	NAD
					01/11/2018	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 8165-10-18
Location: Gateway
Contact: Barry Sexton

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason

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

JE Job No.: 18/17300

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. 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.

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

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

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.

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.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Exova Jones Environmental 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	x2 Dilution
AB	x10 Dilution
BA	x2 Dilution
BB	x10 Dilution

Appendix - Methods used for WAC (2003/33/EC)

JE Job No.: 18/17300

Leachate tests	
10l/kg; 4mm	I.S. EN 12457-2:2002 Specified particle size; water added to L/S ratio; capped; agitated for 24 ± 0.5 hours; eluate settled and filtered over 0.45 µm membrane filter.
Eluate analysis	
As	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ba	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cd	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cr total	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cu	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Hg	I.S. EN 13370 rec. EN 1483 (CVAAS)
Mo	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ni	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Pb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Sb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Se	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Zn	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Chloride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Fluoride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Sulphate	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Phenol index	I.S. EN 13370 rec. ISO 6439 (4-Aminoantipyrine spectrometic methods after distillation)* (BY HPLC - Jones Env)
DOC	I.S. EN 1484
TDS	I.S. EN 15216
Compositional analysis	
TOC	I.S. EN 13137 Method B: carbonates removed with acid; TOC by combustion.
BTEX	GC-FID
PCB7**	I.S. EN 15308 analysis by GC-ECD.
Mineral oil	I.S. EN 14039 C10 to C40 analysis by GC-FID.
PAH17***	I.S. EN 15527 PAH17 analysis by GC-MS
Metals	I.S. EN 13657 - Aqua regia digestion: EN ISO 11885 (ICP-OES)
Other	
Dry matter	I.S. EN 14346 sample is dried to a constant mass in an oven at 105 ± 3 °C; Method B Water content by direct Karl-Fischer-titration and either volumetric or coulometric detection.
LOI	I.S. EN 15169 Difference in mass after heating in a furnace up to 550 ± 25 °C.
ANC	CEN/TS 15364 Determined by amouns of acid or base needed to cover the pH range

Notes:

*If not suitable due to LOD, precision, etc., any other suitable method can be used, e.g. AFS, ICP-MS
**PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180

***Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)perylene, Benzo(a)pyrene, Chrysene, Coronene, Dibenzo(a,h)anthracene, Fluorene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene and Pyrene.

JE Job No: 18/17300

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 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 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 8270 method for the solvent extraction and determination of 16 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 USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	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 USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	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 8270. 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 160.3 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

JE Job No: 18/17300

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 Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	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 Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	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 Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM17	Modified method EN12457-2 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
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. 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 can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. 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 can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	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

JE Job No: 18/17300

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
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	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 9060, APHA Standard Methods for Examination of Water and Wastewater 5310B, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Modified US EPA methods 245.7 and 200.7. Determination of Mercury by Cold Vapour Atomic Fluorescence.	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	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 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. 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 340.2	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AR	Yes
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method EN12457-2 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	

JE Job No: 18/17300

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	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	

Appendix B

PERMISSIBLE OUTFLOW CALCULATIONS

PROJECT			JOB REF.
Gateway Phase 3, Knocknacarra, Galway			p180191
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations Allowable Outflow			1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
180191-3000	FNS	NCG	11-Apr-19

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall site/catchment area? **1.93** Hectares (ha) Site is Less than 50 Hectares

(Area of site within catchment of new drainage networks excludes open space areas not within new drainage networks)

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment This refers to the entire site area	1.93	
Area	1.93	Hectares (ha)
Drainage Group	2	Class
Depth to Impermeable Layers	2	Class
Permeability Group above Impermeable Layers	3	Class
Slope [o]	1	Class
SOIL Type	**3**	From FSR Table
[1]**SOIL Index**	0.40	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.40**

Site SPR Value **0.37**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? Yes

How many sub-catchments? 2

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 1247.0 mm

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 13.00 Litres/sec

[7]Site Discharge = **13.00** Litres/sec

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).
2. SPR value calculated from GDSDS - Table 6.7.
3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.
4. Long-term storage Vol_{xs} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).
   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.
5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies
   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.
6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.
7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

Appendix C

ATTENUATION CALCULATIONS

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	27.127	0.387	8.0	132.7	O K
30 min Summer	27.272	0.532	8.4	182.6	O K
60 min Summer	27.415	0.675	8.7	231.4	O K
120 min Summer	27.541	0.801	9.0	274.7	O K
180 min Summer	27.595	0.855	9.1	293.3	O K
240 min Summer	27.618	0.878	9.2	301.3	O K
360 min Summer	27.625	0.885	9.2	303.6	O K
480 min Summer	27.621	0.881	9.2	302.3	O K
600 min Summer	27.616	0.876	9.2	300.4	O K
720 min Summer	27.609	0.869	9.2	297.9	O K
960 min Summer	27.589	0.849	9.1	291.3	O K
1440 min Summer	27.539	0.799	9.0	273.9	O K
2160 min Summer	27.449	0.709	8.8	243.3	O K
2880 min Summer	27.358	0.618	8.6	212.0	O K
4320 min Summer	27.190	0.450	8.2	154.5	O K
5760 min Summer	27.053	0.313	7.8	107.3	O K
7200 min Summer	26.944	0.204	7.6	70.0	O K
8640 min Summer	26.860	0.120	7.4	41.2	O K
10080 min Summer	26.798	0.058	7.4	19.7	O K
15 min Winter	27.177	0.437	8.2	149.8	O K
30 min Winter	27.343	0.603	8.6	206.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	75.304	0.0	142.3	22
30 min Summer	52.677	0.0	199.1	36
60 min Summer	34.650	0.0	262.6	66
120 min Summer	22.092	0.0	334.6	124
180 min Summer	16.829	0.0	382.6	182
240 min Summer	13.848	0.0	419.1	240
360 min Summer	10.488	0.0	476.9	306
480 min Summer	8.600	0.0	520.6	372
600 min Summer	7.368	0.0	558.0	436
720 min Summer	6.491	0.0	589.7	506
960 min Summer	5.314	0.0	643.7	646
1440 min Summer	4.007	0.0	728.6	924
2160 min Summer	3.019	0.0	823.8	1324
2880 min Summer	2.466	0.0	896.3	1728
4320 min Summer	1.853	0.0	1010.1	2472
5760 min Summer	1.511	0.0	1097.8	3224
7200 min Summer	1.290	0.0	1172.9	3896
8640 min Summer	1.133	0.0	1236.6	4584
10080 min Summer	1.016	0.0	1292.9	5248
15 min Winter	75.304	0.0	159.7	22
30 min Winter	52.677	0.0	223.1	36

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	27.507	0.767	8.9	263.2	O K
120 min Winter	27.660	0.920	9.3	315.7	O K
180 min Winter	27.733	0.993	9.4	340.5	O K
240 min Winter	27.770	1.030	9.5	353.3	O K
360 min Winter	27.792	1.052	9.6	360.8	O K
480 min Winter	27.784	1.044	9.6	358.0	O K
600 min Winter	27.770	1.030	9.5	353.1	O K
720 min Winter	27.754	1.014	9.5	347.7	O K
960 min Winter	27.719	0.979	9.4	335.8	O K
1440 min Winter	27.628	0.888	9.2	304.7	O K
2160 min Winter	27.479	0.739	8.9	253.3	O K
2880 min Winter	27.335	0.595	8.5	204.0	O K
4320 min Winter	27.089	0.349	7.9	119.9	O K
5760 min Winter	26.902	0.162	7.4	55.7	O K
7200 min Winter	26.764	0.024	7.4	8.1	O K
8640 min Winter	26.740	0.000	6.8	0.0	O K
10080 min Winter	26.740	0.000	6.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	34.650	0.0	293.5	64
120 min Winter	22.092	0.0	374.5	122
180 min Winter	16.829	0.0	427.9	178
240 min Winter	13.848	0.0	470.1	234
360 min Winter	10.488	0.0	534.1	342
480 min Winter	8.600	0.0	583.5	390
600 min Winter	7.368	0.0	624.8	466
720 min Winter	6.491	0.0	660.4	546
960 min Winter	5.314	0.0	720.9	700
1440 min Winter	4.007	0.0	815.4	1000
2160 min Winter	3.019	0.0	922.2	1428
2880 min Winter	2.466	0.0	1004.5	1844
4320 min Winter	1.853	0.0	1132.0	2596
5760 min Winter	1.511	0.0	1230.9	3288
7200 min Winter	1.290	0.0	1313.0	3896
8640 min Winter	1.133	0.0	1384.5	0
10080 min Winter	1.016	0.0	1447.8	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.000	Shortest Storm (mins)	15
Ratio R	0.261	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 1.010

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.505	4	8	0.505

Model Details

Storage is Online Cover Level (m) 28.800

Tank or Pond Structure

Invert Level (m) 26.740

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	343.0	0.700	343.0	1.400	0.0	2.100	0.0
0.100	343.0	0.800	343.0	1.500	0.0	2.200	0.0
0.200	343.0	0.900	343.0	1.600	0.0	2.300	0.0
0.300	343.0	1.000	343.0	1.700	0.0	2.400	0.0
0.400	343.0	1.100	343.0	1.800	0.0	2.500	0.0
0.500	343.0	1.200	0.0	1.900	0.0		
0.600	343.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0126-9600-2150-9600
Design Head (m)	2.150
Design Flow (l/s)	9.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	126
Invert Level (m)	25.650
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.150	9.6	Kick-Flo®	1.122	7.1
Flush-Flo™	0.544	9.0	Mean Flow over Head Range	-	8.0

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)
0.100	4.5	1.200	7.3	3.000	11.2	7.000	16.8
0.200	7.6	1.400	7.8	3.500	12.1	7.500	17.4
0.300	8.4	1.600	8.3	4.000	12.9	8.000	17.9
0.400	8.8	1.800	8.8	4.500	13.6	8.500	18.4
0.500	8.9	2.000	9.3	5.000	14.3	9.000	19.0
0.600	8.9	2.200	9.7	5.500	15.0	9.500	19.5
0.800	8.7	2.400	10.1	6.000	15.6		
1.000	8.0	2.600	10.5	6.500	16.2		

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	28.160	0.310	3.4	59.3	O K
30 min Summer	28.279	0.429	3.4	81.9	O K
60 min Summer	28.399	0.549	3.4	104.9	O K
120 min Summer	28.511	0.661	3.4	126.2	O K
180 min Summer	28.564	0.714	3.4	136.3	O K
240 min Summer	28.592	0.742	3.4	141.7	O K
360 min Summer	28.609	0.759	3.4	145.0	O K
480 min Summer	28.607	0.757	3.4	144.5	O K
600 min Summer	28.604	0.754	3.4	143.9	O K
720 min Summer	28.600	0.750	3.4	143.2	O K
960 min Summer	28.589	0.739	3.4	141.1	O K
1440 min Summer	28.558	0.708	3.4	135.3	O K
2160 min Summer	28.498	0.648	3.4	123.8	O K
2880 min Summer	28.427	0.577	3.4	110.2	O K
4320 min Summer	28.250	0.400	3.4	76.4	O K
5760 min Summer	28.115	0.265	3.4	50.7	O K
7200 min Summer	28.019	0.169	3.4	32.3	O K
8640 min Summer	27.953	0.103	3.3	19.7	O K
10080 min Summer	27.909	0.059	3.2	11.3	O K
15 min Winter	28.201	0.351	3.4	67.0	O K
30 min Winter	28.336	0.486	3.4	92.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	75.304	0.0	63.4	22
30 min Summer	52.677	0.0	88.9	36
60 min Summer	34.650	0.0	116.7	66
120 min Summer	22.092	0.0	149.0	124
180 min Summer	16.829	0.0	170.2	184
240 min Summer	13.848	0.0	186.7	242
360 min Summer	10.488	0.0	212.4	360
480 min Summer	8.600	0.0	232.0	418
600 min Summer	7.368	0.0	248.4	482
720 min Summer	6.491	0.0	263.0	548
960 min Summer	5.314	0.0	286.8	684
1440 min Summer	4.007	0.0	324.6	968
2160 min Summer	3.019	0.0	366.4	1384
2880 min Summer	2.466	0.0	399.3	1796
4320 min Summer	1.853	0.0	450.2	2552
5760 min Summer	1.511	0.0	489.4	3232
7200 min Summer	1.290	0.0	522.2	3896
8640 min Summer	1.133	0.0	550.6	4584
10080 min Summer	1.016	0.0	575.7	5248
15 min Winter	75.304	0.0	71.1	22
30 min Winter	52.677	0.0	99.4	36

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	28.473	0.623	3.4	119.1	O K
120 min Winter	28.606	0.756	3.4	144.3	O K
180 min Winter	28.672	0.822	3.4	157.1	O K
240 min Winter	28.711	0.861	3.4	164.5	O K
360 min Winter	28.745	0.895	3.4	171.0	O K
480 min Winter	28.749	0.899	3.4	171.8	O K
600 min Winter	28.739	0.889	3.4	169.9	O K
720 min Winter	28.729	0.879	3.4	167.9	O K
960 min Winter	28.711	0.861	3.4	164.4	O K
1440 min Winter	28.657	0.807	3.4	154.1	O K
2160 min Winter	28.553	0.703	3.4	134.2	O K
2880 min Winter	28.434	0.584	3.4	111.6	O K
4320 min Winter	28.153	0.303	3.4	57.9	O K
5760 min Winter	27.984	0.134	3.4	25.6	O K
7200 min Winter	27.895	0.045	3.2	8.7	O K
8640 min Winter	27.852	0.002	3.0	0.5	O K
10080 min Winter	27.850	0.000	2.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	34.650	0.0	130.7	64
120 min Winter	22.092	0.0	166.9	122
180 min Winter	16.829	0.0	190.7	180
240 min Winter	13.848	0.0	209.3	236
360 min Winter	10.488	0.0	237.7	348
480 min Winter	8.600	0.0	260.1	456
600 min Winter	7.368	0.0	278.6	548
720 min Winter	6.491	0.0	294.4	574
960 min Winter	5.314	0.0	321.3	732
1440 min Winter	4.007	0.0	363.3	1042
2160 min Winter	3.019	0.0	410.7	1496
2880 min Winter	2.466	0.0	447.1	1956
4320 min Winter	1.853	0.0	504.4	2640
5760 min Winter	1.511	0.0	548.4	3288
7200 min Winter	1.290	0.0	585.0	3888
8640 min Winter	1.133	0.0	616.9	4416
10080 min Winter	1.016	0.0	645.1	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.000	Shortest Storm (mins)	15
Ratio R	0.261	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 0.450

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.225	4	8	0.225

Model Details

Storage is Online Cover Level (m) 29.600

Tank or Pond Structure

Invert Level (m) 27.850

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	191.0	0.700	191.0	1.400	0.0	2.100	0.0
0.100	191.0	0.800	191.0	1.500	0.0	2.200	0.0
0.200	191.0	0.900	191.0	1.600	0.0	2.300	0.0
0.300	191.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	191.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	191.0	1.200	0.0	1.900	0.0		
0.600	191.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0087-3400-1019-3400
Design Head (m)	1.019
Design Flow (l/s)	3.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	87
Invert Level (m)	27.731
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.019	3.4	Kick-Flo®	0.637	2.7
Flush-Flo™	0.302	3.4	Mean Flow over Head Range	-	3.0

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)
0.100	2.7	1.200	3.7	3.000	5.6	7.000	8.4
0.200	3.3	1.400	3.9	3.500	6.0	7.500	8.6
0.300	3.4	1.600	4.2	4.000	6.4	8.000	8.9
0.400	3.4	1.800	4.4	4.500	6.8	8.500	9.2
0.500	3.2	2.000	4.6	5.000	7.1	9.000	9.4
0.600	2.9	2.200	4.9	5.500	7.5	9.500	9.7
0.800	3.0	2.400	5.1	6.000	7.8		
1.000	3.4	2.600	5.2	6.500	8.1		

Appendix D

SURFACE WATER SEWER CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	16.000	Add Flow / Climate Change (%)	10
Ratio R	0.261	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
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.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for SW_2

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.560	4-8	0.360

Total Area Contributing (ha) = 0.920

Total Pipe Volume (m³) = 38.073

Network Design Table for SW_2

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
1.000	40.561	0.510	79.5	0.159	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	15.038	0.150	100.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	37.759	0.660	57.2	0.079	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	25.627	0.305	84.0	0.086	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)
1.000	48.74	4.46	27.700	0.159	0.0	0.0	2.1	1.47	58.4	23.1
1.001	48.03	4.65	27.190	0.159	0.0	0.0	2.1	1.31	51.9	23.1
2.000	49.10	4.36	27.700	0.079	0.0	0.0	1.1	1.73	68.9	11.6
1.002	46.99	4.95	27.040	0.324	0.0	0.0	4.1	1.43	56.8	45.4

Network Design Table for SW_2

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
3.000	19.428	0.243	80.0	0.098	4.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	16.681	0.209	79.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.000	6.596	0.170	38.8	0.074	4.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	17.497	0.283	61.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	27.636	0.230	120.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.000	18.307	0.330	55.5	0.146	4.00	0.0	0.600	o	150	Pipe/Conduit	
5.001	54.284	0.536	101.3	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	6.631	0.050	132.6	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.005	17.745	0.100	177.5	0.261	0.00	0.0	0.600	o	375	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)
3.000	49.39	4.29	27.850	0.098	0.0	0.0	1.3	1.13	19.9	14.4
3.001	48.46	4.53	27.607	0.098	0.0	0.0	1.3	1.13	19.9	14.4
4.000	50.26	4.07	27.370	0.074	0.0	0.0	1.0	1.62	28.6	11.1
4.001	49.36	4.30	27.200	0.074	0.0	0.0	1.0	1.28	22.6	11.1
1.003	45.92	5.27	26.660	0.496	0.0	0.0	6.2	1.43	101.3	67.9
5.000	49.64	4.23	27.650	0.146	0.0	0.0	2.0	1.35	23.9	21.6
5.001	47.09	4.92	27.245	0.163	0.0	0.0	2.1	1.30	51.7	22.9
1.004	45.70	5.34	25.800	0.659	0.0	0.0	8.2	1.57	173.6	89.7
1.005	45.02	5.56	25.750	0.920	0.0	0.0	11.2	1.36	149.9	123.4

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	16.000	Add Flow / Climate Change (%)	10
Ratio R	0.261	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
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.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for SW_1

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.147	4-8	0.300

Total Area Contributing (ha) = 0.447

Total Pipe Volume (m³) = 140.815

Network Design Table for SW_1

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
1.000	45.976	0.311	147.8	0.077	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	6.120	0.034	180.0	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	8.453	0.047	179.9	0.062	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	6.807	0.023	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	9.442	0.063	150.0	0.075	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)
1.000	47.81	4.71	28.300	0.077	0.0	0.0	1.0	1.07	42.7	11.0
1.001	47.44	4.82	27.989	0.112	0.0	0.0	1.4	0.97	38.6	15.8
1.002	46.94	4.96	27.955	0.174	0.0	0.0	2.2	0.97	38.6	24.3
1.003	46.52	5.09	27.833	0.174	0.0	0.0	2.2	0.90	63.8	24.3
3.000	49.94	4.15	28.300	0.075	0.0	0.0	1.0	1.07	42.4	11.2

Network Design Table for SW_1

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
3.001	9.045	0.060	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.002	7.652	0.048	160.0	0.073	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.003	17.318	0.108	160.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.004	22.094	0.136	162.5	0.071	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	15.400	0.051	300.0	0.046	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	8.270	0.028	300.0	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	34.859	0.205	170.0	0.000	4.00	0.0	0.600	o	375	Pipe/Conduit	
1.008	68.404	0.150	456.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.009	16.503	0.033	500.1	0.000	0.00	0.0	0.600	o	600	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)
3.001	49.39	4.29	28.237	0.075	0.0	0.0	1.0	1.07	42.4	11.2
3.002	48.92	4.41	28.177	0.148	0.0	0.0	2.0	1.03	41.0	21.6
3.003	47.89	4.69	28.129	0.148	0.0	0.0	2.0	1.03	41.0	21.6
3.004	46.65	5.05	28.021	0.219	0.0	0.0	2.8	1.02	40.7	30.4
1.004	45.60	5.37	27.810	0.439	0.0	0.0	5.4	0.90	63.8	59.6
1.005	45.13	5.53	27.759	0.447	0.0	0.0	5.5	0.90	63.8	60.1
4.000	48.89	4.42	27.630	0.000	0.0	0.0	0.0	1.39	153.1	0.0
1.008	41.50	6.84	27.275	0.447	0.0	0.0	5.5	1.04	225.6	60.1
1.009	40.88	7.10	27.050	0.447	0.0	0.0	5.5	1.08	306.0	60.1

Appendix E

FOUL WATER SEWER CALCULATIONS

FOUL SEWERAGE DESIGN

Design Criteria for FS_2

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Calculation Method	BS 8301	Maximum Backdrop Height (m)	1.500
Frequency Factor	0.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for FS_2

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	41.178	0.770	53.5	0.000	1344.0	0.0	1.500	o	150	Pipe/Conduit	
1.001	15.129	0.250	60.5	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
2.000	41.859	0.920	45.5	0.000	560.0	0.0	1.500	o	150	Pipe/Conduit	
1.002	22.203	0.247	90.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
3.000	6.135	0.110	55.8	0.000	280.0	0.0	1.500	o	225	Pipe/Conduit	
3.001	19.274	0.290	66.5	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
4.000	19.284	0.386	50.0	0.000	280.0	0.0	1.500	o	225	Pipe/Conduit	
4.001	13.354	0.214	62.4	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	27.500	0.000	0.0	1344.0	0.0	69	1.16	1.20	21.2	9.2
1.001	26.730	0.000	0.0	1344.0	0.0	72	1.11	1.13	19.9	9.2
2.000	27.400	0.000	0.0	560.0	0.0	54	1.11	1.30	23.0	6.4
1.002	26.405	0.000	0.0	1904.0	0.0	73	0.98	1.21	48.1	11.0
3.000	27.300	0.000	0.0	280.0	0.0	44	0.93	1.54	61.2	5.1
3.001	27.190	0.000	0.0	280.0	0.0	46	0.88	1.41	56.0	5.1
4.000	27.700	0.000	0.0	280.0	0.0	43	0.97	1.63	64.7	5.1
4.001	27.314	0.000	0.0	280.0	0.0	45	0.90	1.45	57.8	5.1

Network Design Table for FS_2

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.003	28.263	0.236	120.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
5.000	15.438	0.420	36.8	0.000	560.0	0.0	1.500	o	225	Pipe/Conduit	
5.001	55.080	1.118	49.3	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.004	25.347	0.201	126.1	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.005	10.359	0.081	127.9	0.000	42.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.003	26.158	0.000	0.0	2464.0	0.0	85	0.92	1.05	41.6	12.8
5.000	27.460	0.000	0.0	560.0	0.0	44	1.15	1.90	75.4	6.4
5.001	27.040	0.000	0.0	560.0	0.0	48	1.04	1.64	65.1	6.4
1.004	25.922	0.000	0.0	3024.0	0.0	93	0.94	1.02	40.6	14.5
1.005	25.721	0.000	0.0	3066.0	0.0	94	0.93	1.01	40.3	14.6

FOUL SEWERAGE DESIGN

Design Criteria for FS_1

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	10
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Calculation Method	BS 8301	Maximum Backdrop Height (m)	1.500
Frequency Factor	0.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for FS_1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	11.612	0.204	56.9	0.000	1008.0	0.0	1.500	o	150	Pipe/Conduit	
1.001	10.089	0.146	69.1	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.002	6.562	0.094	69.8	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.003	17.777	0.242	73.5	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.004	25.389	0.314	80.9	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
2.003	12.473	0.119	104.8	0.000	616.0	0.0	1.500	o	150	Pipe/Conduit	
2.004	15.391	0.144	106.9	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.005	12.244	0.102	120.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.006	20.243	0.167	121.2	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
3.000	30.316	0.454	66.8	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	28.100	0.000	0.0	1008.0	0.8	69	1.12	1.16	20.5	8.9
1.001	27.896	0.000	0.0	1008.0	0.8	73	1.04	1.05	18.6	8.9
1.002	27.750	0.000	0.0	1008.0	0.8	73	1.04	1.05	18.5	8.9
1.003	27.656	0.000	0.0	1008.0	0.8	74	1.02	1.02	18.1	8.9
1.004	27.414	0.000	0.0	1008.0	0.8	76	0.98	0.97	17.2	8.9
2.003	27.363	0.000	0.0	616.0	0.7	73	0.85	0.86	15.1	7.3
2.004	27.244	0.000	0.0	616.0	0.7	74	0.84	0.85	15.0	7.3
1.005	27.025	0.000	0.0	1624.0	1.0	79	0.89	1.05	41.6	11.1
1.006	26.923	0.000	0.0	1624.0	1.0	80	0.88	1.04	41.4	11.1
3.000	27.210	0.000	0.0	0.0	0.0	0	0.00	1.41	55.9	0.0

Network Design Table for FS_1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.007	91.977	0.965	95.3	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.007	26.756	0.000	0.0	1624.0	1.0	75	0.97	1.18	46.8	11.1

Appendix F

IRISH WATER STATEMENT OF DESIGN ACCEPTANCE

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

DBFL c/o John Moloney
Ormond House
Upper Ormond Quay
Dublin 7

7 October 2019

Re: Design Submission for Knocknacarra District Centre, Rahoon (the "Development") (the "Design Submission") / Connection Reference No: 0114292540

Dear John Moloney,

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: James O'Malley
Phone: 094 90 43310
Email: jomalley@water.ie

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

Appendix A

Document Title & Revision

- [Watermain Layout] 180191-3005-A
- [Longitudinal Sections Through Foul Sewer Sheet 1] 180191-3021
- [Longitudinal Sections Through Foul Sewer Sheet 2] 180191-3022
- [Longitudinal Sections Through Foul Sewer Sheet 3] 180191-3023
- [Site Services Layout] 180191-3000-A

*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 G

IRISH WATER PRE CONNECTION FEEDBACK FORM

DBFL c/o John Moloney
Ormond House
Upper Ormond Quay
Dublin 7

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
Éire

Irish Water
PO Box 6000
Dublin 1
Ireland

T: +353 1 89 25000
F: +353 1 89 25001
www.water.ie

14th August 2019

Dear Sir/Madam,

Re: Customer Reference No 1000850255 pre-connection enquiry - Subject to contract | Contract denied
Connection for 340 Housing Units & 3,200 sqm of Retail Space

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connections at Knocknacarra, Galway . Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the network(s), as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network(s) can be facilitated.

A wastewater connection can be facilitated to the Irish Water 300mm diameter wastewater network which runs to the south west of the proposed development site. Please see the enclosed indicative Irish Water GIS map which indicates the location of the Irish Water networks. It is noted that the proposed retail type discharge may require a Trade Effluent to Sewer Discharge Licence to be in place prior to connection being made. The applicant is advised to visit https://www.water.ie/for-business/trade-effluent/ in this regard.

A watermain connection can be facilitated to the Irish Water 150mm diameter watermain network. The confirmation of feasibility to connect to the Irish Water infrastructure does not extend to your fire flow requirements. To guarantee a flow to meet the Fire Authority requirements you should provide adequate fire storage capacity within your development.

Strategic Housing Development
Irish Water notes that the scale of this development may dictate that it is subject to the Strategic Housing Development planning process. Therefore in advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services. A design proposal for the water and/or wastewater infrastructure can be submitted to cdsdesignqa@water.ie for assessment.

This feasibility feedback relates to the capacity of the Irish Water network to cater for the proposed development's demand/loadings. Irish Water networks traverse the proposed development site as indicated in the enclosed Irish Water GIS Map. Should you require to divert Irish Water assets you will require to liaise with the Irish Water diversions team. Proposals can be submitted to diversions@water.ie. to allow feasibility feedback to be provided. Further information in this regard is available at https://www.water.ie/connections/developer-services/diversions/.

You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed at a later date.

A connection agreement can be applied for by completing the connection application form available 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.

If you have any further questions, please contact James O Malley from the design team at jomalley@water.ie. For further information, visit **www.water.ie/connections**

Yours sincerely,

Maria O'Dwyer
Connections and Developer Services