Waterman Moylan
Engineering Consultants

Engineering Assessment Report

Proposed Strategic Housing Development at Fosterstown North, Dublin Road / R132, Swords, Co. Dublin

April 2022

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This document has been prepared and checked in accordance with
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Comments

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1. Introduction

Waterman Moylan has been appointed by J. Murphy (Developments) Limited to provide Engineering services on the development of lands at Fosterstown North, Dublin Road/R132, Swords, Co. Dublin.

This report has been prepared as part of a Strategic Housing Development planning submission to An Bord Pleanála, for the proposed development which will consist of 645no. residential units (comprising of 208no. 1-bedroom units, 410no. 2-bedroom units, and 27no. 3-bedroom units), in 10no. apartment blocks, with heights ranging from 4no. storeys to 10no. storeys, including undercroft / basement levels (for 6no. blocks). The proposals include 1no. community facility in Block 1, 1no. childcare facility in Block 3, and 5no. commercial units (for Class 1-Shop, or Class 2- Office / Professional Services or Class 11- Gym or Restaurant / Café use, including ancillary takeaway use) in Blocks 4 and 8. The proposal includes all associated and ancillary development.

This report sets out the intended approach to deal with water/drainage services and road access/parking that would be required to facilitate a high-density residential development on the subject site. It details the options available for the disposal of storm water, disposal of foul water, water supply and road access for the developed site.

The site is located within an area which is identified in the Fingal County Development Plan as being subject to a masterplan. In this regard the "Fosterstown Masterplan" has been published by Fingal County Council and this assessment takes into consideration recommendations within the masterplan relating to the engineering aspects of the proposed development. Objectives WT07, WT08, SW04, SW05, SW06, CC02,DMS16,DMS73, DMS74 and DMS132 of the Development Plan are also considered within this report and outlined below.

Relevant Fingal Development Plan 2017-2023 Objectives

Objective WT07 *Require all new developments to provide separate foul and surface water drainage systems and to incorporate sustainable urban drainage systems*

Objective WT08 *Prohibit the discharge of additional surface water to combined (foul and surface water) sewers in order to maximise the capacity of existing collection systems.*

Objective SW04 *Require the use of sustainable drainage systems (SuDS) to minimise and limit the extent of hard surfacing and paving and require the use of sustainable drainage techniques where appropriate, for new development or for extensions to existing developments, in order to reduce the potential impact of existing and predicted flooding risks.*

Objective SW05 *Discourage the use of hard non-porous surfacing and pavements within the boundaries of rural housing sites.*

Objective SW06 *Encourage the use of Green Roofs particularly on apartment, commercial, leisure and educational buildings.*

Objective CC02 *Implement the specific recommendations of Table CC1 of the GDSDS Regional Policy Volume 5 Climate Change Policy for all housing, commercial and industrial developments within the County.*

Objective DMS16 *Promote and encourage the use of green walls and roofs for new developments that demonstrate benefits in terms of SuDS as part of an integrated approach to green infrastructure provision.*

Objective DMS73 *Ensure as far as practical that the design of SuDS enhances the quality of open spaces. SuDS do not form part of the public open space provision, except where it contributes in a significant and positive way to the design and quality of open space. In instances where the Council determines that SuDS make a significant and positive contribution to open space, a maximum 10% of*

open space provision shall be taken up by SuDS. The Council will give consideration to the provision of SuDS on existing open space, where appropriate.

Objective DMS74 *Underground tanks and storage systems will not be accepted under public open space, as part of a SuDS solution*.

Objective DMS132 *Require the incorporation of rain water harvesting systems in new commercial developments and the use of water butts as a minimum for use in residential developments*

2. Site Description

2.1 Site Location

The site is located in Fosterstown, Swords, Co. Dublin and is bound to the north by a greenfield site, which forms the northern portion of the Swords Masterplan, to the east by the R132 and to the south and west by the Boroimhe residential development. The subject site is located 2km north of Dublin Airport and 1km south of Swords Main Street.

Refer to Figure 2-1 for the location of the proposed development.

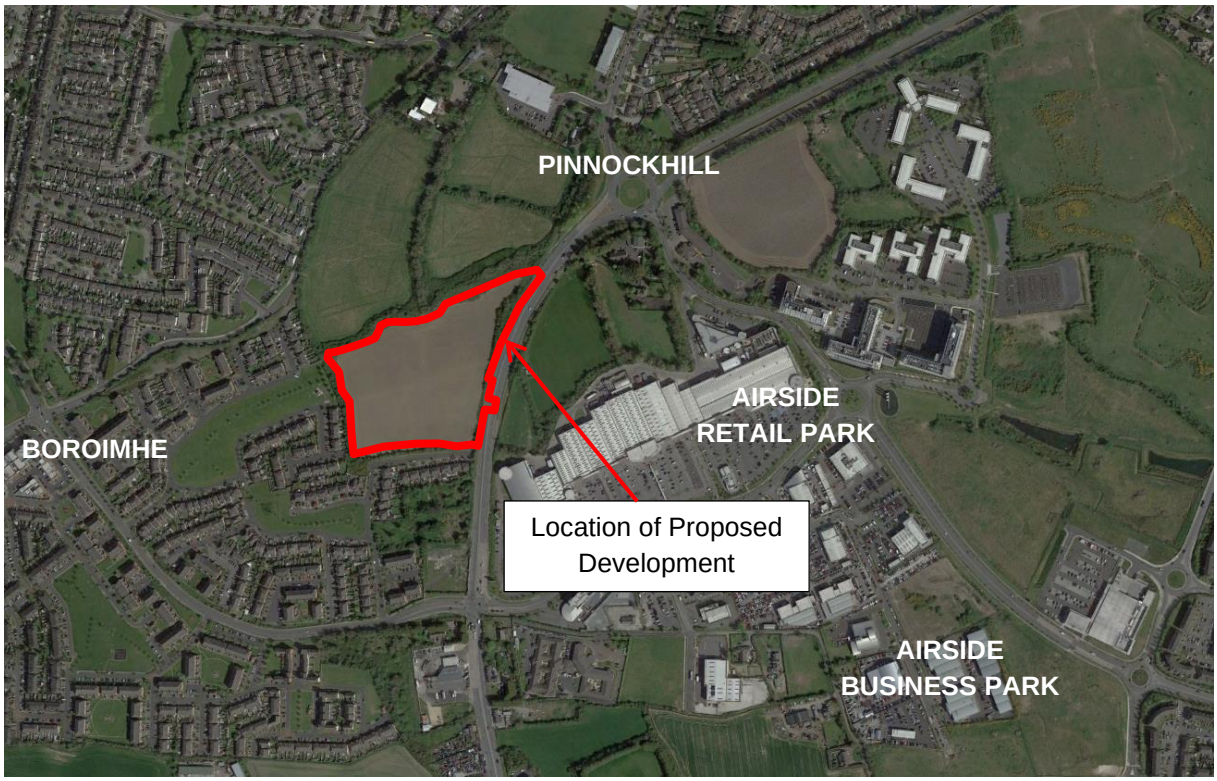


Figure 2-1: Site Location (image taken from Google Maps)

2.2 Existing Land Use

The total site area is approximately 4.635 hectares and is currently greenfield. The site falls from the existing high point in the southwest corner with a level of 47.88m OD Malin to the low point in the northeast corner of the site with a level of 36.75m OD Malin. The site slopes sharply to the northeast with an average slope of 1:34. There is an existing watercourse (Gaybrook Stream) along the entirety of the northern boundary of the site which flows from west to east. The site is currently accessed by a gate from the R132.

Refer to Figure 2-2 for the map of the existing site topography.

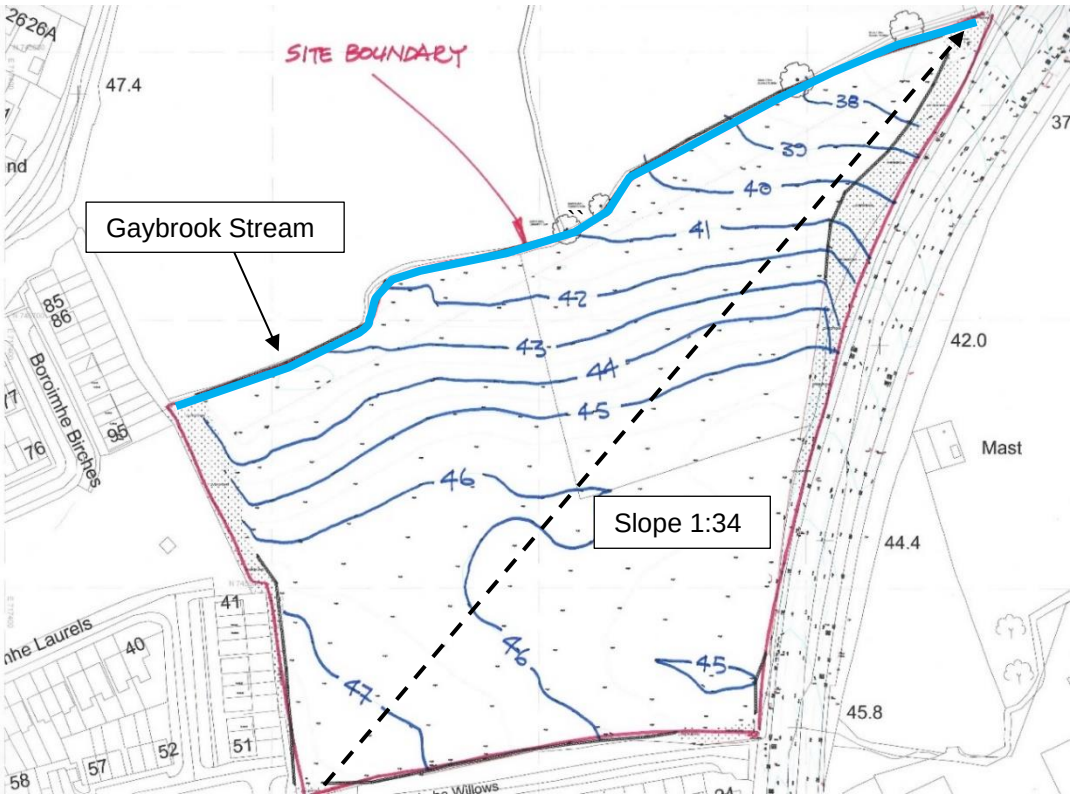


Figure 2-2: Subject Site Topography

2.3 Proposed Development

The proposed development comprises a Strategic Housing Development of 645 no. residential units (comprising 208 no. 1 bedroom units, 410 no. 2 bedroom units, and 27 no. 3 bedroom units), in 10 no. apartment buildings, with heights ranging from 4 no. storeys to 10 no. storeys, including undercroft / basement levels (for 6 no. of the buildings). The proposals include 1 no. community facility in Block 1, 1 no. childcare facility in Block 3, and 5 no. commercial units (for Class 1-Shop, or Class 2- Office / Professional Services or Class 11- Gym or Restaurant / Café use, including ancillary takeaway use) in Blocks 4 and 8.

The development will consist of the following:

- Block 1 comprises 29 no. residential units, within a four storey building (with a pitched roof), including 8 no. 1 bedroom units and 21 no. 2 bedroom units. A community facility (191.8 sq.m) is provided at ground floor level.
- Block 2 comprises 23 no. residential units, within a four storey building (with a pitched roof), including 8 no. 1 bedroom units and 15 no. 2 bedroom units.
- Block 3 comprises 24 no. residential units, within a four storey building (with a pitched roof), including 6 no. 1 bedroom units and 18 no. 2 bedroom units. A childcare facility (609.7 sq.m) is provided at ground floor level.
- Block 4 comprises 93 no. residential units, within a part seven, part eight, and part nine storey building, with an undercroft level, including 34 no. 1 bedroom units, 54 no. 2 bedroom units, and 5 no. 3 bedroom units. 3 no. commercial units (with a GFA of 632.2 sq.m) are provided at ground floor level.

- Block 5 comprises 91 no. residential units, within a part six, part seven, and part eight storey building, with an undercroft level, including 34 no. 1 bedroom units, 55 no. 2 bedroom units, and 2 no. 3 bedroom units.
- Block 6 comprises 54 units, within a part eight, part nine storey building, with an undercroft level, including 13 no. 1 bedroom units, 38 no. 2 bedroom units, and 3 no. 3 bedroom units.
- Block 7 comprises 117 no. residential units, within a part seven, part eight, and part nine storey building height, over a basement level, including 40 no. 1 bedroom units, 76 no. 2 bedroom units, and 1 no. 3 bedroom unit.
- Block 8 comprises 94 no. residential units, within a part six, part seven, part eight, and part nine storey building, over a basement level, including 33 no. 1 bedroom units, 58 no. 2 bedroom units, and 3 no. 3 bedroom units. A commercial unit (with a GFA of 698.2 sq.m) is provided at ground floor level.
- Block 9 comprises 75 no. residential units, within a part seven, part eight, part nine, and part ten storey building, over a basement level, including 23 no. 1 bedroom units, 48 no. 2 bedroom units, and 4 no. 3 bedroom units.
- Block 10 comprises 45 no. residential units, within a part nine, part ten storey building, including 9 no. 1 bedroom units, 27 no. 2 bedroom units, and 9 no. 3 bedroom units.

The development includes a total of 363 no. car parking spaces (63 at surface level and 300 at undercroft / basement level). 1,519 no. bicycle parking spaces are provided at surface level, undercroft / basement level, and at ground floor level within the blocks / pavilions structures. Bin stores and plant rooms are located at ground floor level of the blocks and at undercroft / basement level. The proposal includes private amenity space in the form of balconies / terraces for all apartments. The proposal includes hard and soft landscaping, lighting, boundary treatments, the provision of public and communal open space including 2 no. playing pitches, children's play areas, and an ancillary play area for the childcare facility.

The proposed development includes road upgrades, alterations and improvements to the Dublin Road / R132, including construction of a new temporary vehicular access, with provision of a new left in, left out junction to the Dublin Road / R132, and construction of a new signalised pedestrian crossing point, and associated works to facilitate same. The proposed temporary vehicular access will be closed upon the provision of permanent vehicular access as part of development on the lands to the north of the Gaybrook Stream. The proposal includes internal roads, cycle paths, footpaths, vehicular access to the undercroft / basement car park, with proposed infrastructure provided up to the application site boundary to facilitate potential future connections to adjoining lands.

The development includes foul and surface water drainage, green roofs and PV panels at roof level, 5 no. ESB Substations and control rooms (1 no. at basement level and 4 no. at ground floor level within Blocks 2, 4, 7 and 8), services and all associated and ancillary site works and development.

3. Foul Water Drainage

3.1 Receiving Environment

There are 2 no. foul sewers in the vicinity of the site. There is an existing 300mm diameter foul sewer to the east of the subject site with the R132 and an existing 300mm diameter foul sewer to the south of the proposed development located in Boroimhe Willows. See Appendix A for Irish Water Record Maps.

A Pre-Connection Enquiry form was resubmitted to Irish Water and a response has been received. Please refer to Appendix D for the Irish Water response in February 2021. In summary, Irish Water stated that to accommodate the proposed connection to the Irish Water network at the premises, certain upgrade works are required. As part of the Confirmation of Feasibility received from Irish Water on 17 February 2021, Irish Water has noted that upgrades are required to the surrounding wastewater network as noted below:-

"*Upgrades required for the connection:*

- *Approximately 230m of network extension from the SO17469004 manhole (see figure below) to the Site and;*
- *Approximately 750m of the exisitng 300 mm ID gravity sewer upgrade to 450mm ID in R132 Road, from the SO17469004 manhole to the existing 600mm gravity sewer. The section is highlighted in yellow in the figure below.* "

SITE SPECIFIC COMMENTS	
Wastewater Connection	Upgrades required for the connection: • Approximately 230m of network extension from the SO17469004 manhole (see figure below) to the Site and • Approximately 750m of the existing 300 mm ID gravity sewer upgrade to 450mm ID in R132 Road, from the SO17469004 manhole to the existing 600mm gravity sewer. The section is highlighted in yellow in the figure below. Should you wish to progress with the connection, you have to fund the extension and upgrade works. At connection application stage the network upgrade will be reviewed, and the upgrade works fee will be calculated in the connection offer fee or in a separate upgrade project agreement.

Figure 3-1 Extract from Updated Confirmation of Feasibility received from Irish Water on 17 February 2021

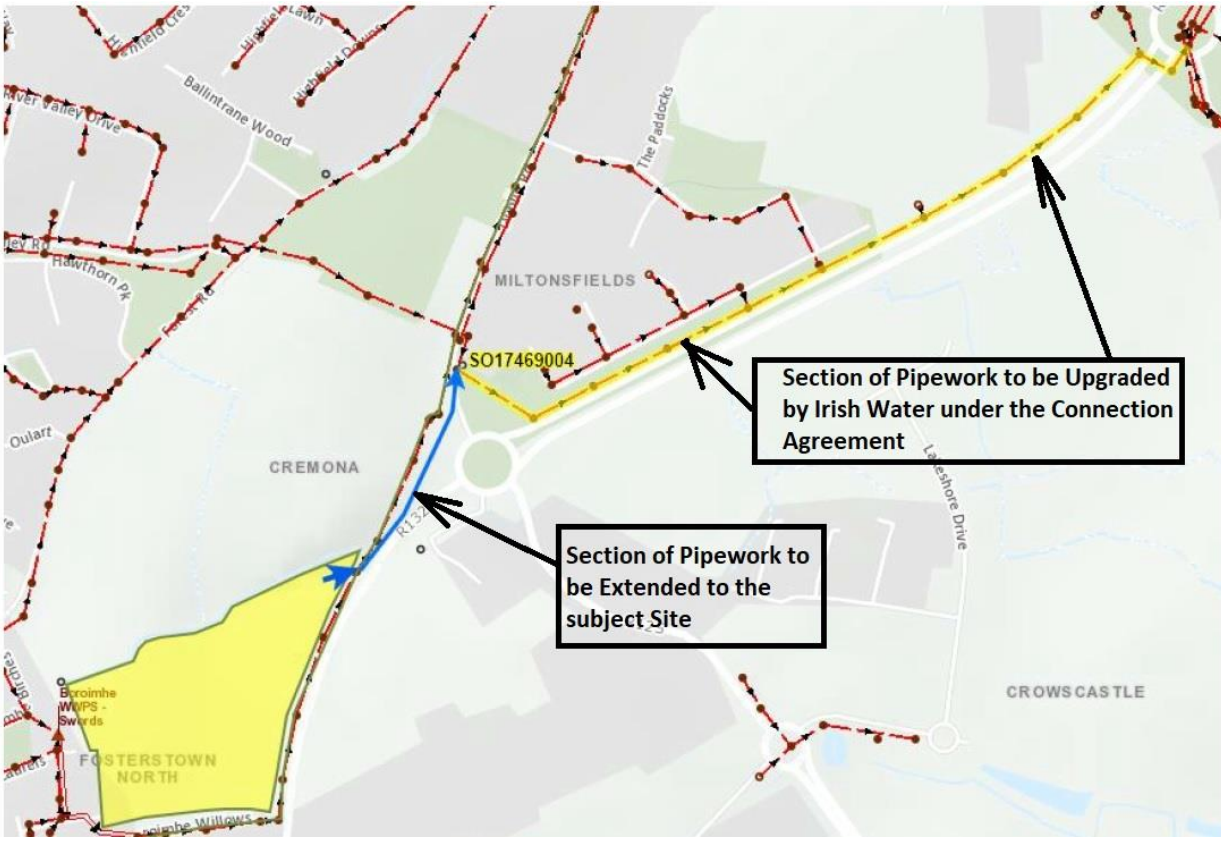


Figure 3-2: Pipework to be upgraded by Irish Water

The connection to the public sewer together with the upgrade of the existing pipework will be carried out by Irish Water under the Connection Agreement that will be entered into with Irish Water. In this regard the normal procedure is that works within the public roadways in respect of Irish Water infrastructure (proposed or existing) will be undertaken by Irish Water. The costs for the upgrade works or extension of the public sewers is calculated by Irish Water when the Connection Application is submitted to Irish Water and these costs are then added onto the Irish Water "Standard Charges" by Irish Water in the Connection offer. They would appear in the Connection Offer as "Quotable Charges".

We would note that the extract included in Figure 3-1 specifically states that the applicant will have to fund the upgrade works and that these costs will be established by Irish Water in the Connection Offer Fee or in a separate Upgrade Project Agreement. In the case of this particular application the costs will be quite significant. As the works are being funded by the applicant through the connection application process, the timelines for the delivery of the upgrades are simply dependant upon the application being submitted, the costs being determined by Irish Water and then being paid by the applicant.

Planning permission is not required for Irish Water to carry out these upgrade works, which are all contained within public roads/verges.

In conclusion, Irish Water have confirmed that a foul water connection to serve the proposed development is feasible subject to upgrade works. The upgrade works will be carried out by Irish Water and will be paid for by the applicant. The upgrade works can be delivered in a timely manner as they do not need planning permission. They just require Irish Water to confirm the cost and the applicant to pay, which is done as part of the Connection Application Process.

A Statement of Design Acceptance for the proposed drainage design has been received from Irish Water on 01 April 2022 and is included in Appendix E.

As part of the development, it is proposed to connect the foul water drainage by gravity to the existing foul sewer in R132 as outlined in Section 3.3 below. This sewer drains northwards ultimately outfalling to the Swords WasteWater Treatment Plant (WWTP). The Swords WWTP was recently upgraded to increase treatment capacity from a population equivalent of 60,000 to a population equivalent of 90,000. The upgraded treatment plant will protect and improve quality of receiving waters at the inner Broadmeadow Estuary, using tertiary treatment by filtration, and disinfection using ultra-violet treatment.

3.2 Proposed Foul Water Drainage

As set above, it is proposed to connect the foul water drainage from the subject site by gravity to the existing foul sewer in R132 via one new connection. As per Irish Water Confirmation of Feasibility, approximately 230m of new foul sewer will be required to connect to existing manhole SO17469004 followed by 750m upgrade gravity sewer from 300mm to 450mm in R132 in order to connect to the existing 600mm gravity sewer to the northeast of the site.

3.3 Foul Water Calculations

The design of the foul water drainage has been based on the "*Code of Practice for Wastewater Infrastructure*", (July 2020) published by Irish Water. The peak foul flow is based on Irish Water recommended peak demand/ flow factors.

The proposed development will consist of the construction of 645 no. residential units, 1no. childcare facility and 5no. commercial units. Based on the Irish Waters Code of Practice, the peak foul flow from the proposed development catchments will be as follows:

Table 3-1: Calculation of proposed Foul Water Flow

Description	No. of Units / Floor Area	Flow l/p/day	Population per Unit / Floor Area	Infiltration Factor	Total Discharge (l/d)
Residential Units	645	150	2.7	1.1	287,347.5
Creche	609.7 m^2	50	42 Staff 197 children	1.1	13,145
Commercial Units	1330.5 m^2	45	133 staff	1.1	6,584
				Totals	307,076 l/d
Calculation of Proposed Peak Foul Flow					
Dry Weather Flow - Residential (DWF)				3.326	l/s
Dry Weather Flow - Commercial (DWF)				0.228	l/s
Peak Foul Flow Residential (=6 x DWF)				19.956	l/s
Peak Foul Flow Commercial (=4.5 x DWF)				1.028	l/s
Total Peak Foul Flow				***20.982***	***l/s***

The peak foul water outflow is **20.982 l/s**. Waterman Moylan Drawing No's 17-062-P210, P211 and P212 illustrate the proposed layout for the foul water sewer outfalls for the subject site, including the proposed

private drainage networks for the ground level and basement level of the development. Waterman Moylan Drawing № 17-062-P214 illustrates the proposed foul water upgrades required by Irish Water.

The proposed foul water outfalls from the development are 225mm diameter pipes laid at a minimum gradient of 1:200, giving a minimum capacity of 32 l/s per outfall. Therefore, the proposed outfall sewers have adequate capacity to cater for the flows from the development.

3.4 Network Design

Drains generally will consist of uPVC pipes (to IS 123) or concrete socket and spigot pipes (to IS 6). Pipes will be laid to comply with the requirement of the Building Regulations 2010, and in accordance with the recommendations contained in the Technical Guidance Documents, Section H. Foul water sewers will consist of concrete pipes (to IS 6) or uPVC capable of resisting jetting pressure of 2,600psi and laid strictly in accordance with Irish Water requirements for taking in charge.

Internal Slung drains will generally consist of Ductile Iron pipework fixed to the underside of the basement floor slab.

In accordance with the Irish Water *"Code of Practice for Wastewater Supply*", 150mm nominal internal diameter sewers have been proposed for carrying wastewater from 20 properties or less; whilst 225mm nominal internal diameter carrying Wastewater from more than 20 properties. Furthermore, where there are at least ten dwelling units connected, the 150mm diameter pipes are laid at a minimum gradient of 1:150 and they will be laid at 1:60 for up to nine connected dwelling units.

4. Surface Water Drainage

4.1 Introduction

The following section deals with surface water drainage design including details of the SUDS measures proposed as part of the development.

The proposed surface water drainage network complies with the GDSDS Regional Drainage Policies Volume 2, for New Developments and CIRIA documents. The Masterplan for Fosterstown has also been considered in preparing the surface water drainage strategy for the development.

There is an existing watercourse to the north of the subject site, the Gaybrook Stream. The site currently drains unrestricted to this watercourse. Surface water for the proposed development will be discharged at a restricted rate to the existing watercourse mimicking the existing greenfield run-off rates or 2l/s/ha as outlined in the Fosterstown Masterplan. Appropriate flow control will be provided to restrict surface water runoff from the proposed development to the required runoff rate, with adequate on-site storage provided to store excessive surface water runoff during extreme rainfall events.

4.2 Site Characteristics

The following parameters have been used in greenfield run-off rate and attenuation calculations:

Table 4-1: Surface Water Catchment Details

	Catchment
Site Area (Catchment) Ha	4.635
Impermeable Area - Ha	3.18
SAAR - mm	915
SOIL Index	0.3
Climate Change	20%

4.3 Greenfield run-off rates

The Fosterstown Masterplan stipulates that the post-development run-off rates are limited to 2l/s/ha for the site. Therefore, for the total site area is 4.635 Ha, the proposed design is based on a maximum outflow limit of 9.27 l/s (4.635 Ha x 2 l/s/ha).

4.4 SUDS Assessment

As per Fingal County Council guidelines surface water should be managed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Volume 2, for New Developments and CIRIA documents. These documents specify that surface water run-off should be managed as close to its source as possible, with the re-use of rainwater within the buildings prioritised.

Sustainable Urban Drainage Systems (SUDS) have been developed and are in use to alleviate the detrimental effects of traditional urban storm water drainage practice that typically consisted of piping run-off of rainfall from developments to the nearest receiving watercourse. Surface water drainage methods that take account of quantity, quality and amenity issues are collectively referred to as SUDS. They are typically made up of one or more structures, built to manage surface water run-off. The use of SUDS to control run-off also provides the additional benefit of reducing pollutants in the surface water by settling out suspended solids, and in some cases providing biological treatment.

A stormwater management or treatment train approach ensures that run-off quantity and quality is improved. The following objectives of the treatment train provide an integrated and balanced approach to help mitigate the changes in stormwater run-off flows that occur as land is urbanised and to help mitigate the impacts of stormwater quality on receiving systems:

1) **Source control:** conveyance and infiltration of run-off; and
2) **Site Control:** reduction in volume and rate of surface run-off, with some additional treatment provided.

In addition, the specific guidelines from Fingal County Council's Fosterstown Masterplan were considered for the SUDS design and the following SUDS strategy is proposed:

- Run-off within the curtilage of the property boundary shall pass through at least one SUDS component prior to discharging to downstream SUDS components within the public realm.
- Run-off from public areas (such as roads, parking bays, hard and soft landscaped areas and footpaths) shall pass through at least two SUDS components prior to discharging to the final downstream detention/retention/polishing SUDS components within the public realm.
- The final SUDS Components located in the public realm shall comprise of a detention basin prior to discharge to the Gaybrook Stream The location of the proposed detention basin is outside the high-end future scenario fluvial flood extents.
- Storage for the 100-year event (as a minimum) including a 20% increase in rainfall intensity for climate change shall be provided for run-off from the public realm, with a maximum discharge rate of 2l/s/ha.

The applicant has considered the use of all appropriate SUDS measures as part of the site SUDS strategy, details are outlined in Table 4-2 below. Refer to drawing 17-062-P213 for the proposed SUDS drainage layout and drawing 17-062-P215 for the SUDS details.

Table 4-2: SUDS Measures

SUDS Stage	SUDS Measure	Measure Outline	Use on site
Source Control	Green Roofs	Green Roofs are roofs with a vegetated surface that can provide attenuation and treatment of rainwater. They also provide evapotranspiration from the roof's plants and substrate, reducing run-off volumes and the burden on the drainage network.	It is proposed to use green roofs on the roofs of the proposed apartment blocks for both treatment and interception storage.
	Permeable Multi-use playing surface	Permeable surfaces are alternative surfaces to standard finishes that allow stormwater run-off to filter through voids in the surface into an underlying stone reservoir, where it is temporarily stored and/or infiltrated.	A permeable playing surface will be used on the playing pitches with a stone reservoir beneath to attenuate surface water before discharging to the stream. Ground conditions do not allow for infiltration on site as demonstrated in the site Investigation and Infiltration testing carried out on site in June 2005 and November 2019 respectively. Refer to appendices H and I.
SUDS Stage	SUDS Measure	Measure Outline	Use on site
Site Control	Detention Basin and Hydrobrake	A detention basin is a landscaped depression which is normally dry, except during and following rainfall events. They are designed to provide storage and treat run-off. Hydrobrakes are used to restrict the outfall from the detention basins. This ensures the development will not give rise to an increase in surface water flow rates downstream of the site.	It is proposed to use 4 detention basins as a secondary form of treatment and final storage of surface water on site before discharging to the watercourse to the north of the development via hydrobrakes.
	Petrol Interceptor	A petrol interceptor is a trap used to filter out hydrocarbon pollutants from rainwater run-off. It is typically used in road construction to prevent fuel contamination of water courses carrying away the run-off. Petrol interceptors work on the premise that some hydrocarbons such as petroleum and diesel float on the top of water. The contaminated water enters the interceptor typically after flowing off roads and entering a drain before being deposited into the first tank inside the interceptor. The first tank builds up a layer of the hydrocarbon as well as other scum preventing it from entering the water course.	A Petrol Interceptor will be installed, upstream of the discharge point into the porous playing surface attenuation layer for any areas that could not benefit from source control treatment. A petrol interceptor will also be used in the basement carpark before discharging to the local foul sewer network.

In accordance with Fingal County Council SUDS pro-forma, Section 26 of CIRIA C753 (The SUDS Manual), the pollution prevention guidelines have been followed to ensure appropriate levels of treatment are provided before attenuated run-off from the site is discharged into the Gaybrook Stream. The use of these

guidelines is outlined in section 4.6 of this document. Fingal County Council pro forma for SUDS has also been completed and is included in Appendix G.

4.5 Mitigation Measures

The Pollution Hazard Indices, shown in Table 4-3 below, for the different proposed land uses have been derived from Table 26.2 of CIRIA C753.

Table 4-3 Pollution Hazard Indices for different land uses

	TSS	Metals	Hydro-carbons
Apartment roof	0.2	0.2	0.05
Residential road/car park	0.5	0.4	0.4
Main access road	0.7	0.6	0.7

In order to ensure the proposed SUDS strategy will appropriately mitigate against the potential pollution derived from these areas the Pollution Mitigation Indices (PMI) in Table 26.3 and 26.15 of CIRIA C753 have been reviewed and laid out in Table 4-4 below:-

Table 4-4 Indicative SUDS mitigation indices for discharge to surface waters

	TSS (PMI)	Metals (PMI)	Hydro-Carbons
Permeable Paving/Porous Play Surface	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Green Roof	0.8	0.7	0.9

For each land use different mitigations have been applied. Below are shown the calculations for the total pollution prevention for each type of hard standing on site. The calculation has been made in line with CIRIA C753 as follows:

- The following formula has been used to calculate the total mitigation in line with CIRIA C753.

  $$Total\ SUDS\ Mitigation\ index = Mitigation\ Index_{1} + 0.5(Mitigation\ Index_{2}) + 0.5(Mitigation\ Index_{3}) \quad [1]$$

- Total Mitigation index is then taking away from the pollution Hazard indices for the land use in order to determine if sufficient treatment has been provided. A negative number indicates that enough treatment has been provided and a positive number indicated additional forms of treatment are required.

  $$Total\ SUDS\ mitigation = Pollution\ Harzard_{Table\ 5} - Total\ SUDS\ Mitigation\ Index_{[1]} \quad [2]$$

Below are shown the calculations for the total pollution prevention for each type of hard standing on site.

Main Access Road: water on main road will be discharged into the permeable car parking spaces followed by the porous play surface.

Table 4-5 SUDS Mitigation Indices for Main Access Road

SUDS Mitigation Indices			
	TSS	Metals	H-C
Permeable Paving	0.7	0.6	0.7
(x0.5)Porous Play Surface	0.35	0.3	0.35
Total Index [1]	1.05	0.9	1.05

Table 4-6 SUDS Mitigation for Main Access Road

Total SUDS Mitigation			
	TSS	Metals	H-C
Pollution Hazard Table 5	0.7	0.6	0.7
	0.7 – 1.05	0.6 – 0.9	0.7-1.05
Total SUDS Mitigation [2]	-0.35	-0.3	-0.35

Therefore, adequate treatment is provided for the main access road. For those areas where there is not parking permeable space, appropriate treatment is provided using a class I Petrol Interceptor.

Surface Car Park: surface water from the carpark spaces will be treated through permeable pavement and the porous play surface.

Table 4-7 SUDS Mitigation Indices for Surface Car Park

SUDS Mitigation Indices			
	TSS	Metals	H-C
Permeable Pavement	0.7	0.6	0.7
(x0.5)Porous Play Surface	0.35	0.3	0.35
Total Index [1]	1.05	0.9	1.05

Table 4-8 SUDS Mitigation for Surface Car Park

Total SUDS Mitigation			
	TSS	Metals	H-C
Pollution Hazard Table 5	0.5	0.4	0.4
	0.5 – 1.05	0.4 – 0.9	0.4 – 1.05
Total SUDS Mitigation [2]	-0.55	-0.5	-0.65

Therefore, adequate treatment is provided for the surface parking area.

Apartment Roofs Blocks 1 to 3: surface water from the apartment roofs will be treated by green roofs and discharged into the Porous Play Surface.

Table 4-9 SUDS Mitigation Indices for Apartment Roofs Blocks 1 to 3

SUDS Mitigation Indices			
	TSS	Metals	H-C
Green Roof	0.8	0.7	0.9
(x0.5)Porous Play Surface	0.35	0.3	0.35
Total Index [1]	1.15	1.0	1.25

Table 4-10 SUDS Mitigation for Apartment Roofs Blocks 1 to 3

Total SUDS Mitigation			
	TSS	Metals	H-C
Pollution Hazard Table 5	0.2	0.2	0.05
	0.2 – 1.15	0.2 – 1.0	0.05 – 1.25
Total SUDS Mitigation [2]	-0.95	-0.8	-1.2

Therefore, adequate treatment is provided for the Apartment Block Roofs 1-3.

Apartment Roofs Blocks 4 to 10: surface water from the apartment roofs will be treated by green roofs and discharged into the detention basin to the northwest of the site.

Table 4-11 SUDS Mitigation Indices for Apartment Roofs Blocks 4 to 10

SUDS Mitigation Indices			
	TSS	Metals	H-C
Green Roof	0.8	0.7	0.9
(x0.5)Detention Basin	0.25	0.25	0.3
Total Index [1]	1.05	0.95	1.2

Table 4-12 SUDS Mitigation for Apartment Roofs Blocks 4 to 10

Total SUDS Mitigation			
	TSS	Metals	H-C
Pollution Hazard Table 5	0.2	0.2	0.05
	0.2 – 1.15	0.2 – 1.0	0.05 – 1.25
Total SUDS Mitigation [2]	-0.85	-0.75	-1.15

Therefore, adequate treatment is provided for the Apartment Block Roofs 4-10.

Podium (residential/road carpark): top level of podium composed by footpaths, cycle paths and public open space will have green podium features, therefore water will be treated through the landscape areas on the green podium to follow a detention basin.

Table 4-13 SUDS Mitigation Indices for Podium

SUDS Mitigation Indices			
	TSS	Metals	H-C
Green Roof/Podium	0.8	0.7	0.9
(x0.5)Detention Basin	0.25	0.25	0.3
Total Index [1]	1.05	0.95	1.2

Table 4-14 SUDS Mitigation for Podium

Total SUDS Mitigation			
	TSS	Metals	H-C
Pollution Hazard Table 5	0.2	0.2	0.05
	0.2 – 1.15	0.2 – 1.0	0.05 – 1.25
Total SUDS Mitigation [2]	-0.85	-0.75	-1.15

Therefore, adequate treatment is provided for the podium level.

As described above, all the hardstanding on-site passes through adequate levels of treatment to remove the Total Suspended Solids, Metals and Hydrocarbons present before discharge to the watercourse. In conclusion, the quality of the surface water discharge from the proposed development will be high.

4.6 Storm Water Calculations

The total area of the subject site is 4.635 Ha, the impermeable area of the site including roads, car-parking and roofs, is approximately 3.3 Ha, and the peak outflow will be limited to 9.2 l/s for the 1 in 100-year event plus 20% allowance for climate change. The proposed surface water drainage network can be seen on Waterman Moylan drawings 17-062-P210.

The drainage for the proposed development, has been designed as two catchment areas, similar to the foul water network. The two catchment areas are shown in Figure 4-1 and the calculations for each catchment area are set out below.

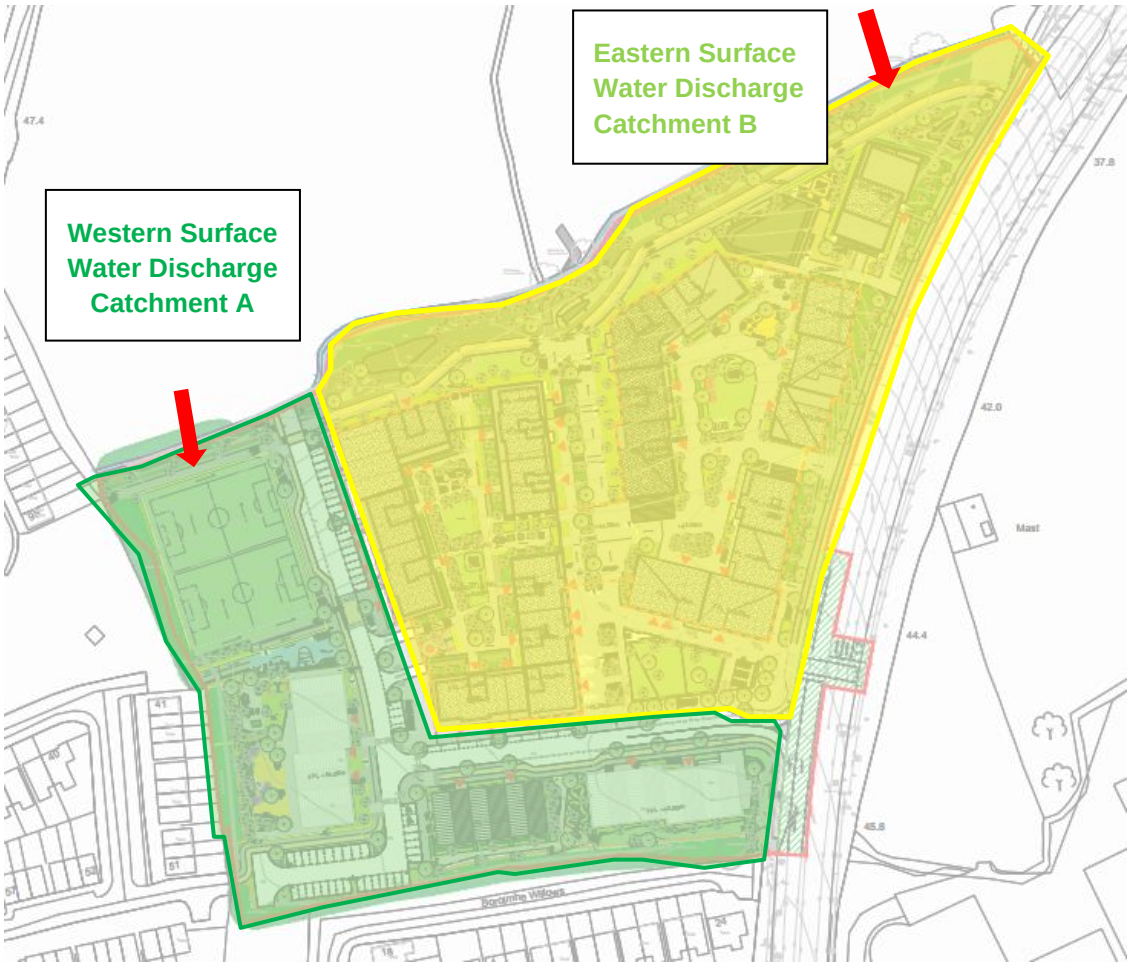


Figure 4-1: Surface Water Catchment Areas

Catchment A

Catchment A comprises the south and western area of the subject site. It is composed of Apartment Blocks 1,2 and 3, the access road through the site and two sport pitches. The overall catchment area is 1.74 Ha with approximately 1.1 ha of hardstanding. A local surface network designed within the internal roads will discharge water to a granular attenuation layer beneath the sports pitches, as indicated on the accompanying Waterman Moylan Drawing No. 16-062-P210.

Storage calculations indicate that for a return period of 100 years + 20 % allowance climate change, the 1440 minutes winter storm event is critical and requires a storage volume of 650m^3 assuming a void ratio of 30% in the stone layer. The sports pitches provide 648m^3 of stormwater attenuation in the sub-base and the remaining 2m3 of storage is provided in the perforated pipes within the sub-base. Water from the pitches' sub-base will discharge to the Gaybrook Stream via a hydrobrake limiting the discharge to 3.4 l/s.

Catchment B

Catchment B comprises the remainder of the site (2.89 Ha) with approximately 2.08 ha of hardstanding. This catchment will attenuate water falling on the roof of apartment blocks 4-9 and on the podium level in an attenuation tank positioned in the basement of the Blocks 4-9 parking area. Apartment Block 10 and the footpath adjacent the Gaybrook stream will be attenuated in detention basin 4 adjacent Apartment Block

10, the remainder of the footpath will be attenuated in the small detention basins along the northern boundary of the site, as indicated on the accompanying Waterman Moylan Drawing No. 16-062-P210.

Surface water will be discharged from the basement attenuation tank to detention basin 3 at a rate of 4.6 l/s. Detention basin 3 will then discharge into the same surface water network as detention basin 4. The final outfall from this catchment is then restricted to 5.8l/s by a hydrobreak, before discharging to the Gaybrook Stream.

Table 4-15 shows a summary of impermeable areas, volume required and outflow rate for each of the attenuation systems within Catchment B. Additionally, volume storage calculations can be found in Appendix F. The proposed attenuation tank will provide 1220.8 m^3 of attenuation storage and the remainder of the storage will be provided in four detention basins (3 small and 1 large) located in the public realm. The tank will have a footprint of 759.5 m^2 and a depth of 1.65 m.

Table 4-15 Surface Water Summary

Attenuation System	Imp. Area (ha)	Areas Draining	Critical Storm	Volume Required (m^3)	Outflow Rate restriction via hydrobrake (l/s)
Tank at basement Level	1.83	Block 4-9, Basement/undercroft car park and Podium	2160 min Winter	1,171	4.6
Detention Basin 1	0.045	Adjacent Footpaths	15 min Winter	3.2	5.8*1
Detention Basin 2	0.027	Adjacent Footpaths	30 min Winter	0.8	
Detention Basin 3	0.061	Adjacent Footpaths	600 min Winter	40.36	
Detention Basin 4	0.118	Block 10	600 min winter	62.4	
Total	2.08				5.8

*1 – A final hydrobrake manhole located prior to the headwall will control the outfall rate for Catchment B to 5.8 l/s. This last hydrobrake will allow any surface water going through the detention basins to be attenuated and stored in the Detention Basins prior to discharging to the Gaybrook Stream.

Overall Site Catchment Areas

As discussed in Section 4.3 the maximum allowable outflow for the development is 9.27 l/s which equates to the greenfield runoff rate for the entire site. The surface water strategy outlined above discharges 3.4 l/s from Catchment A and 5.8 l/s for Catchment B into the Gaybrook Stream giving a total outflow rate of 9.2 l/s for the overall development. The proposed outflow is therefore less than the maximum allowable outflow 9.27 l/s. and therefore is considered acceptable.

4.7 Network Design

As described above the proposed surface water drainage system for this development has been designed as a SUDS system and uses filter drains, green roofs, permeable surfacing, detention basins, and an

attenuation tank in the basement together with flow control devices and a petrol interceptor to treat run-off and remove pollutants to improve quality, restrict outflow and control quantity.

Strict separation of surface water and wastewater will be implemented within the development. Surface water local drains will be a minimum 225mm dia. and generally will consist of uPVC (to IS123) or concrete socket and spigot pipes (to IS 6). These drains will be laid to comply with the requirement of the Building Regulations 2010, in accordance with the recommendations contained in the Technical Guidance Documents, Section H and will be laid strictly in accordance with the taking in charge requirements of Fingal County Council.

5. SUDS Maintenance

For the SUDS strategy to work as designed it is important that the entire drainage system is well maintained. It will be the responsibility of the site management team to ensure the drainage system is maintained during construction and until handover of the development to the Management Company. The Management Company will then assume responsibility for the maintenance and upkeep of the surface water drainage network including all SuDS. Maintenance and cleaning of gullies, manholes (including catch pits) and attenuation tanks will ensure adequate performance. The recommended program is outlined in the tables below.

Table 5-1 Permeable Paving Maintenance Schedule

SUDS Element	Maintenance		
Permeable Playing Surface	Maintenance period	Maintenance Task	Frequency
	Regular	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or as required, based on site specific observations of clogging or manufacturer's recommendations.
	Occasional	Removal of weeds	As required
	Remedial work	Remediation work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users	As required
	Monitoring	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually

Table 5-2 Green Roof Maintenance Schedule

SUDS Element	Maintenance		
Green Roof	Maintenance Issues	Vegetation becoming either overgrown or dying	
	Maintenance Period	Maintenance Task	Frequency
	Regular	Inspect all components including soil substrate, vegetation, drains, membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
		Inspect soil substrate for evidence of erosion channels and identify any sediment source	Annually and after severe storms
		Inspect drain inlets to ensure unrestricted run-off from the drainage layer to conveyance or roof drain system.	Annually and after severe storms
		Inspect underside of roof for evidence of leakage.	Annually and after severe storms
		Remove debris and litter to prevent clogging of inlet drains and interference with plant growth.	Six monthly and annually or as required
		During establishment (i.e. year one), replace dead plants as required.	Monthly

		Post-establishment, replace dead plants as required (where >5% of coverage)	Annually (in autumn)
		Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
		Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
		Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate.	Six monthly or as required
	Remedial Work	If erosion channels are evident, these should be established with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
		If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Table 5-3 Detention Basin Maintenance Schedule

	Maintenance period	Maintenance Task	Frequency
Detention Basin	**Regular**	Remove the litter and debris	Monthly, or as required
		Cut grass – to retain height within specified design range.	Monthly (during growing season), or as required
		Manage other vegetation and remove nuisance plants.	Monthly at start, then as required
		Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
		Inspect infiltration coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
		Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
	Occasional	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if soil is exposed over 10% or more of the swale treatment area
	Remedial actions	Repair erosion or other damage by re-turfing or re-seeding	As required
		Re-level uneven surfaces and reinstate design levels	As required
		Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
		Remove and dispose of oils or petrol residues using safe standards practices	As required

6. Water Supply

6.1 Water Supply – General

There is an existing 225 mm watermain along the R132 roadway to the east of the proposed development. There is also of network of watermains within the Boroimhe housing development to the west and south of the subject site, ilcuding a trunk 225 mm diameter watermain.

Previous Irish Water Applications

A Pre-Connection Enquiry form was submitted to Irish Water in December 2018 and a Confirmation of Feasibility ref. CDS19000250 was received on 28 February 2019. In summary, Irish Water confirmed that the existing water infrastructure can accommodate a development of 710№ residential units on the subject site. Please refer to Appendix B for the Confirmation of Feasibility.

Furthermore, the design of this scheme was developed to detailed design stage, and a Statement of Design Acceptance from Irish Water was received for this development on 22 June 2020. Please refer to Appendix C for the Statement of Design Acceptance.

Current Irish Water Application

An updated Confirmation of Feasibility was received from Irish Water on 17 February 2021. Please refer to Appendix D for the updated Confirmation of Feasibility (COF). As part of the COF, Irish Water has again stated no further upgrades are required for the water supply network and has no objections to the proposed connection.

The detailed design information for the subject application was submitted to Irish Water and an updated Statement of Design Acceptance was received from Irish Water on 01 April 2022 (refer to Appendix E).

The updated confirmation of Feasibility set out site specific design parameters which were incorporated into the design, namely:

The minimum depth of cover from the finished ground level to the external crown of a Water Main shall be 900mm. A greater depth of cover and/or greater strength pipe and/or a higher class of bedding may be required where high traffic loading is anticipated. Depths may be altered to avoid obstructions, including separation distances between other utility services. The desirable maximum cover for a Service Connection pipe or a Water Main should be 1200mm, where practicable.

It is further noted that:

- All watermain T-junctions will 90-degree angles as per STD-W-07;
- All services connections to be less than, or equal to 15m;
- Hydrants will not be closer than 6m to any structure;
- In general, mains will not extend further than 1.2m beyond the final service connection to mitigate dead-ends where possible;

It is proposed to connect the development to the existing 225mm watermain in the R132 as per Irish Water's requirements.

6.2 Water Supply Network

It is proposed to service the development via a 200mm diameter PE watermain laid in a loop around the apartment blocks within the internal road and footpath network. 2no. connections will be made onto the existing 225 mm watermain within the R132, one to the south adjacent to the entrance to the development, and one to the north, c 204m north of the site entrance. Each connection will include provision for an Irish Water Bulk Meter.

6.3 Water Supply – Calculations

The proposed development will consist of the construction of 645no residential units, 1№ childcare facility and 5№ commercial units. Based on the Irish Waters Code of Practice, the water demand from the proposed development will be as follows:

Table 6-1: Water Supply-Demand Calculations

Description	№ of Units / Floor Area	Usage l/p/day	Population per Unit / Floor Area	Total Demand (l/d)
Residential Units	645	150	2.7	261,225
Creche	609.7 m²	30	42staff 197 children	7,170
Commercial and Comunnity	1,330.5 m²	45	133 staff	5,985
Total				**274,380 l/d**

The total water requirement from the public supply, for the development, is estimated at 274 m^3/day. Waterman Moylan Drawing 17-062-P310 included as part of this submission shows the proposed water supply layout for the development.

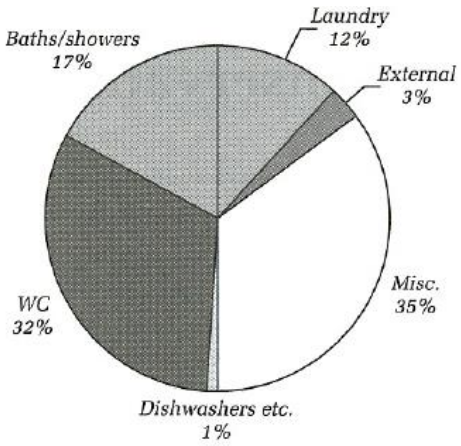
6.4 Water Conservation

The water demand for development can be subdivided as follows:

- Potable / Non-potable Breakdown

Detailed studies have quantified the breakdown between potable and non-potable uses for residential uses.

The following diagram illustrates the current percentage breakdown of water usage in domestic circumstances and is from Griggs and Shouler 1994 as published in Chapter 11 of 'Water, Sanitary & Waste Services for Buildings' by Wise and Sheffield.



In addition, water conservation measures will be used, to further reduce overall water demand, including:

- Low volume flush / dual flush WC's

- Aerated showerheads
- Spray taps
- Draw off tap controls
- Leak detection measures – through the metering of supply

7. Transport

7.1 Introduction

An independent site-specific Transport Impact Assessment (TIA) has been carried out for the proposed development by OCSC and is included under separate cover as part of this application. OCSC were also appointed by the adjoining landowners to the northwest of the subject site to prepare a traffic impact assessment as part of their development proposals. In this regard, the Traffic Impact Assessment considered the development of the adjoining lands together with the subject lands.

The adjacent site (Reg. Ref An Bord Pleanála Ref ABP-308366-20) relates to the construction of a mixed use development ranging in height from 5 no. storeys to 9 no. storeys from street level. The development will comprise a total of 278 no. apartment units, internal amenity space (218.8 sq.m), 1 no. creche facility (354.4 sq.m) and 1 no. retail unit (262 sq.m). The site is bound to the west by Forrest Road where the main access for the site is proposed. An Bord Pleanala granted planning permission on the 3rd February 2021 subject to 28 no. conditions. Condition 3 requires the reduction in height of Block A to 8 no. storeys and the amendment of Block B to form two distinct blocks. Condition 7(b), the developer is required to "facilitate the provision of a future road access to the lands south of the proposed development that form part of the Masterplan lands.

The site will be accessed via a new temporary access from the R132/Dublin Road. The proposed temporary vehicular access has been designed in such a way that it can be closed upon the provision of permanent vehicular access as part of development on the lands to the north of the Gaybrook Stream. Furthermore, there are two potential future accesses to be facilitated by the Planning Authority to the west of the site for pedestrians and cyclists. Further details of which are discussed in the following sections.

In addition, an assessment of the Public Transport Capacity has been undertaken in order to demonstrate that there is adequate spare capacity in the existing network to facilitate development and this stand alone report is included as part of the submission.

7.2 Site Access

Left In / Left Out Proposal

It is proposed to construct a temporary left in/left out junction to access from the R132 which can be closed off when the roads infrastructure set out in the Fosterstown Masterplan is constructed and access via this infrastructure is available to connect to the public roads. A letter of support for the from the adjoining landowner, MKN Properties Ltd. is included as part of the planning application confirming the proposed layout is in line with the indicative layout proposed in the Fosterstown Masterplan and that the proposed layout does not prejudice the future delivery of the future connectivity between the northern and southern portion of the masterplan area.

The independent Traffic Impact Assessment prepared by OCSC demonstrates the proposed access can operate well within normal capacity limits under a left / in left out arrangement and will have no negative impact on the operation of the local road network. Similarly, the assessment demonstrates that the proposed development as a whole will have a low impact on the operation of the links and junctions in the local network.

Vehicles exiting the proposed development who wish to travel southbound towards Dublin will be able to turnaround at the Pinnock Hill Roundabout to access the southbound side of the R132. In the event that this junction is upgraded to a signal-controlled junction (currently proposed by Fingal County Council) those wishing to travel southbound can turn right into airside and travel through Airside to the R132 at Boromihe.

Vehicles arriving from the north will turn left at Pinnock Hill roundabout and travel through Airside, refer to Figure 7-1 for details of the routes.

Figure 7-1: Access Routes for Southbound Traffic Entering/Exiting the Development

Fosterstown Masterplan 2019

It is noted that the current policy/objectives of Fingal County Council as set out in the Fosterstown Masterplan 2019 propose that access to the masterplan lands is provided from the proposed future Fosterstown Link Road to the North and from the existing Forest Road to the West. In this regard the current masterplan requires the subject lands to be accessed through third party lands, adjoining the subject site to the north of the Gaybrook Stream (See Figure 7-2 below). The new Fosterstown Link Road and the access via the lands to the north are not yet delivered, and therefore the applicant's lands would be effectively landlocked until the Proposed Fosterstown Link Road and access via the lands to the north is delivered, despite having over 250m of site frontage directly onto the R132.

Refer to Figure 7-2 which shows an extract of the site's proposed access, extracted from the 2019 Fosterstown Masterplan, which includes arterial main road, link street, local access street, restricted access street, nature path, and pedestrian connection access proposals for the subject site.

Figure 7-2: Fosterstown Masterplan Extract with Subject Site

Waterman Moylan's proposal for the access to the site has considered the current policy/objective whilst also taking account of the need to be able to develop the site without relying on third parties. In this regard, our pre-application submission to An Board Pleanala had proposed a signalised junction to access the development which facilitated vehicular movements in all directions. As described above it is now proposed to seek a temporary left in/left out junction to access from the R132/Dublin Road which can be closed off when the roads infrastructure set out in the Fosterstown Masterplan is constructed and access via this infrastructure is available to connect to the public roads.

Refer to Figure 7-3 which shows the temporary and future permanent proposal for the access junction to the proposed development.

The proposed roads layout together with the temporary left in/left out junction were subjected to a Road Safety Audit (RSA) which is included under separate cover with this application. The RSA identified a number of issues with respect to the proposed left in left out junction which have been addressed by way of amendments to the layout which now form part of this planning submission. The Road Safety Auditor has accepted that the proposed amendments adequately address the concerns raised in the RSA and in this regard has closed out Stage 1 of the audit.

Figure 7-3: Left in/Left Out – Temporary Arrangement (left hand image) and Future Permanent Arrangement (Right hand image)

7.3 Bus Connects

The current Bus Connects proposals were reviewed to determine if the proposed temporary left in/left out junction would have any impact upon the delivery of the Bus Connects proposals. In this regard we have overlaid the temporary left in/left out junction onto the Bus Connects proposals as presented by TII in the most recent public consultation (November 2020 – Preferred Route Option) to show how this junction can be accommodated within the Bus Connects proposals. Details are set out in Figure 7-4 overleaf.

We would be of the opinion that the proposed temporary left in left out junction will not have any implication for the strategic function of the R132 in terms of Bus Connects.

The left in/left out junction will be an uncontrolled junction which will not allow right turning vehicles so it will not obstruct the flow of traffic and therefore will not give rise to any impact on the strategic function of the road. The bus connects proposals include improvements to pedestrian and cycle connectivity by way of footpaths and cycle paths along the bus route. The proposed footpath and cycle path can be accommodated in accordance with the objectives of the Bus Connects proposals. The detailed design of the left in/left out junction can be done in conjunction with TII/Fingal County Council if planning permission

is granted for the proposed development. The overlay exercise presented in Figure 7-4 clearly indicates that the provision of the temporary left in/left out junction can be accommodated within the Bus Connects proposals.

Figure 7-4 - Proposed Temporary Left in/Left out junction incorporated into Bus Connects Proposals

7.4 Car Parking

The proposed development comprises 645no. apartments, a childcare facility and commercial services units. Parking for the residents and creche will be provided with parking at basement level beneath apartment blocks 4 to 9. Visitors and disabled parking will be provided at ground level.

The following table outlines the breakdown of the carparking spaces provided on completion of the development and justification for the reduced parking provision is outlined in the Carparking Rational and Mobility Management Plan which is included as part of this application under a separate cover.

Table 7-1 Car Parking Required and Provided

Land-Use	Max FCC Requirements	Units / Staff Members	Proposed Car Parking Spaces
Apartment	1 per 1 bed unit	208	330
	1.5 per 2 bed unit	410	
	2 per 3 bed unit	27	
Visitors	1 per every 5 units	645	-
Crèche	0.5 per classroom	42 staff 197 children	10
Commercial and Community Facility units	1 per 30 sqm	1,330.5 m^2	23
Total			**363**

The total car parking proposed for the apartments is 330 spaces with 300 spaces at undercroft / basement level and 30 spaces at surface level. A total of 10 car spaces are proposed for the childcare facility, and 23 spaces are proposed for the community facility and commercial units. The creche and retail parking will be provided at surface level. An overall total of 363 car parking spaces will be provided within the development.

The Fosterstown Masterplan seeks to encourage the use of public transport and in the case of commercial uses, Fingal County Council maximum car parking standards will be reduced by 50% after the delivery of Metrolink. After the construction of the metro station, any excess car parking spaces will revert to designated green open space or an alternative permissible use, in line with the Masterplan. The proposed parking ratio provided for this development is 0.51, with 330 parking spaces for the apartments and 645 apartment units.

7.5 Cycle Parking

Table 12.9 of the 'Fingal Development Plan 2017-2023' sets out the cycle parking requirements as follows:

Table 7-2 Total cycle parking spaces required

Land-Use	FCC Requirements	Proposed Development	Number of Bicycle Parking Spaces Required
Apartment	1 per unit	645	645
Commercial units and Community facility	1 per 100 sqm	1,330 sqm	14
Crèche	0.5 per classroom	42 staff 197 children	21
Visitor Spaces	1 per 5 apartment unit	645	129
Total			**809**

The Design Standards for New apartments, who set out a requirement of 1 long stay space per bedroom and 1 visitor space for every two units, have also been reviewed with regards to cycle parking requirements and are set out in Table 7-3 below.

Table 7-3 Bicycle Design Standards for New apartments

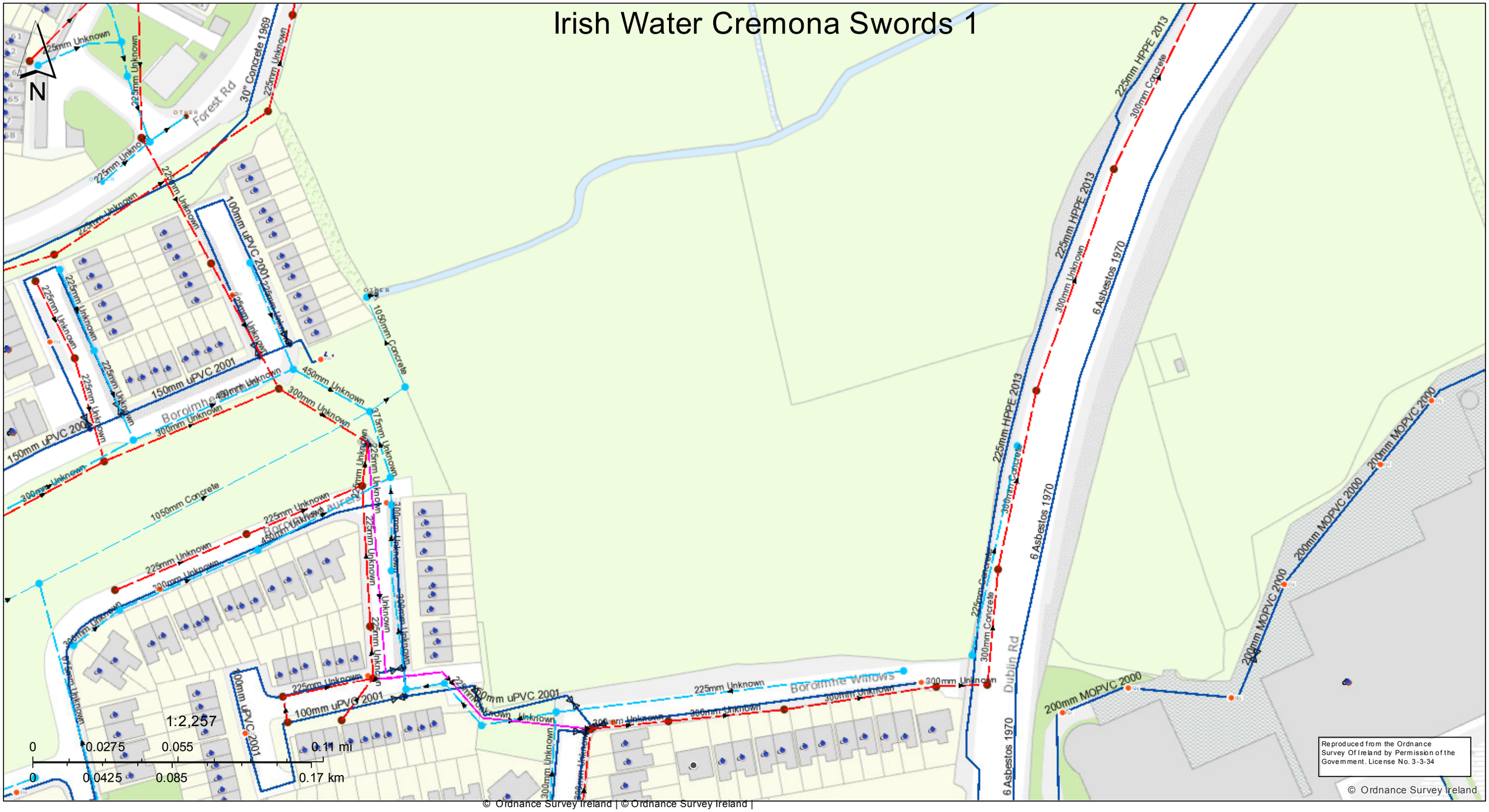
Land Use	Beds/Units		Long stay parking required (National Standards)	Short stay parking required (National Standards)
Residential – Long Stay	1,109 beds	1 space per bedroom	1,109	
Residential – Short Stay	645 units	1 space per 2 units		323
Total			**1432**	

It is proposed to provide a total of **1,519 cycle** parking spaces for the apartments and commercial units, with 347 spaces at the surface level, 244 spaces at the ground floor level in secure parking, 100 spaces within the store secured parking, and 828 basement spaces. This level of cycle parking provision exceeds both the Development Plan and Design Standards for New apartments requirements. The location of the cycle parking can be seen on the accompanying architect's drawings.

APPENDICES

A. Irish Water Record Drawings

Irish Water Cremona Swords 1



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Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown

- Storm Culverts
- Storm Clean Outs

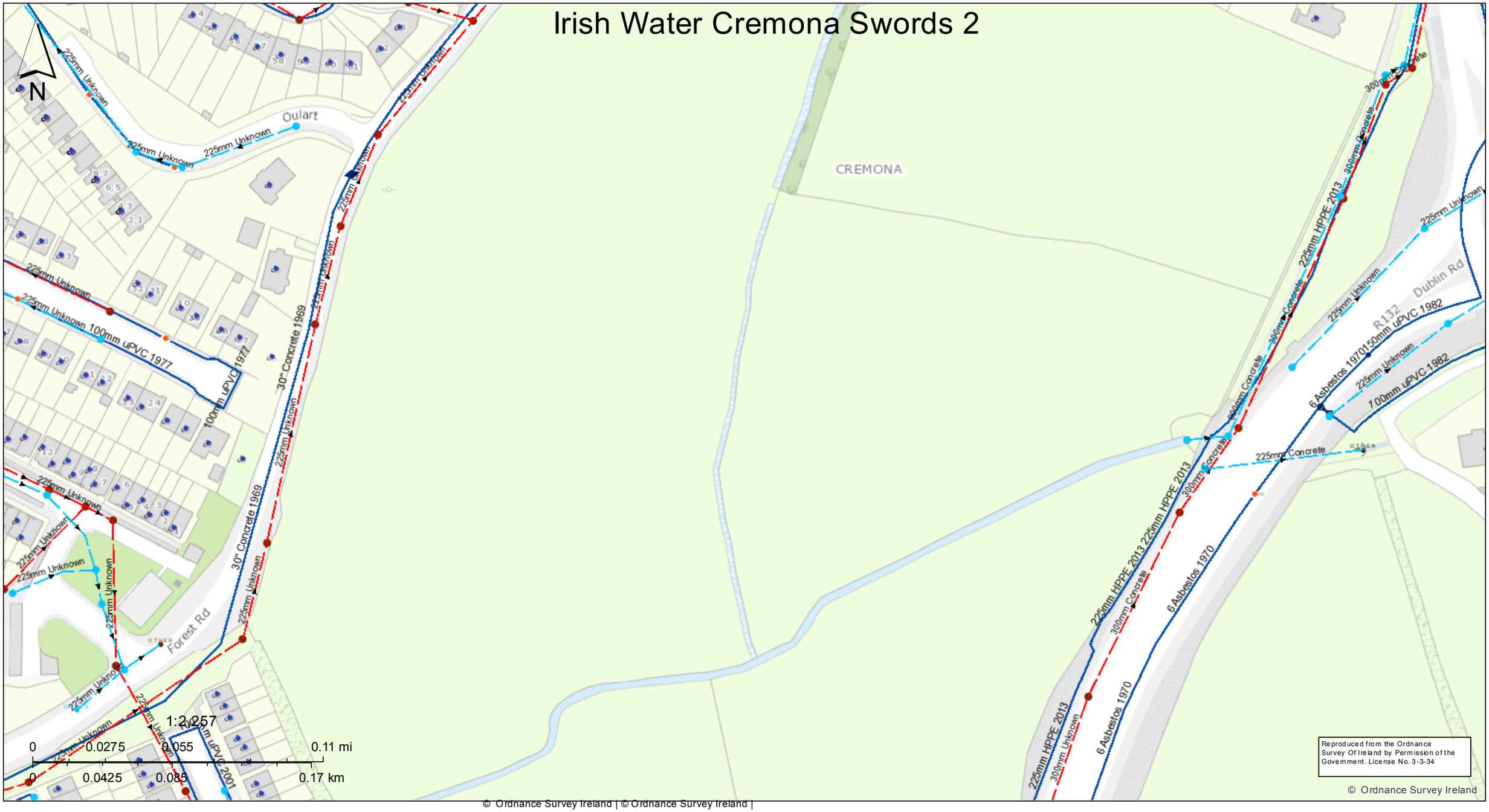
Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated. © Irish Water

"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the Information (including maps or mapping data). NOTE: DIAL BEFORE YOU DIG Phone 1850 427 747 or e-mail dig@gasnetworks.ie – The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of the gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

Irish Water Cremona Swords 2



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Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

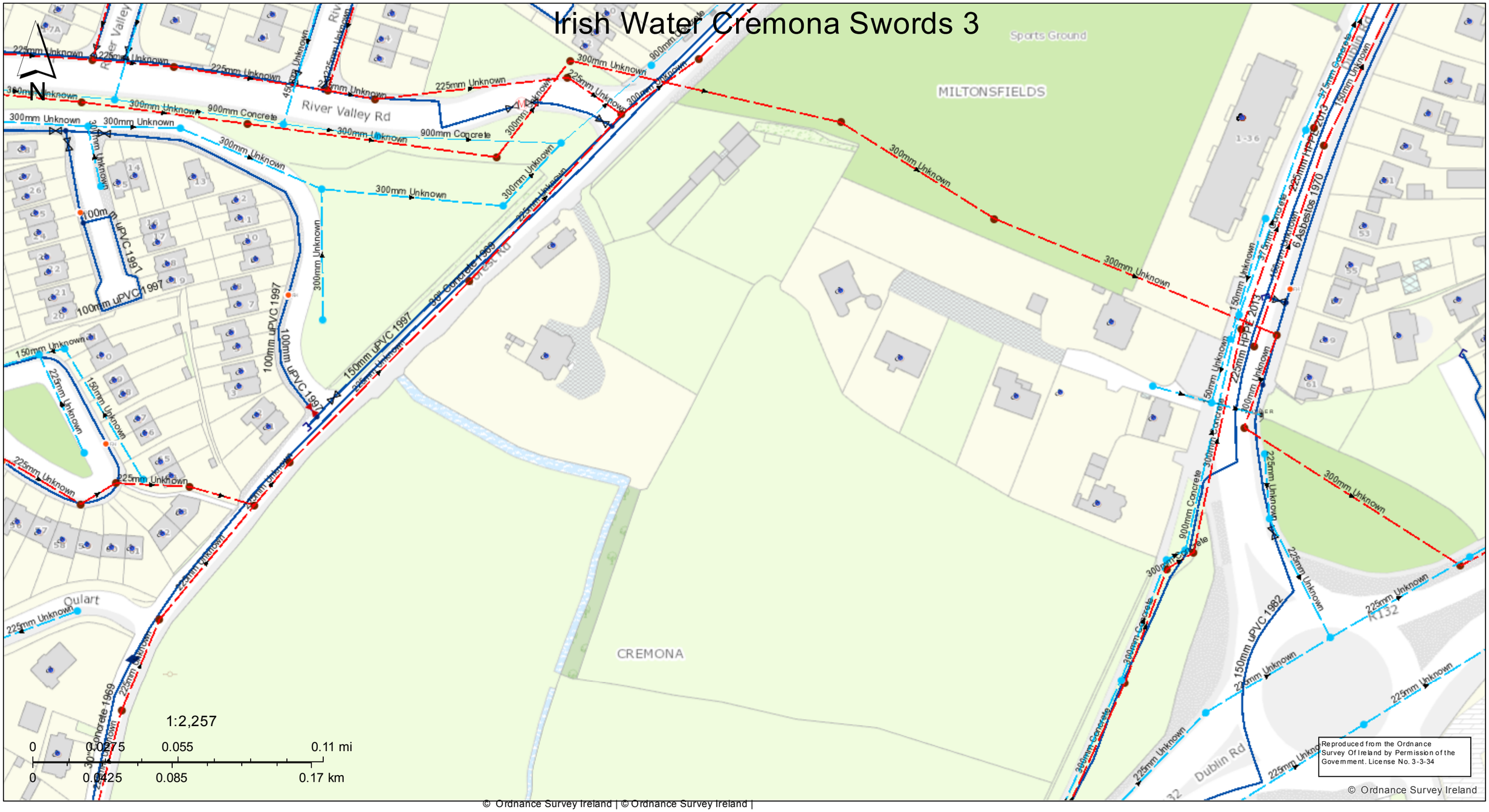
Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown

- Storm Culverts
- Storm Clean Outs

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Irish Water Cremona Swords 3



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Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown

- Storm Culverts
- Storm Clean Outs

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

B. Historic Irish Water Confirmation of Feasibility (Received 28 February 2019)

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

Matteo Iannucci
Block 5
Alfie Byrne Road
Eastpoint Business Park
Dublin, Dublin

28 February 2019

Dear Matteo Iannucci,

Re: Connection Reference No CDS19000250 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 710 units at Fostertown, R132, Swords, Dublin.

Irish Water has reviewed your pre-connection enquiry in relation to a water connection at Fostertown, R132, Swords, Dublin.

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.

Water:

New connection to the existing network is feasible without upgrade.
There is sufficient capacity in the network to supply the development from the existing 225mmHPPE main adjacent to the site.

Wastewater:

New connection to the existing network is feasible subject to upgrade.
There are significant wastewater network constraints in the foul sewer in which this development proposes to connect. A study is required to determine the upgrades required to facilitate this development. Currently Drainage Area Plan (DAP) with hydraulic modelling for the area is in progress which will determine system deficiencies and outline needed upgrades in existing Irish Water infrastructure. The DAP hydraulic model for existing network and current load will be available in Q3 2019 (subject to change). The hydraulic model can then be updated with load from the proposed site and specific network upgrade to cater the load can be established. For the hydraulic model update, wastewater master plan for the area has to be established.

Strategic Housing Development

Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. Therefore:

A. 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.

B. 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 and appropriate connection fee paid at a later date.

C. In advance of submitting this development to An Bord Pleanala for full assessment, the Developer is required to have entered into a Project Works Services Agreement to deliver wastewater masterplan for the area with the model upgrade to confirm the available capacity and to determine the full extent of any upgrades which may be required to be completed to Irish Water infrastructure.

D. In advance of submitting this development to An Bord Pleanala for full assessment, the Developer is required to have entered into a Project Works Services Agreement to deliver infrastructure upgrades to facilitate the connection of the development to Irish Water infrastructure.

All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details.

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 Marina Zivanovic Byrne from the design team on 01 89 25991 or email mzbyrne@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

C. Historic Statement of Design Acceptance (Received 22 June 2020)

Laura Ruiz Garrido
Block 5
Alfie Byrne Road
Eastpoint Business Park
Dublin, Dublin

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

22 June 2020

Re: Design Submission for Fostertown, R132, Swords, Dublin (the "Development") (the "Design Submission") / Connection Reference No: CDS19000250

Dear Matteo Iannucci,

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: Alvaro Garcia
Email: agarcia@water.ie

Yours sincerely,

Maria O'Dwyer
Connections and Developer Services

Appendix A

Document Title & Revision

- 17-062 Basement Main Foul Longsections
- 17-062 Car Parking Foul Longsections
- 17-062 Ground Level Foul Longsections
- 17-062-P210 - Drainage Layout
- 17-062-P211 - Basement Drainage Layout
- 17-062-P232-Public Foul Water Drainage Details
- 17-062-P310 - Water Supply Layout
- 17-062-P330 - Water Supply Details (Sheet 1 of 3)
- 17-062-P331 - Water Supply Details (Sheet 2 of 3)
- 17-062-P332 - Water Supply Details (Sheet 3 of 3)

*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.

D. Updated Confirmation of Feasibility (Received 17 February 2021)

Laura Ruiz

Waterman Moylan

Block S, Eastpoint Business Park
Alfie Byrne Road
Dublin 3
D03H3F4

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

17 February 2021

Re: CDS20004473 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 705 unit(s) at Fosterstown South, R132, Co Dublin

Dear Sir/Madam,

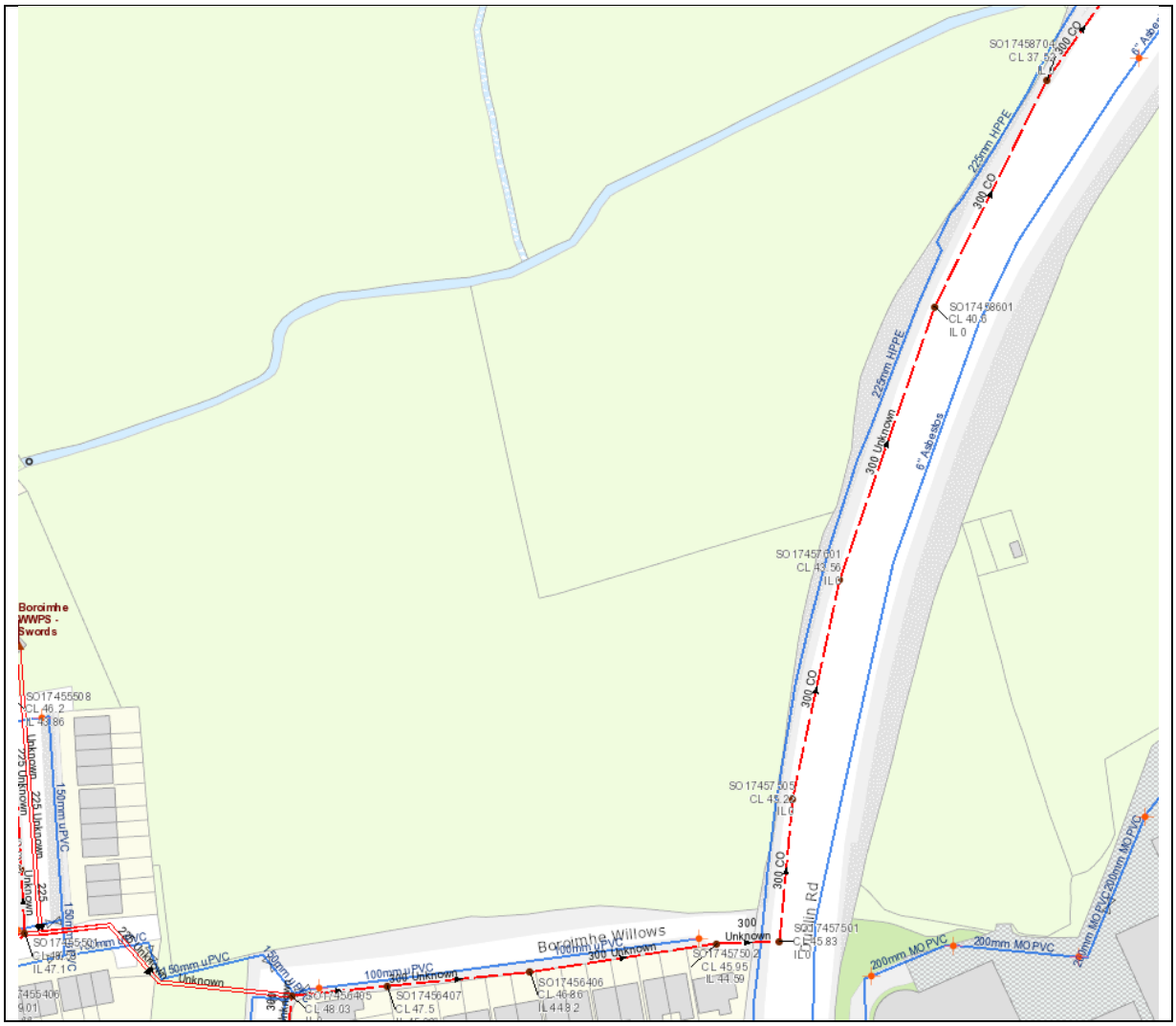
Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Fosterstown South, R132, Co Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible Subject to upgrades
SITE SPECIFIC COMMENTS	
Wastewater Connection	Upgrades required for the connection: • Approximately 230m of network extension from the SO17469004 manhole (see figure below) to the Site and • Approximately 750m of the existing 300 mm ID gravity sewer upgrade to 450mm ID in R132 Road, from the SO17469004 manhole to the existing 600mm gravity sewer. The section is highlighted in yellow in the figure below. Should you wish to progress with the connection, you have to fund the extension and upgrade works. At connection application stage the network upgrade will be reviewed, and the upgrade works fee will be calculated in the connection offer fee or in a separate upgrade project agreement.

Storm water from the Site cannot be discharged to the wastewater network. Proposed basement car park should be designed such that surface water from the Site and/or surrounding areas cannot flow down to the car park. Wastewater from the car park (contaminated water generated from run off from cars/tyres) must be discharged by gravity to the Irish Water Network via a petrol interceptor.

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

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



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

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

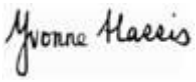
General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.

3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team on 01 89 25991 or email mzbyrne@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

E. Updated Statement of Design Acceptance (Received 01 April 2022)

Penelope Ingle
Waterman Moylan
Eastpoint Business Park Block S
Alfie Byrne Road
Dublin 3, Dublin D03H3F4

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

1 April 2022

Re: Design Submission for Fosterstown South, R132, Co Dublin (the "Development") (the "Design Submission") / Connection Reference No: CDS20004473

Dear Penelope Ingle,

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'Sullivan
Phone: 02252269
Email: jameosull@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

17-062-IW210 - Drainage Layout
17-062-IW220 - Foul Water Long Sections

17-062-IW310 - Water Supply Layout

17-062-IW311 - Watermain Long Sections - Sheet 1 of 2

17-062-IW312 - Watermain Long Sections - Sheet 2 of 2

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

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

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

F. Attenuation Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	15.600	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
18	0.034	4.00	39.500	1200	717693.491	745675.912	0.900
30	0.033	4.00	39.902	1200	717663.683	745720.814	1.425
21	0.025	4.00	39.500	1200	717657.750	745685.962	1.350
12	0.063	4.00	39.500	1200	717647.464	745628.584	0.900
22			39.500	1200	717662.295	745683.655	1.946
17	0.105	4.00	39.500	1200	717669.334	745652.262	1.428
TANK			39.500	1200	717666.973	745703.333	1.987
13	0.040	4.00	39.500	1200	717655.891	745660.920	1.384
3	0.048	4.00	44.500	1200	717596.588	745639.544	1.126
1	0.133	4.00	44.500	1200	717600.134	745609.659	0.825
4	0.114	4.00	44.500	1200	717583.218	745607.447	1.444
10			44.500	1200	717577.844	745651.400	1.716
8	0.136	4.00	44.500	1200	717573.783	745685.146	0.825
6	0.074	4.00	44.500	1200	717589.340	745689.337	0.825
7	0.097	4.00	44.500	1200	717592.658	745662.373	1.097
19			39.500	1200	717674.614	745680.433	1.669
16	0.269	4.00	39.500	1200	717662.324	745624.068	0.800
32	0.014	4.00	39.902	1200	717659.821	745705.275	1.547
28	0.037	4.00	39.500	1200	717648.870	745724.476	0.900
31	0.065	4.00	39.500	1200	717638.686	745710.693	0.900
15			39.500	1200	717659.376	745673.078	1.575
5	0.091	4.00	44.500	1200	717579.537	745637.606	1.647
2	0.061	4.00	44.500	1200	717613.806	745641.503	0.825
9	0.071	4.00	44.500	1200	717576.743	745660.438	1.232
14	0.044	4.00	39.500	1200	717637.920	745670.477	0.900
20	0.048	4.00	39.500	1200	717636.366	745683.626	0.900
11			42.000	1200	717621.181	745656.734	1.500
26	0.027	4.00	39.500	1200	717686.876	745730.617	0.900
27			39.500	1200	717679.668	745700.925	1.425
25	0.068	4.00	39.500	1200	717693.596	745697.476	1.204
23	0.036	4.00	39.500	1200	717700.913	745727.027	0.900
24	0.053	4.00	39.500	1200	717690.060	745683.293	0.900
29	0.042	4.00	39.902	1200	717666.817	745733.396	0.900
OUTFALL			39.500	1200	717677.392	745738.597	2.079
DB1	0.045	4.00	42.000	1200	717573.912	745714.047	0.600
1_1			42.000	1200	717616.373	745719.728	0.814
DB2	0.027	4.00	42.000	1200	717639.876	745740.772	1.350
3_1			39.000	1200	717700.776	745775.462	1.858
DB4	0.118	4.00	38.000	1200	717742.956	745780.974	1.000

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
OUT			37.500	1200	717740.019	745804.712	0.816
5_11			38.000	1200	717741.498	745791.100	1.117
DB3	0.061	4.00	39.000	1200	717692.757	745753.645	1.750
5_1			37.700	1200	717741.351	745798.625	0.926

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
22	22	TANK	20.226	0.600	37.554	37.513	0.041	493.3	525	5.67	50.0
27	27	TANK	12.921	0.600	38.075	37.813	0.262	49.3	225	4.65	50.0
25	25	27	14.349	0.600	38.296	38.075	0.221	64.9	225	4.54	50.0
26	26	27	30.554	0.600	38.600	38.294	0.306	99.9	225	4.39	50.0
23	23	25	30.443	0.600	38.600	38.296	0.304	100.1	225	4.39	50.0
24	24	25	14.617	0.600	38.600	38.454	0.146	100.1	225	4.19	50.0
19	19	22	12.733	0.600	37.831	37.779	0.052	244.9	300	4.80	50.0
15	15	22	10.972	0.600	37.925	37.704	0.221	49.6	375	5.34	50.0
21	21	22	5.097	0.600	38.150	37.929	0.221	23.1	225	4.31	50.0
20	20	21	21.511	0.600	38.600	38.385	0.215	100.1	225	4.27	50.0
13	13	15	12.680	0.600	38.116	38.053	0.063	201.3	375	5.26	50.0
14	14	15	21.613	0.600	38.600	38.384	0.216	100.1	225	4.28	50.0
11	11	13	34.962	0.600	40.500	38.375	2.125	16.5	300	5.10	50.0
12	12	13	33.447	0.600	38.600	38.266	0.334	100.1	225	4.43	50.0
10	10	11	43.664	0.600	42.784	40.500	2.284	19.1	300	4.95	50.0
5	5	10	13.898	0.600	42.853	42.784	0.069	201.4	300	4.75	50.0
9	9	10	9.105	0.600	43.268	43.222	0.046	197.9	300	4.69	50.0
8	8	9	24.887	0.600	43.675	43.426	0.249	99.9	225	4.32	50.0
7	7	9	16.032	0.600	43.428	43.268	0.160	100.0	225	4.55	50.0
6	6	7	27.167	0.600	43.675	43.403	0.272	99.9	225	4.35	50.0
3	3	5	17.161	0.600	43.399	43.056	0.343	50.0	225	4.54	50.0
4	4	5	30.383	0.600	43.056	42.853	0.203	149.7	225	4.47	50.0
1	1	3	30.095	0.600	43.675	43.374	0.301	100.0	225	4.38	50.0
2	2	3	17.329	0.600	43.675	43.502	0.173	100.2	225	4.22	50.0
18	18	19	19.411	0.600	38.600	38.406	0.194	100.1	225	4.25	50.0
17	17	19	28.662	0.600	38.075	37.836	0.239	120.0	300	4.58	50.0
16	16	17	29.055	0.600	38.700	38.072	0.628	46.3	225	4.25	50.0
30	30	32	16.012	0.600	38.477	38.382	0.095	168.5	225	4.48	50.0
31	31	32	21.818	0.600	38.600	38.355	0.245	89.1	225	4.26	50.0
29	29	30	12.966	0.600	39.002	38.872	0.130	99.7	225	4.17	50.0
28	28	30	15.259	0.600	38.600	38.477	0.123	124.1	225	4.22	50.0
14.002	32	TANK	7.411	0.600	38.355	38.075	0.280	26.5	225	4.53	50.0
1.008	TANK	OUTFALL	36.771	0.600	37.513	37.421	0.092	400.0	225	6.62	0.0
1.009	OUTFALL	DB3	21.506	0.600	37.421	37.313	0.108	200.0	225	7.01	0.0
7_1	DB4	5_11	7.035	0.600	37.000	36.883	0.117	60.0	225	4.06	50.0
18.001	5_11	5_1	7.526	0.600	36.883	36.849	0.034	221.4	225	4.20	50.0
5_1	3_1	5_1	31.251	0.600	37.142	36.774	0.368	84.9	300	5.81	50.0
10_1	DB3	3_1	6.510	0.600	37.250	37.217	0.033	200.0	225	4.12	50.0
3_1	DB2	3_1	70.691	0.600	40.650	37.753	2.897	24.4	225	5.53	50.0
2_1	1_1	DB2	31.772	0.600	41.186	41.027	0.159	199.8	225	5.05	50.0

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1_1	DB1	1_1	42.864	0.600	41.400	41.186	0.214	200.0	225	4.78	50.0
9_1	5_1	OUT	18.072	0.600	36.774	36.684	0.090	200.0	300	6.26	50.0

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	15.600	Check Discharge Rate(s)	✓
Ratio-R	0.300	5 year (l/s)	6.3
Summer CV	0.750	30 year (l/s)	10.2
Winter CV	0.840	100 year (l/s)	13.0
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	✓	100 year 360 minute (m³)	

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	0	0	0
100	20	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	2.100	Betterment (%)	0
SAAR (mm)	915	QBar	5.2
Soil Index	2	Q 5 year (l/s)	6.3
SPR	0.30	Q 30 year (l/s)	10.2
Region	1	Q 100 year (l/s)	13.0
Growth Factor 5 year	1.20		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	2.100	Storm Duration (mins)	360
Soil Index	2	Betterment (%)	0
SPR	0.30	PR	
CWI		Runoff Volume (m³)	

Node 16 Time-Area Diagram

Overrides Design Area	✓	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to All storms

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.135	12-16	0.000	24-28	0.000	36-40	0.000	48-52	0.000
4-8	0.135	16-20	0.000	28-32	0.000	40-44	0.000	52-56	0.000
8-12	0.000	20-24	0.000	32-36	0.000	44-48	0.000	56-60	0.000

Node 5_1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	36.774	Product Number	CTL-SHE-0113-5800-1000-5800
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.8	Min Node Diameter (mm)	1200

Node TANK Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	37.513	Product Number	CTL-SHE-0092-4600-1650-4600
Design Depth (m)	1.650	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.6	Min Node Diameter (mm)	1200

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.513
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	759.5	0.0	1.650	759.5	0.0	1.651	0.0	0.0

Node DB1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	41.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	107.0	0.0	0.335	107.0	0.0	0.336	0.0	0.0

Node DB2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	41.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	40.0	0.0	0.400	40.0	0.0	0.401	0.0	0.0

Node DB4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.40	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	250.0	0.0	0.600	250.0	0.0	0.601	0.0	0.0

Node DB3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.313
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.40	Time to half empty (mins)	270

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	267.0	0.0	0.500	267.0	0.0	0.501	0.0	0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	18	10	38.664	0.064	8.6	0.1202	0.0000	OK
15 minute winter	30	10	38.628	0.151	28.5	0.2399	0.0000	OK
1440 minute winter	21	1410	38.442	0.292	1.2	0.4388	0.0000	SURCHARGED
15 minute winter	12	10	38.685	0.085	16.0	0.2152	0.0000	OK
1440 minute winter	22	1410	38.442	0.888	28.9	1.0047	0.0000	SURCHARGED
1440 minute winter	17	1410	38.442	0.370	6.0	0.9636	0.0000	SURCHARGED
1440 minute winter	TANK	1410	38.442	0.929	28.3	706.8796	0.0000	SURCHARGED
15 minute winter	13	11	38.665	0.549	223.2	0.9383	0.0000	SURCHARGED
15 minute summer	3	10	43.575	0.201	61.6	0.3988	0.0000	OK
15 minute summer	1	10	43.806	0.131	33.8	0.5708	0.0000	OK
15 minute winter	4	11	43.312	0.256	29.0	0.6938	0.0000	SURCHARGED
15 minute winter	10	11	42.998	0.214	197.3	0.2425	0.0000	OK
15 minute winter	8	10	43.817	0.142	34.6	0.6279	0.0000	OK
15 minute winter	6	10	43.768	0.093	18.8	0.2714	0.0000	OK
15 minute winter	7	10	43.710	0.307	43.5	0.8906	0.0000	SURCHARGED
1440 minute winter	19	1410	38.442	0.611	6.5	0.6913	0.0000	SURCHARGED
15 minute winter	16	12	38.834	0.134	50.7	1.0573	0.0000	OK
15 minute winter	32	10	38.483	0.128	48.5	0.1685	0.0000	OK
15 minute winter	28	10	38.668	0.068	9.4	0.1329	0.0000	OK
15 minute summer	31	10	38.685	0.085	16.5	0.2186	0.0000	OK
1440 minute winter	15	1410	38.442	0.517	15.3	0.5851	0.0000	SURCHARGED
15 minute winter	5	11	43.214	0.361	108.0	0.8071	0.0000	SURCHARGED
15 minute summer	2	10	43.763	0.088	15.5	0.2303	0.0000	OK
15 minute winter	9	10	43.582	0.314	92.7	0.7173	0.0000	SURCHARGED
15 minute winter	14	10	38.673	0.073	11.2	0.1542	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	18	18	19	8.6	0.955	0.165	0.1746	
15 minute winter	30	30	32	28.3	1.053	0.710	0.4308	
1440 minute winter	21	21	22	1.2	0.867	0.011	0.2027	
15 minute winter	12	12	13	16.0	0.830	0.308	0.8946	
1440 minute winter	22	22	TANK	22.4	0.694	0.103	4.3695	
1440 minute winter	17	17	19	6.0	0.701	0.059	2.0184	
1440 minute winter	TANK	Hydro-Brake®	OUTFALL	4.2				
15 minute winter	13	13	15	224.7	2.039	1.598	1.3623	
15 minute summer	3	3	5	61.4	1.959	0.833	0.5370	
15 minute summer	1	1	3	33.9	1.078	0.652	0.9246	
15 minute winter	4	4	5	27.2	0.712	0.641	1.2084	
15 minute winter	10	10	11	199.3	3.964	0.780	2.1925	
15 minute winter	8	8	9	34.6	1.332	0.665	0.6940	
15 minute winter	6	6	7	18.8	0.682	0.361	0.7498	
15 minute winter	7	7	9	41.1	1.033	0.790	0.6376	
1440 minute winter	19	19	22	8.0	0.587	0.113	0.8966	
15 minute winter	16	16	17	50.5	1.676	0.659	0.9187	
15 minute winter	32	14.002	TANK	48.3	2.280	0.476	0.1571	
15 minute winter	28	28	30	9.4	0.502	0.202	0.2924	
15 minute summer	31	31	32	16.6	0.906	0.301	0.4046	
1440 minute winter	15	15	22	19.7	1.199	0.069	1.2102	
15 minute winter	5	5	10	107.0	1.592	1.371	0.8637	
15 minute summer	2	2	3	15.5	1.113	0.298	0.2413	
15 minute winter	9	9	10	91.5	1.353	1.162	0.5906	
15 minute winter	14	14	15	11.2	1.028	0.215	0.2353	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	20	10	38.677	0.077	12.2	0.1683	0.0000	OK
15 minute winter	11	11	40.688	0.188	199.3	0.2130	0.0000	OK
15 minute winter	26	10	38.656	0.056	6.9	0.0969	0.0000	OK
1440 minute winter	27	1410	38.442	0.367	2.9	0.4155	0.0000	SURCHARGED
1440 minute winter	25	1410	38.442	0.146	2.5	0.3309	0.0000	OK
15 minute winter	23	10	38.664	0.064	9.2	0.1229	0.0000	OK
15 minute summer	24	10	38.682	0.082	13.5	0.1899	0.0000	OK
15 minute summer	29	10	39.075	0.073	10.7	0.1500	0.0000	OK
60 minute summer	OUTFALL	59	37.473	0.052	4.2	0.0589	0.0000	OK
15 minute winter	DB1	12	41.470	0.070	11.4	2.4334	0.0000	OK
30 minute winter	1_1	21	41.254	0.068	7.3	0.0772	0.0000	OK
30 minute winter	DB2	20	40.699	0.049	11.2	0.0757	0.0000	OK
360 minute winter	3_1	352	37.428	0.286	9.6	0.3234	0.0000	OK
360 minute winter	DB4	352	37.427	0.427	8.2	44.2330	0.0000	SURCHARGED
15 minute summer	OUT	1	36.684	0.000	5.8	0.0000	0.0000	OK
360 minute winter	5_11	352	37.427	0.544	3.4	0.6157	0.0000	SURCHARGED
360 minute winter	DB3	352	37.428	0.178	6.8	12.7038	0.0000	OK
360 minute winter	5_1	352	37.427	0.653	9.3	0.7390	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	20	20	21	12.2	1.052	0.235	0.2494	
15 minute winter	11	11	13	200.8	3.819	0.729	2.0328	
15 minute winter	26	26	27	6.8	0.903	0.132	0.2313	
1440 minute winter	27	27	TANK	2.9	0.857	0.039	0.5139	
1440 minute winter	25	25	27	2.5	0.779	0.039	0.4814	
15 minute winter	23	23	25	9.2	0.524	0.177	0.5375	
15 minute summer	24	24	25	13.5	1.069	0.260	0.1847	
15 minute summer	29	29	30	10.7	1.003	0.206	0.1383	
60 minute summer	OUTFALL	1.009	DB3	4.2	0.612	0.114	0.1467	
15 minute winter	DB1	1_1	1_1	7.5	0.761	0.204	0.4324	
30 minute winter	1_1	2_1	DB2	7.1	0.713	0.195	0.3177	
30 minute winter	DB2	3_1	3_1	11.1	1.731	0.105	0.4529	
360 minute winter	3_1	5_1	5_1	9.3	0.294	0.077	2.1823	
360 minute winter	DB4	7_1	5_11	-3.3	0.512	-0.049	0.2798	
360 minute winter	5_11	18.001	5_1	-3.4	0.388	-0.097	0.2993	
360 minute winter	DB3	10_1	3_1	6.6	0.679	0.182	0.2359	
360 minute winter	5_1	Hydro-Brake®	OUT	5.8				164.5

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	18	2100	39.055	0.455	0.6	0.8581	0.0000	SURCHARGED
2160 minute winter	30	2100	39.053	0.576	2.0	0.9175	0.0000	SURCHARGED
2160 minute winter	21	2100	39.052	0.902	1.2	1.3540	0.0000	SURCHARGED
15 minute winter	12	10	39.119	0.519	24.6	1.3137	0.0000	SURCHARGED
2160 minute winter	22	2040	39.054	1.500	24.9	1.6960	0.0000	SURCHARGED
2160 minute winter	17	2100	39.054	0.982	6.7	2.5546	0.0000	SURCHARGED
2160 minute winter	TANK	2100	39.053	1.540	33.4	1171.0660	0.0000	SURCHARGED
2160 minute winter	13	2040	39.053	0.937	16.3	1.6007	0.0000	SURCHARGED
15 minute winter	3	12	44.133	0.759	75.3	1.5056	0.0000	SURCHARGED
15 minute winter	1	12	44.297	0.622	51.9	2.7107	0.0000	FLOOD RISK
15 minute winter	4	12	43.923	0.867	44.5	2.3488	0.0000	SURCHARGED
15 minute winter	10	11	43.540	0.756	255.3	0.8552	0.0000	SURCHARGED
15 minute winter	8	11	43.989	0.314	53.1	1.3886	0.0000	SURCHARGED
15 minute winter	6	11	44.089	0.414	28.9	1.2101	0.0000	SURCHARGED
15 minute winter	7	11	44.007	0.604	61.6	1.7503	0.0000	SURCHARGED
2160 minute winter	19	2100	39.054	1.223	7.2	1.3829	0.0000	SURCHARGED
15 minute winter	16	13	39.271	0.571	77.8	4.4994	0.0000	FLOOD RISK
2160 minute winter	32	2100	39.053	0.698	3.3	0.9152	0.0000	SURCHARGED
2160 minute winter	28	2100	39.053	0.453	0.7	0.8838	0.0000	SURCHARGED
2160 minute winter	31	2100	39.053	0.453	1.1	1.1653	0.0000	SURCHARGED
2160 minute winter	15	2100	39.053	1.128	17.0	1.2754	0.0000	SURCHARGED
15 minute winter	5	11	43.782	0.929	140.8	2.0779	0.0000	SURCHARGED
15 minute winter	2	12	44.157	0.482	23.8	1.2593	0.0000	SURCHARGED
15 minute winter	9	11	43.742	0.474	132.4	1.0833	0.0000	SURCHARGED
2160 minute winter	14	2100	39.053	0.453	0.8	0.9552	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute winter	18	18	19	0.6	0.439	0.012	0.7720	
2160 minute winter	30	30	32	2.0	0.524	0.050	0.6368	
2160 minute winter	21	21	22	1.2	0.818	0.011	0.2027	
15 minute winter	12	12	13	25.2	0.831	0.486	1.3302	
2160 minute winter	22	22	TANK	27.8	0.686	0.128	4.3695	
2160 minute winter	17	17	19	6.6	0.660	0.065	2.0184	
2160 minute winter	TANK	Hydro-Brake®	OUTFALL	4.4				
2160 minute winter	13	13	15	16.2	0.797	0.115	1.3986	
15 minute winter	3	3	5	77.6	1.976	1.052	0.6825	
15 minute winter	1	1	3	40.7	1.140	0.783	1.1969	
15 minute winter	4	4	5	36.3	0.914	0.857	1.2084	
15 minute winter	10	10	11	250.1	3.939	0.980	3.0748	
15 minute winter	8	8	9	47.6	1.279	0.916	0.9898	
15 minute winter	6	6	7	26.0	0.692	0.500	1.0805	
15 minute winter	7	7	9	58.8	1.479	1.131	0.6376	
2160 minute winter	19	19	22	7.0	0.539	0.099	0.8966	
15 minute winter	16	16	17	78.1	1.963	1.018	1.1555	
2160 minute winter	32	14.002	TANK	3.3	1.106	0.032	0.2947	
2160 minute winter	28	28	30	0.7	0.261	0.015	0.6069	
2160 minute winter	31	31	32	1.1	0.474	0.020	0.8677	
2160 minute winter	15	15	22	16.8	1.090	0.059	1.2102	
15 minute winter	5	5	10	135.6	1.926	1.738	0.9787	
15 minute winter	2	2	3	23.8	1.106	0.459	0.6892	
15 minute winter	9	9	10	130.8	1.858	1.661	0.6412	
2160 minute winter	14	14	15	0.8	0.481	0.016	0.8596	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	20	2040	39.051	0.451	0.8	0.9912	0.0000	SURCHARGED
15 minute winter	11	11	41.037	0.537	250.1	0.6073	0.0000	SURCHARGED
2160 minute winter	26	2100	39.053	0.453	0.5	0.7833	0.0000	SURCHARGED
2160 minute winter	27	2100	39.053	0.978	3.2	1.1056	0.0000	SURCHARGED
2160 minute winter	25	2100	39.053	0.757	2.7	1.7105	0.0000	SURCHARGED
2160 minute winter	23	2100	39.053	0.453	0.6	0.8738	0.0000	SURCHARGED
2160 minute winter	24	2100	39.052	0.452	0.9	1.0448	0.0000	SURCHARGED
15 minute summer	29	10	39.094	0.092	16.4	0.1905	0.0000	OK
600 minute winter	OUTFALL	570	37.685	0.264	4.2	0.2981	0.0000	SURCHARGED
15 minute winter	DB1	12	41.493	0.093	17.6	3.2310	0.0000	OK
15 minute winter	1_1	13	41.278	0.092	12.8	0.1037	0.0000	OK
30 minute summer	DB2	19	40.715	0.065	18.9	0.0990	0.0000	OK
600 minute winter	3_1	570	37.682	0.540	9.2	0.6111	0.0000	SURCHARGED
600 minute winter	DB4	570	37.682	0.682	7.6	62.4296	0.0000	SURCHARGED
15 minute summer	OUT	1	36.684	0.000	5.8	0.0000	0.0000	OK
600 minute winter	5_11	570	37.682	0.799	3.0	0.9032	0.0000	SURCHARGED
600 minute winter	DB3	570	37.683	0.433	6.8	40.3628	0.0000	SURCHARGED
600 minute winter	5_1	570	37.682	0.908	8.8	1.0265	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute winter	20	20	21	0.8	0.481	0.016	0.8555	
15 minute winter	11	11	13	245.7	3.621	0.893	2.4620	
2160 minute winter	26	26	27	0.5	0.416	0.010	1.2152	
2160 minute winter	27	27	TANK	3.1	0.766	0.042	0.5139	
2160 minute winter	25	25	27	2.7	0.757	0.042	0.5707	
2160 minute winter	23	23	25	0.6	0.268	0.012	1.2108	
2160 minute winter	24	24	25	0.9	0.496	0.017	0.5813	
15 minute summer	29	29	30	16.4	1.121	0.315	0.1899	
600 minute winter	OUTFALL	1.009	DB3	4.2	0.612	0.114	0.8553	
15 minute winter	DB1	1_1	1_1	12.8	0.861	0.350	0.6534	
15 minute winter	1_1	2_1	DB2	12.3	0.827	0.336	0.4730	
30 minute summer	DB2	3_1	3_1	18.8	2.010	0.177	0.6602	
600 minute winter	3_1	5_1	5_1	8.8	0.267	0.073	2.2007	
600 minute winter	DB4	7_1	5_11	-2.9	0.487	-0.043	0.2798	
600 minute winter	5_11	18.001	5_1	-3.0	0.383	-0.086	0.2993	
600 minute winter	DB3	10_1	3_1	6.4	0.672	0.175	0.2589	
600 minute winter	5_1	Hydro-Brake®	OUT	5.8				246.5

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	150.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	15.600	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
8	0.067	4.00	47.500	1200	717515.622	745533.396	1.650
7	0.067	4.00	46.220	1200	717562.392	745539.157	1.425
6	0.055	4.00	45.040	1200	717683.090	745587.708	1.425
5	0.194	4.00	44.710	1200	717633.312	745583.002	1.422
4	0.152	4.00	45.520	1350	717559.698	745574.622	2.743
3	0.233	4.00	44.210	1350	717546.112	745627.710	1.708
2	0.140	4.00	44.000	1350	717534.361	745623.977	1.604
1	0.000		43.500	1800	717515.297	745679.794	1.596
9	0.057	4.00	44.320	1200	717523.777	745680.206	1.670
Pitch	0.140	4.00	44.000	1500	717516.218	745677.261	2.069

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
11	Pitch	1	2.695	0.600	41.931	41.904	0.027	99.8	750	7.07	53.1
2	2	Pitch	56.290	0.600	42.396	42.115	0.281	200.3	450	7.54	0.0
10	9	Pitch	8.112	0.600	42.650	42.549	0.101	80.3	225	4.09	65.6
3	3	2	12.356	0.600	42.502	42.471	0.031	398.6	375	6.88	0.0
4	4	3	54.930	0.600	42.777	42.502	0.275	199.7	375	6.65	54.5
8	7	4	35.633	0.600	44.795	44.350	0.445	80.1	225	4.81	61.9
6	6	5	50.233	0.600	43.615	43.364	0.251	200.1	225	4.91	61.4
9	8	7	47.150	0.600	45.850	44.795	1.055	44.7	225	4.40	64.0
5	5	4	74.089	0.600	43.288	42.852	0.436	169.9	300	5.94	57.1

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	15.600	Check Discharge Rate(s)	✓
Ratio-R	0.300	5 year (l/s)	3.9
Summer CV	0.750	30 year (l/s)	5.3
Winter CV	0.840	100 year (l/s)	6.3
Analysis Speed	Normal	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	0	0	0
100	20	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.65
Greenfield Method	IH124	Growth Factor 100 year	1.96
Positively Drained Area (ha)	1.300	Betterment (%)	0
SAAR (mm)	910	QBar	3.2
Soil Index	2	Q 5 year (l/s)	3.9
SPR	0.30	Q 30 year (l/s)	5.3
Region	11	Q 100 year (l/s)	6.3
Growth Factor 5 year	1.20		

Node 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	41.904	Product Number	CTL-SHE-0091-3400-0800-3400
Design Depth (m)	0.800	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	3.4	Min Node Diameter (mm)	1200

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	41.904
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	2700.0	0.0	0.800	2700.0	0.0	0.801	0.0	0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	8	10	45.921	0.071	17.0	0.1379	0.0000	OK
15 minute winter	7	10	44.922	0.127	34.0	0.2629	0.0000	OK
15 minute summer	6	10	43.711	0.096	14.0	0.1820	0.0000	OK
15 minute summer	5	10	43.477	0.189	63.3	0.7298	0.0000	OK
15 minute winter	4	11	43.242	0.465	134.4	1.1822	0.0000	SURCHARGED
15 minute winter	3	9	43.000	0.498	181.0	2.0735	0.0000	SURCHARGED
15 minute winter	2	9	42.895	0.499	213.6	1.5857	0.0000	SURCHARGED
1440 minute winter	1	1350	42.395	0.491	17.5	398.5614	0.0000	OK
15 minute summer	9	10	42.733	0.083	14.5	0.1513	0.0000	OK
15 minute summer	Pitch	9	42.686	0.755	280.0	2.3557	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	8	9	7	17.0	1.033	0.218	0.7968	
15 minute winter	7	8	4	33.3	1.486	0.573	0.7988	
15 minute summer	6	6	5	14.0	0.779	0.383	0.9048	
15 minute summer	5	5	4	62.9	1.204	0.740	4.3411	
15 minute winter	4	4	3	130.4	1.182	0.924	6.0586	
15 minute winter	3	3	2	183.2	1.677	1.840	1.3628	
15 minute winter	2	2	Pitch	224.9	1.667	0.987	8.9188	
1440 minute winter	1	Hydro-Brake®		3.4				247.4
15 minute summer	9	10	Pitch	14.7	1.153	0.253	0.1563	
15 minute summer	Pitch	11	1	294.5	2.833	0.238	0.5971	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 97.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	8	10	45.939	0.089	26.1	0.1731	0.0000	OK
15 minute winter	7	10	44.969	0.173	52.2	0.3593	0.0000	OK
15 minute winter	6	11	44.330	0.715	21.5	1.3614	0.0000	SURCHARGED
15 minute winter	5	11	44.290	1.002	93.7	3.8665	0.0000	SURCHARGED
15 minute winter	4	11	43.890	1.113	175.9	2.8269	0.0000	SURCHARGED
15 minute winter	3	11	43.384	0.882	254.1	3.6678	0.0000	SURCHARGED
15 minute winter	2	11	43.044	0.648	301.5	2.0574	0.0000	SURCHARGED
1440 minute winter	1	1260	42.705	0.801	26.1	650.4089	0.0000	OK
15 minute winter	9	8	42.794	0.144	22.2	0.2604	0.0000	OK
15 minute winter	Pitch	8	42.767	0.836	369.2	2.6098	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	8	9	7	26.1	1.123	0.335	1.1193	
15 minute winter	7	8	4	51.0	1.615	0.878	1.1290	
15 minute winter	6	6	5	22.5	0.794	0.614	1.9978	
15 minute winter	5	5	4	81.9	1.191	0.963	5.2173	
15 minute winter	4	4	3	176.5	1.601	1.250	6.0586	
15 minute winter	3	3	2	254.4	2.307	2.556	1.3628	
15 minute winter	2	2	Pitch	301.1	1.914	1.322	8.9188	
1440 minute winter	1	Hydro-Brake®		3.4				275.4
15 minute winter	9	10	Pitch	22.2	1.280	0.382	0.2683	
15 minute winter	Pitch	11	1	372.2	3.190	0.301	0.5993	

G. Fingal County Council Pro forma for SUDS

SUDS/Green Infrastructure measures selected for this site

Suds Measures	Measures to be used on this site	Rationale for selecting/not selecting measure
Source Control		
Swales	X	Other SuDS utilised in proposed development
Tree Pits	X	Other SuDS utilised in proposed development
Rainwater Butts	X	No private units in proposed development hence not practical to use
Rainwater harvesting	X	Other SuDS utilised in proposed development
Soakaways	X	Not suitable for the ground conditions on site
Infiltration trenches	X	Not suitable for the ground conditions on site
Permeable pavement	✓	Primary treatment of first flush for the permeable parking and secondary treatment for porous play surface.
- Grasscrete		
- Block paving		
- Porous Asphalt		
Green Roofs	✓	Podium/roof used to reduce peak flow rates during minor storm events
Filter strips	X	Other SuDS utilised in proposed development
Bio-retention systems/Raingardens	X	Other SuDS utilised in proposed development
Blue Roofs / Green Roofs	✓	Green podium/roof used to reduce peak flow rats of minor storm events. Green roofs also improve the biodiversity of the site.
Filter Drain	X	Other SuDS utilised in proposed development
Site Control		
Detention Basins	✓	Green space area available to the north of the site to incorporate detention basins as SuDS features, one large and three small in size.
Retentions basins	X	Water holding SUDS features are not in keeping with the landscape design and the proximity of the development to the Gaybrook Stream. Detention Basins are incorporated to provide the necessary treatment.
Regional Control		
Ponds	X	Water holding SUDS features are not in keeping with the landscape design and the proximity of the development to the Gaybrook Stream. Detention Basins are incorporated to provide the necessary treatment.
Wetlands	X	Water holding SUDS features are not in keeping with the landscape design and the proximity of the development to the Gaybrook Stream. Detention Basins are incorporated to provide the necessary treatment.
Other		
Petrol/Oil interceptor	✓	Provides tertiary treatment of surface water
Attenuation tank – only as a last resort where other measures are not feasible	✓	Attenuation Tank provided in Basement to attenuate run-off from roofs and podium level.
Oversized pipes– only as a last resort where other measures are not feasible	X	Not required.

Note:

1. Fingal has a preference for above ground Green Infrastructure rather than tanks or over sized pipes . Above ground flows through swales, basins etc are encouraged.

2. Demonstrate SUDS system will have sufficient Pollutant removal efficiency in accordance with Ciria Suds Manual C753
3. Basins sides should be no steeper than 1:4 and no deeper than 1.2m in the 1%AEP
4. Culverting shall be avoided where possible
5. De-culverting is encouraged.
6. Examples of Suds systems throughout Fingal available at https://pin.it/yvwrkb3hrekcdu
7. Please submit evidence of infiltration rates

Flood risk to be assessed

Flood risk	Applicable to subject site	Measures to reduce risk	Residual risk
Fluvial	✓	None required	Very Low
Pluvial	✓	Appropriate drainage design, over land flood routing and setting of appropriate floor levels	Low
Coastal	X	None	N/A
Groundwater	✓	Adequate waterproofing of the basement structure	Low
Dam/Embankment/Canal bank breach	X	Not applicable	N/A
Network drainage	✓	Maintenance strategy	Low
Snow melt	X	Not applicable	N/A
Watermain burst	✓	Pressure test prior installation and making use of the correct approved materials	Low

Note:

Models should consider the risk when outlets are surcharged

H. IGSL Site Investigation June 2005

SWORDS DEVELOPMENT
DUBLIN

Clifton Scannell Emerson
Consulting Engineers

CONTENTS

APPENDICES

FOREWORD

Notes on Site Investigation Procedure

The following notes should be read in conjunction with the report. Any modifications to the procedures outlined below are indicated in the main text.

GENERAL

The recommendations made and opinions expressed in the Report are based on the "Boring Records, an examination of samples and results of the site and laboratory tests. No responsibility can be held for conditions which have not been revealed by the boreholes, for example, between borehole positions. Whilst the report may express an opinion on a possible configuration of strata both between borehole positions and below the maximum depth of the investigation, this is for guidance only and no liability can be accepted for its accuracy.

BORING TECHNIQUE

Unless otherwise stated the 'Shell and Auger' technique of soft ground boring has been employed. Whilst this technique allows the maximum data to be obtained on strata conditions, a degree of mixing of some layered soils, (e.g. thin layers of coarse and fine granular material) is inevitable. Specific attention is drawn to this factor where evidence of such a condition is available.

GROUND WATER

The ground water conditions entered on the Boring Records are those appertaining at the time of the investigation. The normal rate of boring does not usually permit the recording of an equilibrium water level for any one water strike. Moreover, ground water levels are subject to variations caused by seasonal effects or changes in local drainage conditions. The table of each Boring Record shows the ground water level at the quoted borehole and casing depths, usually at the start of the day's work. The word "none" indicates that ground water was sealed off by the borehole casing.

GAS MONITORING

Unless otherwise stated gas monitoring is carried out using a GA2000 infra red gas detector. The gases monitored for and levels noted are recorded and plotted on the relevant test data sheets. Unless stated otherwise no monitoring is carried out for gas pressure or to calculate gas flow rates.

ROUTINE SAMPLING

Undisturbed samples of predominantly cohesive soils are obtained in a 102mm diameter open-drive sampler, complying with the requirements of the British Standard Code of Practice B.S. 5930. Large disturbed samples of granular soils, or of soils in which undisturbed sampling is not possible or appropriate, are taken from the boring tools and sealed into polythene bags. Small disturbed samples are taken at frequent intervals and sealed into 0.5 kg glass jars or polythene bags for subsequent visual classification. Where encountered in sufficient quantity, samples of groundwater are taken.

Unless otherwise stated in the main text, disturbed soil samples may not be at their natural water content.

REPORT ON A SITE INVESTIGATION FOR A DEVELOPMENT AT SWORDS CO.DUBLIN FOR CLIFTON SCANNELL EMERSON ASSOCIATES CONSULTING ENGINEERS

Report No. 10741 JUNE 2005

I Introduction

A major new residential development is proposed for a site on the N1, south of Swords in County Dublin.

A comprehensive investigation of sub soil conditions in the area has been ordered by the project-consulting engineers, Clifton Scannell Emerson Associates, on behalf of the project development company.

The programme of the investigation included the construction of twelve boreholes, eight trial pits and two rotary cored drill holes to establish geotechnical criteria on which to base foundation design. Work was carried out in accordance with BS 5930, Code of Practice for Site Investigations (1999).

A programme of laboratory testing to confirm geotechnical soil parameters followed site operations.

This report includes all factual data pertaining to the project and comments on the geotechnical findings relative to foundation design for the proposed housing development.

II Fieldwork

The site is located West of the N1 Dublin to Belfast Road, just South of Swords Village. Exploratory locations are indicated on the site plan enclosed in Appendix V. The site was greenfield, sloping downwards in a northerly direction towards a stream. At the time of investigation the surface was dry and firm, some isolated soft damp surface zones were observed.

a.Boreholes

The twelve exploratory holes were bored with conventional 200mm cable-tool methods using a Dando Exploratory Rig.

Detailed geotechnical records are contained in Appendix I to this report - the records give details of stratification, sampling, in-situ testing and groundwater. Note is also taken of any obstructions to normal boring requiring the use of the heavy chisel for advancement. It was not possible to recover undisturbed samples because of the high stone/cobble content of the strata encountered.

Top soil generally covers the site, varying from 300 to 500mm in thickness. At BH 7, however the surface consists of clayey fill material to a depth of 1.40 metres.

Below the top soil and fill, in the majority of locations a stratum of firm to stiff brown sandy gravelly clay is encountered. This stratum extends to depths varying from 2.10 to 3.30 metres where very stiff to hard grey black gravelly clay is noted. Both the brown and black clay strata typically contain cobble and boulder particles. Boreholes continued to termination in the black gravelly clay at final depths ranging from 5.40 to 10.00 metres.

At BHs 5, 8 and 12, however, a stratum of soft (wet) brown sandy gravelly clay was encountered from below the top soil to respective depths of 1.20, 2.20 and 1.40 metres, where more competent material is encountered.

The final borehole depths are not indicative of bedrock, refusal followed a period of chiselling on cobble or boulder material in the gravelly clay.

The brown and black gravelly clay encountered is the glacial till deposition of the region, locally referred to as brown and black boulder clay.

Ground water was noted as seepage in the majority of boreholes, generally at the brown/black clay interface. Ground water was sealed off in the black clay which was dry throughout.

b. Rotary Drilling

A truck mounted top drive rotary drilling rig was used to penetrate the hard black glacial till to the specified depth of 15.00 metres at two locations. Detailed core logs have been prepared and are presented in Appendix II. These records give a full geological description of the material encountered.

The holes were drilled, each to a depth of 15.00 metres adjoining BHs 2 and 4. Rock was not encountered, holes were terminated in hard grey black gravelly clay (glacial till or boulder clay).

c. Trial Pits.

Trial pits were excavated over the site area in eight locations using a JCB excavator. The work was carried out under geotechnical engineering supervision, the findings were carefully recorded and samples were recovered for laboratory examination and analysis. Detailed Trial Pit Logs have been prepared and are included in Appendix III.

The records generally confirm borehole findings, top soil overlies firm to stiff brown gravelly clay, with hard grey black gravelly clay noted at depths generally between 2.00 and 3.00 metres. Water seepage was observed at the brown/black clay interface in some of the trial excavations. Excavation sides remained stable throughout the investigation period. Trial pits were backfilled with the excavated arisings.

Samples were recovered at intervals and returned to the IGSL laboratory for analysis.

III Testing

(a) In-Situ :

Standard penetration tests were carried out at approximate 1.00 metre intervals in the geotechnical boreholes to measure relative in-situ soil strength. N values are noted in the right hand column of the boring records, representing the blow count required to drive the standard sampler 300mm into the soil, following initial seating blows. Where full test penetration was not achieved the blow count for a specific penetration is recorded, or refusal is indicated where appropriate.

The results of the tests are summarised as follows:

STRATUM	N VALUE RANGE	COMMENT
Fill (BH 7)	9	Firm
Upper soft clay (BHs 5, 8 and 12)	1 to 6	Soft
Brown Gravelly Clay	8 to 32	Firm to Stiff
Black gravelly Clay	30 to 81	Stiff to very hard

Numerous limited penetration SPT tests and refusals were recorded on cobbles or boulders in the hard black clay and also at the base of the respective boreholes.

(b) Laboratory :

All geotechnical samples from the boreholes and trial pits have been returned to the IGSL laboratory for initial visual inspection, a schedule of testing was prepared and tests as appropriate carried out.

The geotechnical tests consisted of the following.

a. Classification (Liquid and Plastic Limits)
b. Grading Analysis (Wet sieve and Hydrometer)
c. Sulphate and pH determination
d. California Bearing ratio (CBR

Classification
The liquid and plastic limits were established for samples of the brown and black gravelly clay (glacial till). Values are tabulated with relevant moisture contents, falling mainly into the CL zone of the standard Casagrande Classification. The results are very closely grouped, indicating soil of uniform origin, of high sensitivity and of low plasticity .

Grading
Particle size distribution curves were established for samples of the brown and black clay using wet sieve analysis for the coarse material and hydrometer analysis for the finer particles. The resulting graphs have fairly straight-line characteristics, typical of the heterogeneous nature of the local glacial clay deposits.

Sulphate and pH
Chemical tests indicate low sulphate concentrations and near neutral pH. No special precautions are indicated to protect foundation concrete.

CBR

Disturbed samples from the trial pits had CBR values established to assist in pavement design. Testing was carried out in accordance with Road Note 29, using the light compaction hammer. CBR values range from 0.80 to 21.7% . An increasing CBR value with depth of test is noted.

Environmental testing of the sub soils was not carried out as part of this project. The materials encountered were mainly original soils. One thin layer of fill was of clay composition, with no evidence of extraneous material.

IV Discussion

The investigation has been carried out to obtain geotechnical data at a proposed housing development in Swords, County Dublin. A comprehensive investigation was scheduled by Clifton Scannell Emerson Associates on behalf of the site developers. This included boreholes, coreholes and trial pits with a follow up programme of laboratory analysis to confirm soil parameters.

The findings confirm the presence of glacial till deposits underlying shallow more recently deposited soils. The glacial tills consist of firm to stiff brown gravelly clay overlying hard grey black gravelly clay. The black till is noted between 2.00 and 3.00 metres and was penetrated by rotary drilling to 15.00 metres. Rock was not encountered.

The glacial material is locally referred to as brown and black boulder clay. The findings on this site are typical of the North County Dublin area.

Some soft material (typically damp) was noted at Boreholes 5, 8 and 12. The soft material extends to a maximum depth of 2.20 metres at BH 8. One shallow area of fill was noted at BH 7 to a depth of 1.40 metres.

House Foundations

Over the majority of the site foundations for traditional housing can be placed on the brown gravelly clay (brown boulder clay) at a nominal depth of 0.80 to 1.00 metres. The lower range of test results indicates an allowable bearing pressure of 100 kN/sq.m. for reinforced strip footings.

The depth to a suitable formation in the brown gravelly clay must be increased where soft zones are encountered. This can typically be to about 1.50 metres as indicated by BHs 5, 7 and 12 and in excess of 2.00 metres in the area of BH 8.

Where excavation depth exceeds about 1.50 metres the use of trench fill techniques should be considered.

The glacial till is over-consolidated and consequently settlement under the above recommended load will be very low, with negligible differential movement anticipated.

The heterogeneous nature of the glacial sub soils is emphasised and variation from hard clay to dense gravel can occur randomly. Careful visual examination of excavated formation is advised to ensure uniformity and suitability of the founding medium. The firm to stiff brown boulder clay should be readily identified by an experienced site foreman or engineer. Any unsuitable material, including upper top soil, soft clay , fill and organic material should be removed and replaced by low grade concrete.

Heavy Loads
The forgoing assumed that traditional house construction is proposed. Should heavier loads be envisaged (apartments or commercial structures) the use of the hard black lodgement till (found at an average depth of 2.50 metres) can be considered as a founding medium. Field and laboratory tests indicate an allowable bearing pressure of 350 kN/sq,m, for strip or pad foundations founded in this material.

Ground Water
Ground water was noted in some locations, generally as a seepage at the brown/black clay interface. The lower black till is highly impermeable. Water ingress into shallow foundation excavations is unlikely. Some soft surface zones were noted and softening of the surface can be expected in winter conditions. The glacial till is sensitive to moisture content variation, excavations should not be exposed to rainfall, either rapid placement of foundation concrete or blinding of foundations following excavation is advised.

Excavation Stability

While vertical excavations in the boulder clay will remain stable in the short term, statutory safety regulations prohibit personnel entering unsupported excavations greater than 1.20 metres deep, irrespective of soil type. This may be particularly relevant to deep service excavations or to areas considered for trench fill.

Roads and Pavements
CBR tests give a range of values from 1 to 4 per cent in the upper soils (0.50 metres BGL). Tests in the stronger underlying soils (2.00 metres) reflect an increase in CBR value to above 16%.

For estate roads we would suggest a preliminary design CBR of about 3% at a depth of about 0.80 metres. Additional CBR tests on the actual road network at construction stage can confirm this proposed design value.

SUMMARY

Traditional shallow reinforced strip footings are recommended over most of the site area. An allowable bearing pressure of 100 kN/sq.m. is recommended, formation depth will generally not exceed 1.00 metre. Isolated soft areas are present which will necessitate deepening foundations to 1.50 to 2.00 metres, this may necessitate the use of trench fill methods. Visual assessment of excavations is advised to ensure uniformity and suitability of the founding medium.

IGSL/JC
JUNE 2005

Appendix I – Cable Tool Borehole Records

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH1
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 7.50
CASING DEPTH (m) 7.50

DATE STARTED: 07/06/2005
DATE COMPLETED: 08/06/2005

CO-ORDINATES : E -
N -

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLES SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil									
	Firm brown sandy gravelly CLAY with cobbles and boulders			0.50						
1					080	B	1.00	C	N=13	
2					081	B	2.00	C	N=13	
3	Firm to stiff grey brown sandy gravelly CLAY			2.90	082	B	3.00	C	N=18	
	Hard black sandy gravelly CLAY with cobbles and boulders			3.50						
4					083	B	4.00	C	N=49	
5					084	B	5.00	C	N=62	
6					085	B	6.00	C	N=49	
7					086	B	7.00	C	N=58/ 225mm	
	End of Borehole at 7.50 m			7.50						
8										
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
4.50	4.70	0.75	
7.30	7.50	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
2.80	2.80	3.00	-	-	Seepage

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
08/06/2005	7.50	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH2
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

CO-ORDINATES : E -
N -

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 7.50
CASING DEPTH (m) 7.50

DATE STARTED: 31/05/2005
DATE COMPLETED: 31/05/2005

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil			0.30						
	Firm brown sandy gravelly CLAY with cobbles and boulders				5686	B	1.00	C	N=10	
1										
					5687	B	2.00	C	N=13	
2				2.50						
	Very stiff to hard black sandy gravelly CLAY with cobbles and boulders				5688	B	3.00	C	N=57	
3										
					5689	B	4.00	C	N=64	
4										
					5690	B	5.00	C	N=33/ 150mm	
5										
					5691	B	6.00	C	N=87/ 235mm	
6										
					5692	B	7.00	C	N=68/ 225mm	
7										
	End of Borehole at 7.50 m			7.50						
8										
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
3.00	7.30	1.00	.
7.30	7.50	2.00	.

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
2.30	2.30	3.00	-	-	Seepage

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
31/05/2005	7.50	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH3
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 8.00
CASING DEPTH (m) 8.00

DATE STARTED: 17/05/2005
DATE COMPLETED: 17/05/2005

CO-ORDINATES : E -
N -

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil									
	Firm to stiff brown sandy gravelly CLAY with occasional cobbles and boulders			0.30						
1					5601	B	1.00	C	N=8	
2	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders			2.10	5602	B	2.00	C	N=22	
3					5603	B	3.00	C	N=46	
4					5604	B	4.00	C	N=68	
5					5605	B	5.00	C	N=81	
6					5606	B	6.00	C	N=72	
7					5607	B	7.00	C	N=66/ 225mm	
8	Obstruction			7.95	5608	B	8.00	C	N=50/ 150mm	
	End of Borehole at 8.00 m			8.00						
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
5.00	5.60	1.00	.
7.30	7.50	1.00	.
7.90	8.00	2.00	.

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
1.80	1.70	2.10	-	-	Seepage

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17/05/2005	8.00	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH4
Sheet 1 of 1

CLIENT :
ENGINEER : Clifton Scannell Emerson Associates

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 7.00
CASING DEPTH (m) 7.00

DATE STARTED: 03/06/2005
DATE COMPLETED: 03/06/2005

CO-ORDINATES : E -
N -

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES: REF. NUMBER	SAMPLES: SAMPLE TYPE	SAMPLES: DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil									
	Firm to stiff brown sandy gravelly CLAY with occasional cobbles and boulders			0.50						
1					071	B	1.00	C	N=12	
2					072	B	2.00	C	N=21	
	Stiff to very stiff black sandy gravelly CLAY with cobbles and boulders			2.80						
3					073	B	3.00	C	N=30	
4					074	B	4.00	C	N=70/ 295mm	
5					075	B	5.00	C	N=51/ 225mm	
6					076	B	6.00	C	N=25/ 75mm	
7	End of Borehole at 7.00 m			7.00	077	B	7.00	C	N=R	
8										
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
2.80	2.90	0.50	
4.30	4.50	0.75	
5.20	5.40	0.75	
6.70	7.00	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
-	-	-	-	-	Dry

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
03/06/2005	7.00	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH5
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

CO-ORDINATES : E -
N -

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 8.00
CASING DEPTH (m) 8.00

DATE STARTED: 13/05/2005
DATE COMPLETED: 13/05/2005

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES: REF. NUMBER	SAMPLES: SAMPLE TYPE	SAMPLES: DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil			0.20						
	Soft brown sandy CLAY				45	B	1.00	C	N=4	
1				1.20						
	Stiff brown sandy gravelly CLAY with occasional cobbles and boulders				46	B	2.00	C	N=32	
2				2.30						
	Very stiff to hard sandy gravelly CLAY with occasional cobbles and boulders				47	B	3.00	C	N=48	
3					48	B	4.00	C	N=65	
4					49	B	5.00	C	N=60	
5					50	B	6.00	C	N=61/ 225mm	
6					51	B	7.00	C	N=25/ 75mm	
7										
8	Obstruction			7.95	52	B	8.00	C	N=R	
	End of Borehole at 8.00 m			8.00						
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
2.30	2.90	1.00	
4.50	4.80	1.00	
6.30	6.50	0.75	
7.50	8.00	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
1.20	1.10	1.80	-	-	Seepage

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
13/05/2005	8.00	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH6
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 8.10
CASING DEPTH (m) 8.10

DATE STARTED: 20/05/2005
DATE COMPLETED: 20/05/2005

CO-ORDINATES : E -
N -

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil									
	Firm to stiff brown sandy gravelly CLAY with occasional cobbles and boulders			0.30						
1					5629	B	1.00	C	N=8	
2					5630	B	2.00	C	N=10	
3	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders			3.00	5631	B	3.00	C	N=32	
4					5632	B	4.00	C	N=70	
5					5633	B	5.00	C	N=55	
6					5634	B	6.00	C	N=49/ 150mm	
7					5635	B	7.00	C	N=62/ 225mm	
8	Obstruction			7.95	5636	B	8.00	C	N=50/ 150mm	
	End of Borehole at 8.10 m			8.10						
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
6.00	6.40	1.75	.
7.90	8.10	2.00	.

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
2.00	1.90	3.30	-	-	Seepage

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
20/05/2005	8.10	0.00	6.40	At end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH7
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

CO-ORDINATES : E -
N -

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 10.00
CASING DEPTH (m) 10.00

DATE STARTED: 18/05/2005
DATE COMPLETED: 18/05/2005

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	MADE GROUND consisting of brown clay fill				5609	B	1.00	C	N=9	
1										
	Firm brown sandy gravelly CLAY with occasional cobbles and boulders			1.40						
2					5610	B	2.00	C	N=18	
	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders			2.20						
3					5611	B	3.00	C	N=54	
4					5612	B	4.00	C	N=66/ 225mm	
5					5613	B	5.00	C	N=49/ 150mm	
6					5614	B	6.00	C	N=50/ 150mm	
7					5615	B	7.00	C	N=50/ 150mm	
8					5616	B	8.00	C	N=R	
9					5617	B	9.00	C	N=R	
10	End of Borehole at 10.00 m			10.00	5618	B	10.00	C	N=R	

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
4.40	4.70	0.75	.
5.30	5.50	1.00	.
6.40	6.80	1.25	.
9.50	10.00	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
10.00	10.00	-	-	-	Dry

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type
18/05/2005	10.00	1.00	10.00	SP

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
18/05/2005	10.00	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH8
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

CO-ORDINATES : E -
N -

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 5.40
CASING DEPTH (m) 5.40

DATE STARTED: 30/05/2005
DATE COMPLETED: 30/05/2005

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil									
	Very soft to soft brown sandy gravelly CLAY with cobbles and boulders			0.30						
1					5676	B	1.00	C	N=1	
2					5677	B	2.00	C	N=6	
	Stiff to very stiff black sandy gravelly CLAY with cobbles and boulders			2.20						
3					5678	B	3.00	C	N=23	
4					5679	B	4.00	C	N=47	
5					5680	B	5.00	C	N=R	
	Obstruction - Possible rock/boulder			5.10						
	End of Borehole at 5.40 m			5.40	5681	B	5.40			
6										
7										
8										
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
5.10	5.40	2.50	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
4.80	4.80	-	4.30	20	Slow

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type
30/05/2005	5.00	1.00	5.00	SP

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
30/05/2005	5.40	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH9
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 7.50
CASING DEPTH (m) 7.50

DATE STARTED: 12/05/2005
DATE COMPLETED: 12/05/2005

CO-ORDINATES : E -
N -

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil									
	Firm to stiff brown sandy gravelly CLAY with occasional cobbles and boulders			0.40						
1					38	B	1.00	C	N=7	
2	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders			2.10	39	B	2.00	C	N=28	
3					40	B	3.00	C	N=49	
4					41	B	4.00	C	N=68/ 225mm	
5					42	B	5.00	C	N=47/ 150mm	
6					43	B	6.00	C	N=63	
7					44	B	7.00	C	N=55/ 225mm	
	Obstruction			7.45						
	End of Borehole at 7.50 m			7.50						
8										
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
3.60	4.00	1.00	
5.80	6.20	1.50	
7.10	7.50	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
7.50	7.50	-	-	-	Dry

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
12/05/2005	7.50	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH10
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 9.00
CASING DEPTH (m) 9.00

DATE STARTED: 19/05/2005
DATE COMPLETED: 19/05/2005

CO-ORDINATES : E -
N -

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLES SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil									
	Firm brown sandy gravelly CLAY with occasional cobbles and boulders			0.30						
1					5619	B	1.00	C	N=13	
2					5620	B	2.00	C	N=18	
	Stiff black sandy gravelly CLAY with occasional cobbles and boulders (moist)			2.30						
3					5621	B	3.00	C	N=34	
	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders			3.50						
4					5622	B	4.00	C	N=46	
5					5623	B	5.00	C	N=R	
6					5624	B	6.00	C	N=57	
7					5625	B	7.00	C	N=61/ 225mm	
8					5626	B	8.00	C	N=66/ 225mm	
9					5627	B	9.00	C	N=25/ 75mm	
	Obstruction			9.15						
	End of Borehole at 9.00 m			9.20						
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
5.00	5.30	1.25	Continues chiseling
8.80	8.40	2.50	
9.10	9.20	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
2.30	2.20	3.50	-	-	Seepage

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type
19/05/2005	9.00	1.00	9.00	SP

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
19/05/2005	9.20	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Swords Housing Development

BOREHOLE NO: BH11
Sheet 1 of 1

CLIENT :

ENGINEER : Clifton Scannell Emerson Associates

CO-ORDINATES : E -
N -

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 8.50
CASING DEPTH (m) 8.50

DATE STARTED: 01/06/2005
DATE COMPLETED: 01/06/2005

BORED BY: J O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLES SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil									
	Firm brown sandy gravelly CLAY with cobbles and boulders			0.30						
1					055	B	1.00	C	N=8	
2					056	B	2.00	C	N=12	
3					057	B	3.00	C	N=17	
	Very stiff to hard black sandy gravelly CLAY with cobbles and boulders			3.30						
4					058	B	4.00	C	N=51	
5					059	B	5.00	C	N=67	
6					060	B	6.00	C	N=68/ 220mm	
7					061	B	7.00	C	N=R	
8					062	B	8.00	C	N=R	
	End of Borehole at 8.50 m			8.50						
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
3.30	6.50	0.50	.
6.50	8.50	3.00	.

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.10	3.10	3.50	-	-	Seepage

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type
01/06/2005	8.00	1.00	8.00	SP

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
01/06/2005	8.50	0.00	-	Borehole dry at end of boring

Remarks:

REPORT NO: 10741	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Swords Housing Development		BOREHOLE NO: BH12 Sheet 1 of 1
CLIENT :	GROUND LEVEL (mOD) -	DATE STARTED: 02/06/2005
ENGINEER : Clifton Scannell Emerson Associates	BOREHOLE DIAMETER (mm) 200	DATE COMPLETED: 02/06/2005
CO-ORDINATES : E - N -	BOREHOLE DEPTH (m) 8.00	BORED BY: J O'Hara
	CASING DEPTH (m) 8.00	

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	Topsoil									
	Soft brown sandy CLAY with gravel			0.30						
1					063	B	1.00	C	N=6	
	Firm brown gravelly CLAY			1.40						
2					064	B	2.00	C	N=15	
3					065	B	3.00	C	N=32	
	Very stiff black sandy gravelly CLAY with cobbles and boulders			3.20						
4					066	B	4.00	C	N=74/ 295mm	
5					067	B	5.00	C	N=63/ 225mm	
6					068	B	6.00	C	N=50/ 150mm	
7					069	B	7.00	C	N=R	
8	End of Borehole at 8.00 m			8.00	070	B	8.00	C	N=R	
9										
10										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
5.20	5.35	0.50	.
6.25	6.30	0.75	.
7.00	8.00	2.00	.

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.00	3.00	3.50	-	-	Seepage

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
02/06/2005	8.00	0.00	-	Borehole dry at end of boring

Remarks:

Appendix II – Rotary Core Records

REPORT NO.	10741	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: Swords Housing Development

DRILLHOLE NO : RC2
SHEET: Sheet 1 of 2

CLIENT:
ENGINEER: Clifton Scannell Emerson Associates

CORE DIAMETER (mm):
GROUND LEVEL (mOD):

DATE STARTED: 12/05/2005
DATE COMPLETED: 12/05/2005

CO-ORDINATES:

INCLINATION (Degrees): 90
FLUSH:

DRILLED BY: C. Carrington
LOGGED BY: C. Carrington,

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
										0.20			Topsoil
													Brown sandy gravelly CLAY with cobbles
										2.70			Black sandy gravelly CLAY with cobbles and boulders
													Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	10741	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: Swords Housing Development

DRILLHOLE NO : RC2
SHEET: Sheet 2 of 2

CLIENT:
ENGINEER: Clifton Scannell Emerson Associates

CORE DIAMETER (mm):
GROUND LEVEL (mOD):

DATE STARTED: 12/05/2005
DATE COMPLETED: 12/05/2005

CO-ORDINATES:

INCLINATION (Degrees): 90
FLUSH:

DRILLED BY: C. Carrington
LOGGED BY: C. Carrington,

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
9													Black sandy gravelly CLAY with cobbles and boulders
10													
11													
12													
13													
14													
15										15.00			End of Borehole at 15.00 m
16													

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	10741	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: Swords Housing Development

DRILLHOLE NO : RC4
SHEET: Sheet 1 of 2

CLIENT:
ENGINEER: Clifton Scannell Emerson Associates

CORE DIAMETER (mm):
GROUND LEVEL (mOD):

DATE STARTED: 13/05/2005
DATE COMPLETED: 13/05/2005

CO-ORDINATES:

INCLINATION (Degrees): 90
FLUSH:

DRILLED BY: C. Carrington
LOGGED BY: C. Carrington,

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
										0.20			Topsoil
													Brown sandy gravelly CLAY ith obbes
										2.50			Black sandy gravelly CLAY with cobbles and boulders
													Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	10741	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: Swords Housing Development

DRILLHOLE NO : RC4
SHEET: Sheet 2 of 2

CLIENT:
ENGINEER: Clifton Scannell Emerson Associates

CORE DIAMETER (mm):
GROUND LEVEL (mOD):

DATE STARTED: 13/05/2005
DATE COMPLETED: 13/05/2005

CO-ORDINATES:

INCLINATION (Degrees): 90
FLUSH:

DRILLED BY: C. Carrington
LOGGED BY: C. Carrington,

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
9													Black sandy gravelly CLAY with cobbles and boulders
10													
11													
12													
13													
14													
15										15.00			End of Borehole at 15.00 m
16													

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

Appendix III – Trial Pit Records

REPORT NO. 10741	TRIAL PIT RECORD	IGSL Ltd.

CONTRACT:	Swords Housing Development	Trial Pit No.:	TP1
		Sheet:	Sheet 1 of 1
CLIENT:		Excavation Method:	JCB
ENGINEER:	Clifton Scannell Emerson Associates	Date Started:	23/05/2005
CO-ORDINATES:	E - N -	Date Completed:	23/05/2005
		Ground Level (mOD):	-

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
0.0	Topsoil		0.30							
	Firm to stiff light brown sandy slightly gravelly CLAY					8573	CBR	0.50		
1.0						8574	B	1.10		
	Firm to stiff dark brown sandy gravelly CLAY with occasional sub-rounded to sub-angular cobbles and boulders		1.20		▽					
2.0										
	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders		2.90			8575	B	3.00		
3.0										
	End of Trial Pit at 3.50 m		3.50							
4.0										

Groundwater Conditions: Seepage at 2.4m

Stability: Stable throughout excavation

Remarks:

REPORT NO. 10741	TRIAL PIT RECORD	IGSL Ltd.

CONTRACT:	Swords Housing Development	Trial Pit No.:	TP2
		Sheet:	Sheet 1 of 1
CLIENT:		Excavation Method:	JCB
ENGINEER:	Clifton Scannell Emerson Associates	Date Started:	23/05/2005
CO-ORDINATES:	E - N -	Date Completed:	23/05/2005
		Ground Level (mOD):	-

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
0.0	Topsoil									
	Firm brown sandy gravelly CLAY with occasional sub-angular to sub-rounded cobbles and boulders		0.30			8570	CBR	0.50		
1.0						8571	B	1.10		
	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders		1.80		▽					
2.0										
						8572	B	2.40		
3.0										
	End of Trial Pit at 3.20 m		3.20							
4.0										

Groundwater Conditions: Seepage at 1.8m

Stability: Stable throughout excavation

Remarks:

REPORT NO. 10741	TRIAL PIT RECORD	IGSL Ltd.

CONTRACT:	Swords Housing Development	Trial Pit No.:	TP3
		Sheet:	Sheet 1 of 1
CLIENT:		Excavation Method:	JCB
ENGINEER:	Clifton Scannell Emerson Associates	Date Started:	23/05/2005
		Date Completed:	23/05/2005
CO-ORDINATES:	E - N -	Ground Level (mOD):	-

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
0.0	Topsoil									
	Firm light brown sandy CLAY		0.40			8585	CBR	0.50		
1.0	Stiff brown sandy gravelly CLAY with occasional sub-rounded to sub-angular cobbles and boulders		0.90			8586	B	1.40		
2.0										
3.0										
	Very stiff to hard sandy gravelly CLAY with ocasional cobbles and boulders		3.10			8587	B	3.20		
	End of Trial Pit at 3.60 m		3.60							
4.0										

Groundwater Conditions: No groundwater encountered

Stability: Stable throughout excavation

Remarks:

REPORT NO. 10741	TRIAL PIT RECORD	IGSL Ltd.

CONTRACT:	Swords Housing Development	Trial Pit No.:	TP4
		Sheet:	Sheet 1 of 1
CLIENT:		Excavation Method:	JCB
ENGINEER:	Clifton Scannell Emerson Associates	Date Started:	23/05/2005
CO-ORDINATES:	E - N -	Date Completed:	23/05/2005
		Ground Level (mOD):	-

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
0.0	Topsoil									
	Firm to stiff brown sandy gravelly CLAY with occasional sub-rounded to sub-angular cobbles and boulders		0.30			8576	CBR	0.50		
1.0						8577	B	1.10		
2.0	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders		2.00			8578	B	2.20		
3.0										
	End of Trial Pit at 3.40 m		3.40							
4.0										

Groundwater Conditions: No groundwater encountered

Stability: Stable throughout excavation

Remarks:

REPORT NO. 10741 — TRIAL PIT RECORD — IGSL Ltd.

CONTRACT:	Swords Housing Development	Trial Pit No.:	TP5
CLIENT:		Sheet:	Sheet 1 of 1
ENGINEER:	Clifton Scannell Emerson Associates	Excavation Method:	JCB
		Date Started:	23/05/2005
CO-ORDINATES:	E - N -	Date Completed:	23/05/2005
		Ground Level (mOD):	-

Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples Ref. No.	Samples Type	Samples Depth (m)	Vane Test (KPa)	Hand Penetrometer (KPa)
Topsoil									
Firm to stiff brown sandy gravelly CLAY with occasional sub-rounded to sub-angular cobbles and boulders and occasional sand lenses		0.40			8567	CBR	0.50		
					8568	B	1.00		
Very stiff to hard black sandy gravelly CLAY with occasional sub-rounded to sub-angular cobbles and boulders		2.00		▽	8569	B	2.30		
End of Trial Pit at 3.40 m		3.40							

Groundwater Conditions: Seepage at 2.0m

Stability: Stable throughout excavation

Remarks:

REPORT NO. 10741	TRIAL PIT RECORD	IGSL Ltd.

CONTRACT:	Swords Housing Development	Trial Pit No.:	TP6
		Sheet:	Sheet 1 of 1
CLIENT:		Excavation Method:	JCB
ENGINEER:	Clifton Scannell Emerson Associates	Date Started:	23/05/2005
CO-ORDINATES:	E - N -	Date Completed:	23/05/2005
		Ground Level (mOD):	-

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples Ref. No.	Samples Type	Samples Depth (m)	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Topsoil									
	Firm light brown sandy slightly gravelly CLAY		0.40			8582	CBR	0.50		
	Firm brown sandy gravelly CLAY with occasional sub-rounded to sub-angular cobbles and boulders		0.80			8583	B	1.40		
1.0					▽					
2.0										
					▽					
3.0	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders		3.10			8584	B	3.20		
	End of Trial Pit at 3.50 m		3.50							
4.0										

Groundwater Conditions: Seepage at 1.8m and 2.8m

Stability: Slightly unstabel from 1.8m

Remarks:

REPORT NO. 10741	TRIAL PIT RECORD	IGSL Ltd.

CONTRACT:	Swords Housing Development	Trial Pit No.:	TP7
		Sheet:	Sheet 1 of 1
CLIENT:		Excavation Method:	JCB
ENGINEER:	Clifton Scannell Emerson Associates	Date Started:	23/05/2005
CO-ORDINATES:	E - N -	Date Completed:	23/05/2005
		Ground Level (mOD):	-

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
0.0	Topsoil									
	Firm to stiff brown sandy gravelly CLAY with occasional sub-rounded to sub-angular cobbles and boulders and occasional sand lenses		0.30			8579	CBR	0.50		
1.0						8580	B	1.20		
2.0										
	Very stiff to hard black sandy gravelly CLAY with occasional cobbles and boulders		2.20			8581	B	2.50		
3.0										
	End of Trial Pit at 3.40 m		3.40							
4.0										

Groundwater Conditions: No groundwater encountered

Stability: Stable throughout excavation

Remarks:

REPORT NO. 10741	TRIAL PIT RECORD	IGSL Ltd.

CONTRACT:	Swords Housing Development	Trial Pit No.:	TP8
		Sheet:	Sheet 1 of 1
CLIENT:		Excavation Method:	JCB
ENGINEER:	Clifton Scannell Emerson Associates	Date Started:	23/05/2005
CO-ORDINATES:	E - N -	Date Completed:	23/05/2005
		Ground Level (mOD):	-

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Ref. No.	Type	Depth (m)		
0.0	Topsoil									
	Firm brown sandy gravelly CLAY with occasional sub-rounded to sub-angular cobbles		0.30			8564	CBR	0.50		
1.0						8565	B	1.00		
	Very stiff to hard black sandy gravelly CLAY with occasional sub-rounded to sub-angular cobbles and boulders		1.80							
2.0						8566	B	2.30		
3.0										
	End of Trial Pit at 3.30 m		3.30							
4.0										

Groundwater Conditions: No groundwater encountered

Stability: Stable throughout excavation

Remarks:

Appendix IV – Laboratory Test Records

Summary of Classification Tests

BS1377:Part 2:1990, clauses 3.2, 4.3, 5.3 & 5.4

BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	<425μm %	Preparation	Description	Classification
BH2	5686	1.00	D	18	36	18	18	65	WS	Mottled grey brown sandy gravelly CLAY	C I
BH3	5601	1.00	D	14	35	19	16	60	WS	Mottled grey brown sandy gravelly CLAY	C L
BH3	5604	4.00	D	9.3	24	16	8	60	WS	Grey black slightly sandy slightly gravelly CLAY	C L
BH5	OO47	3.00	D	7.9	29	15	14	50	WS	Mottled grey brown sandy gravelly CLAY	C L
BH6	5629	1.00	D	16	36	20	16	58	WS	Brown sandy gravelly CLAY with root hairs	C I
BH6	5632	4.00	D	13	30	14	16	57	WS	Grey black slightly sandy slightly gravelly CLAY	C L
BH7	5611	3.00	D	9.3	31	15	16	55	WS	Grey black sandy gravelly CLAY	C L
BH8	5676	1.00	D	24	44	20	24	78	WS	Mottled grey brown sandy gravelly CLAY with roots	C I
BH8	5678	3.00	D	13	30	15	15	67	WS	Grey black slightly sandy slightly gravelly CLAY	C L
BH10	5622	4.00	D	13	32	15	17	53	WS	Dark grey slightly sandy gravelly CLAY	C L
BH11	OO55	1.00	D	15	33	17	16	58	WS	Brown sandy gravelly CLAY with root hairs	C L
BH11	OO58	4.00	D	10	28	15	13	59	WS	Grey black slightly sandy slightly gravelly CLAY	C L
BH11	OO61	7.00	D	7.7	28	14	14	57	WS	Grey black slightly sandy slightly gravelly CLAY	C L

Notes: NAT - tested as received WS - Wet sieved (425μm) NP - Non Plastic

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Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	
50	100.0	
37.5	98.0	
28	94.0	
20	90.2	GRAVEL
14	89.3	
10	86.3	
6.3	82.8	
5	80.7	
3.35	76.2	
2	71.4	
1.18	67.3	
0.6	62.3	SAND
0.425	59.9	
0.3	57.3	
0.15	51.4	
0.063	42.2	
0.04	39.7	
0.03	36.4	
0.02	33.0	SILT/CLAY
0.013	28.3	
0.009	26.2	
0.005	21.8	
0.002	16.1	

Contract No: 10741

Contract: Swords Housing Development

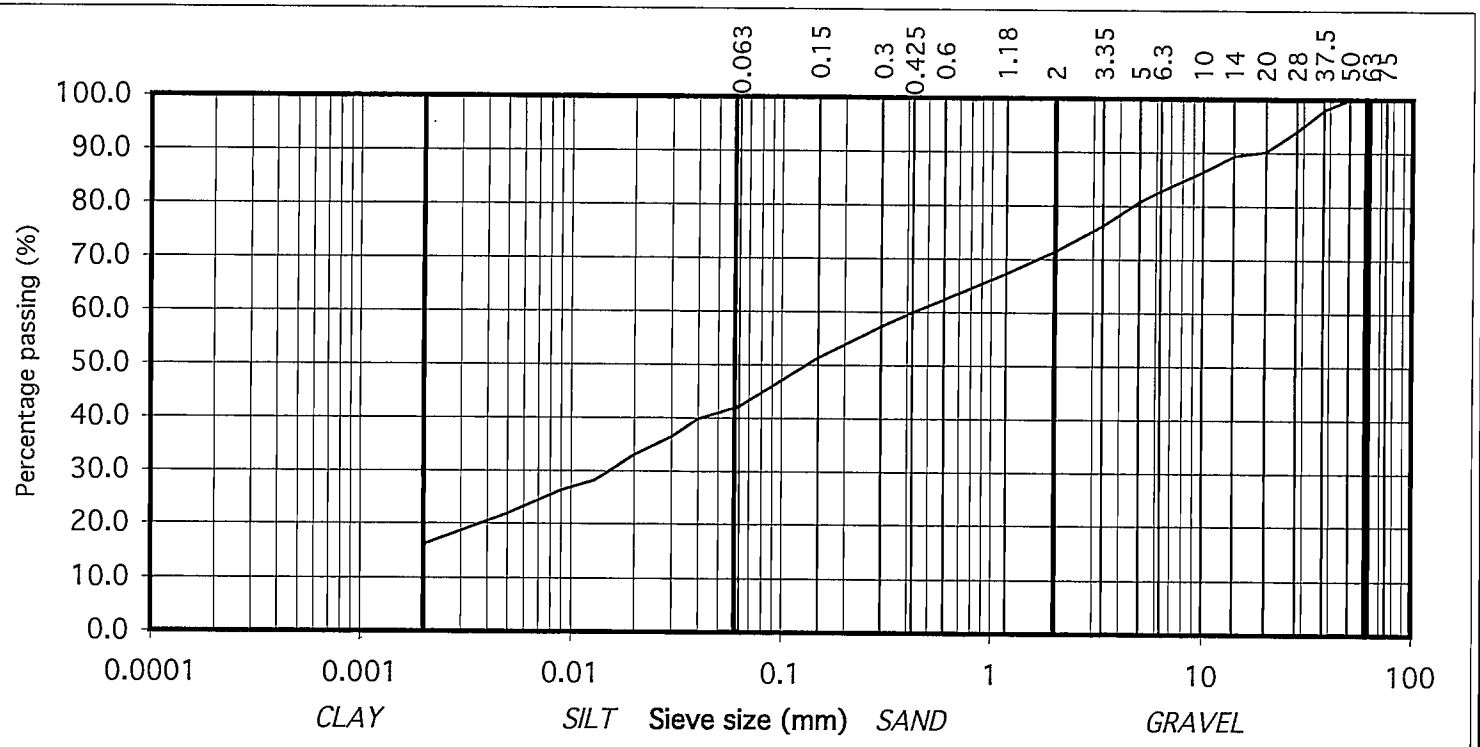
BH/TP No: BH3

SAMPLE No.: 5604

DEPTH (m): 4.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Grey black slightly sandy, slightly gravelly, CLAY



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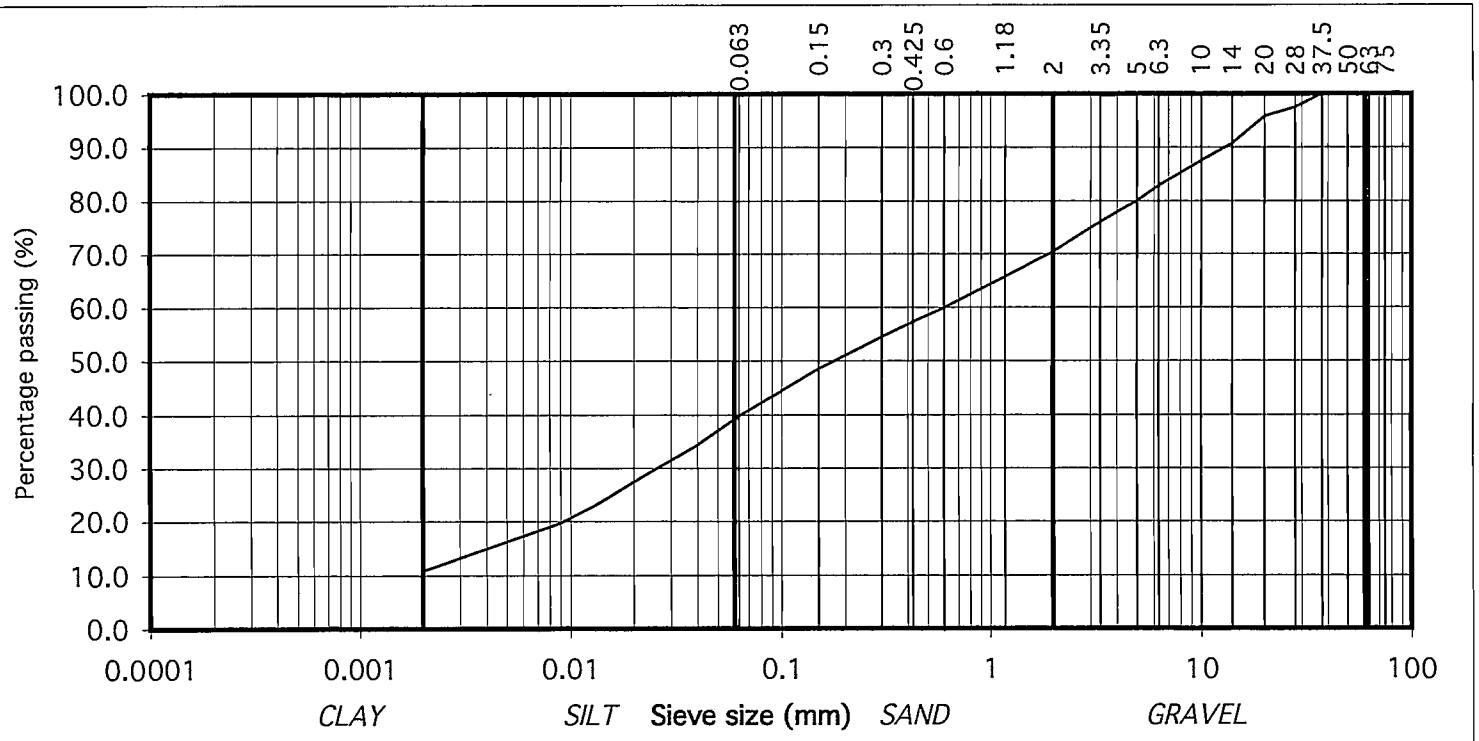
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	
50	100.0	
37.5	100.0	
28	97.5	
20	95.8	GRAVEL
14	90.8	
10	87.5	
6.3	82.9	
5	79.9	
3.35	76.0	
2	70.4	
1.18	65.7	
0.6	59.9	SAND
0.425	57.3	
0.3	54.5	
0.15	48.5	
0.063	39.7	
0.04	34.4	
0.03	31.5	
0.02	27.4	SILT/CLAY
0.013	22.9	
0.009	19.7	
0.005	16.2	
0.002	10.8	

Contract No:	10741
Contract:	Swords Housing Development
BH/TP No:	BH6
SAMPLE No.:	5632
DEPTH (m):	4.00
TEST METHOD:	Wet sieve and hydrometer
DESCRIPTION:	Grey black slightly sandy, slightly gravelly, CLAY



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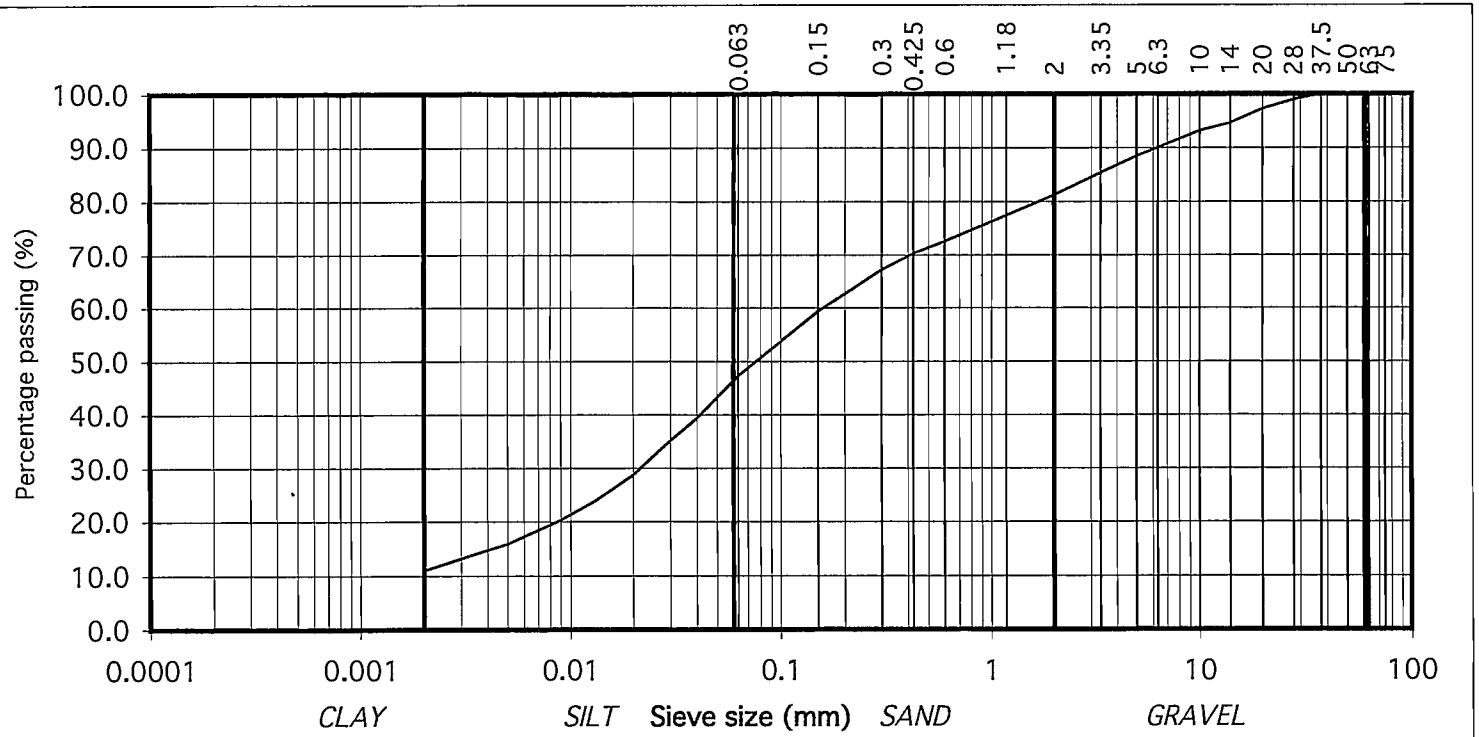
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	GRAVEL
50	100.0	
37.5	100.0	
28	98.9	
20	97.2	
14	94.6	
10	93.2	
6.3	90.1	
5	88.4	
3.35	85.4	
2	81.2	SAND
1.18	77.4	
0.6	72.5	
0.425	70.2	
0.3	67.2	
0.15	59.3	
0.063	47.3	SILT/CLAY
0.04	39.3	
0.03	35.1	
0.02	28.7	
0.013	23.7	
0.009	20.3	
0.005	15.8	
0.002	10.9	

Contract No: 10741
Contract: Swords Housing Development
BH/TP No: BH7
SAMPLE No.: 5616
DEPTH (m): 8.00
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Grey slightly sandy, slightly gravelly, SILT/CLAY



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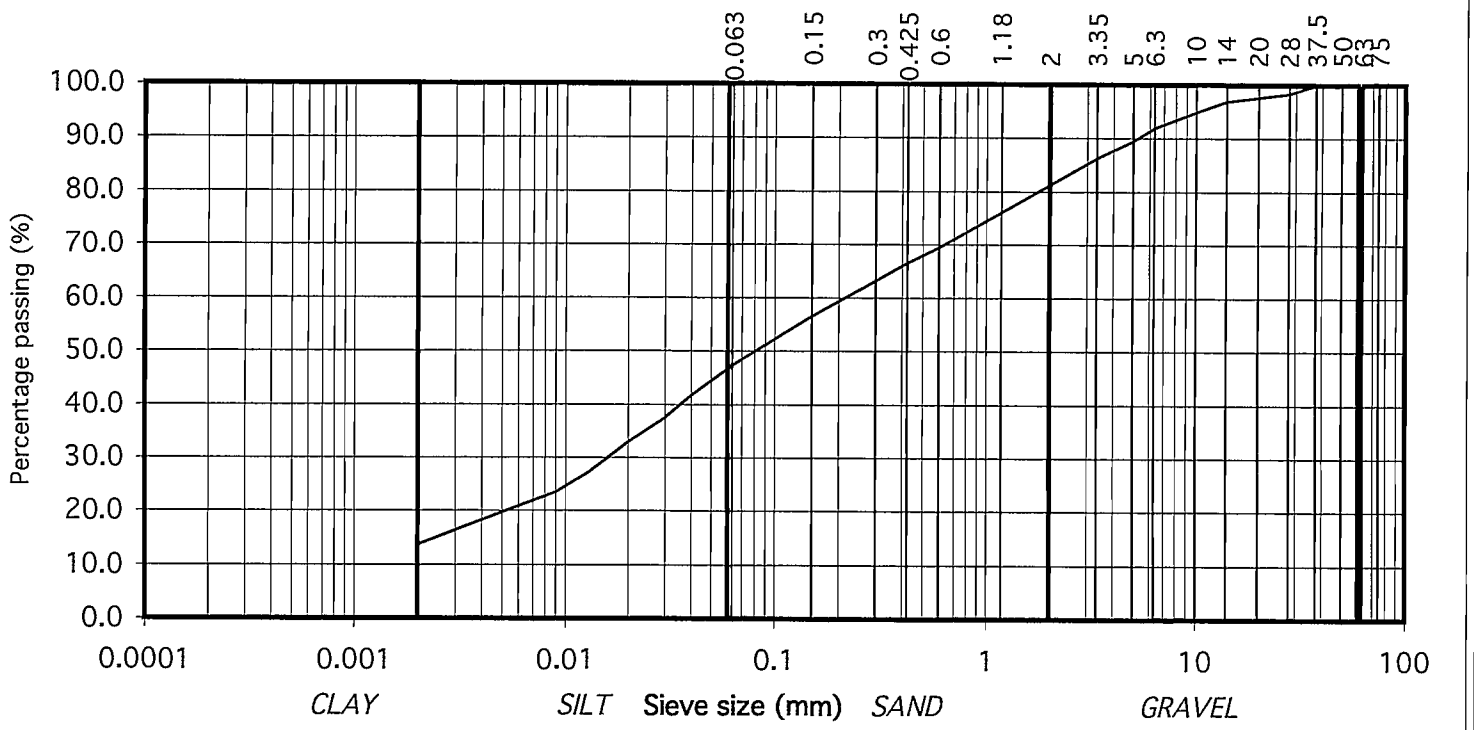
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	
50	100.0	
37.5	100.0	
28	98.3	
20	97.5	GRAVEL
14	96.9	
10	94.9	
6.3	91.9	
5	89.5	
3.35	86.2	
2	81.1	
1.18	76.0	
0.6	69.4	SAND
0.425	66.5	
0.3	63.2	
0.15	56.6	
0.063	47.2	
0.04	41.6	
0.03	37.5	
0.02	32.9	SILT/CLAY
0.013	27.2	
0.009	23.5	
0.005	19.7	
0.002	13.6	

Contract No:	10741
Contract:	Swords Housing Development
BH/TP No:	BH8
SAMPLE No.:	5678
DEPTH (m):	3.00
TEST METHOD:	Wet sieve and hydrometer
DESCRIPTION:	Grey black slightly sandy, slightly gravelly, CLAY



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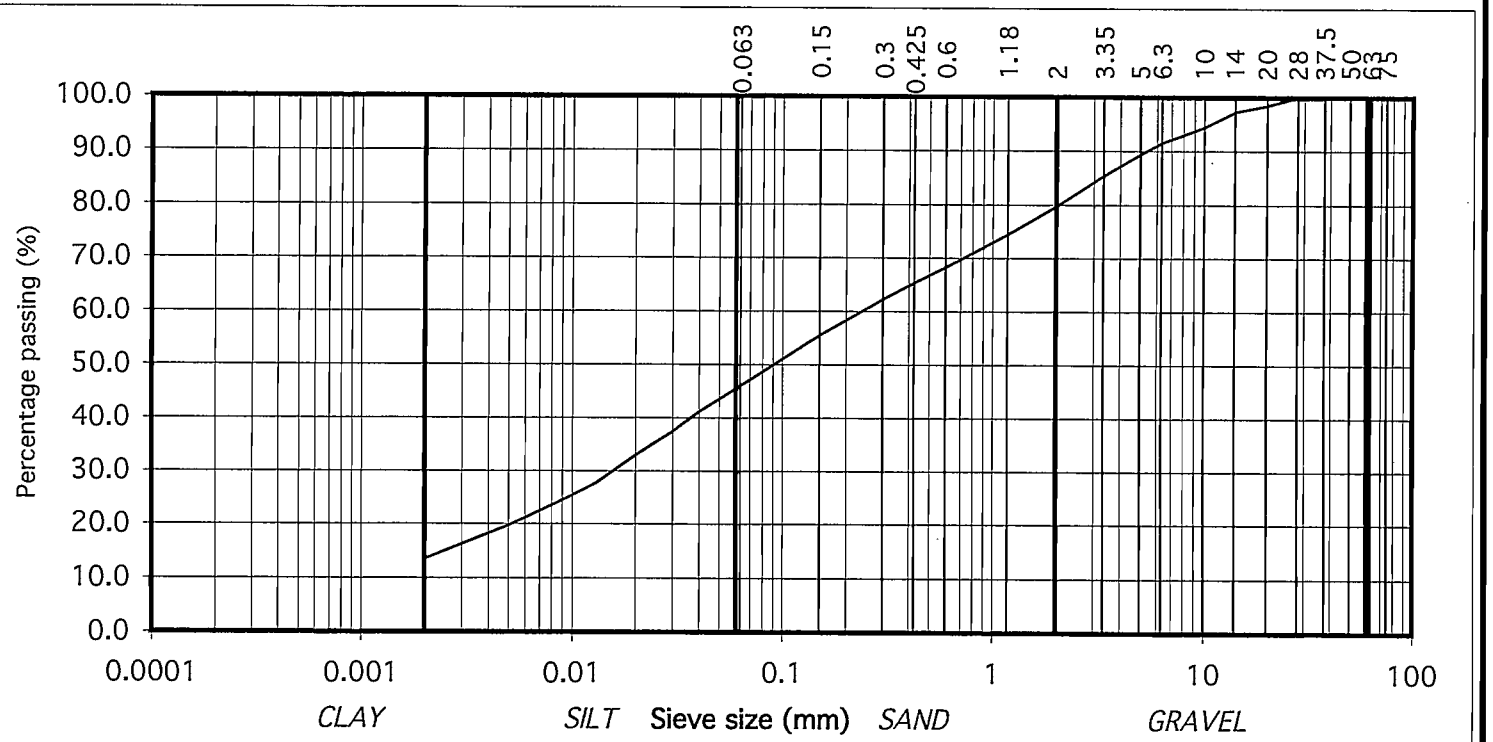
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	
50	100.0	
37.5	100.0	
28	100.0	
20	98.4	GRAVEL
14	97.2	
10	94.3	
6.3	91.5	
5	89.3	
3.35	85.3	
2	79.6	
1.18	74.4	
0.6	68.2	SAND
0.425	65.3	
0.3	62.2	
0.15	55.5	
0.063	46.0	
0.04	41.0	
0.03	37.3	
0.02	32.9	SILT/CLAY
0.013	27.8	
0.009	24.4	
0.005	19.7	
0.002	13.4	

Contract No: 10741
Contract: Swords Housing Development
BH/TP No: BH9
SAMPLE No.: 0040
DEPTH (m): 3.00
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Dark grey brown slightly sandy, slightly gravelly, SILT/CLAY



IGSL	Compiled by:	Date:	Checked by:	Date:	Page no:
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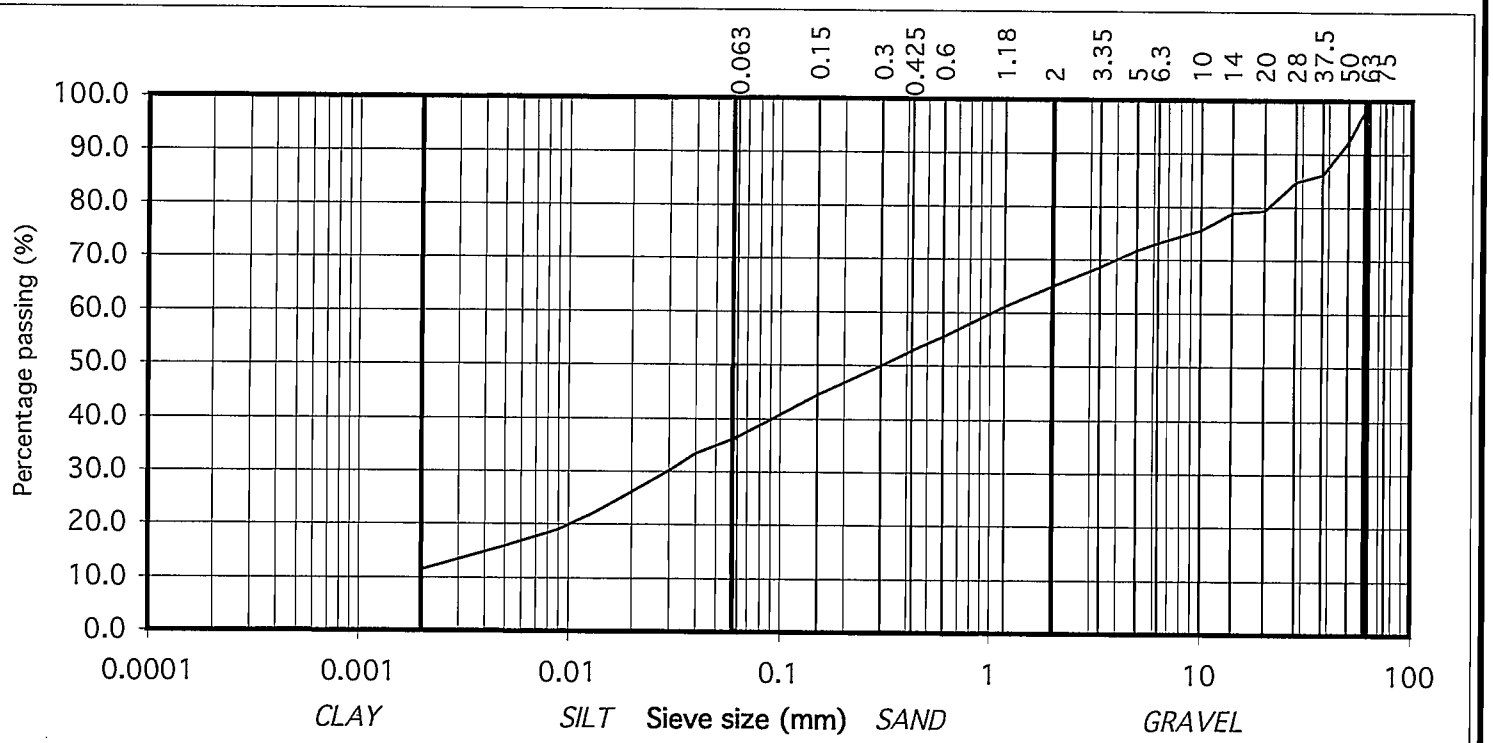
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	GRAVEL
50	92.3	
37.5	86.1	
28	84.6	
20	79.2	
14	78.8	
10	75.5	
6.3	73.1	
5	71.6	
3.35	68.6	
2	65.0	SAND
1.18	61.1	
0.6	55.4	
0.425	52.8	
0.3	50.0	
0.15	44.4	
0.063	36.5	SILT/CLAY
0.04	33.3	
0.03	30.1	
0.02	26.0	
0.013	21.9	
0.009	19.0	
0.005	15.8	
0.002	11.4	

Contract No:	10741
Contract:	Swords Housing Development
BH/TP No:	BH10
SAMPLE No.:	5622
DEPTH (m):	4.00
TEST METHOD:	Wet sieve and hydrometer
DESCRIPTION:	Dark grey slightly sandy, gravelly, CLAY



IGSL

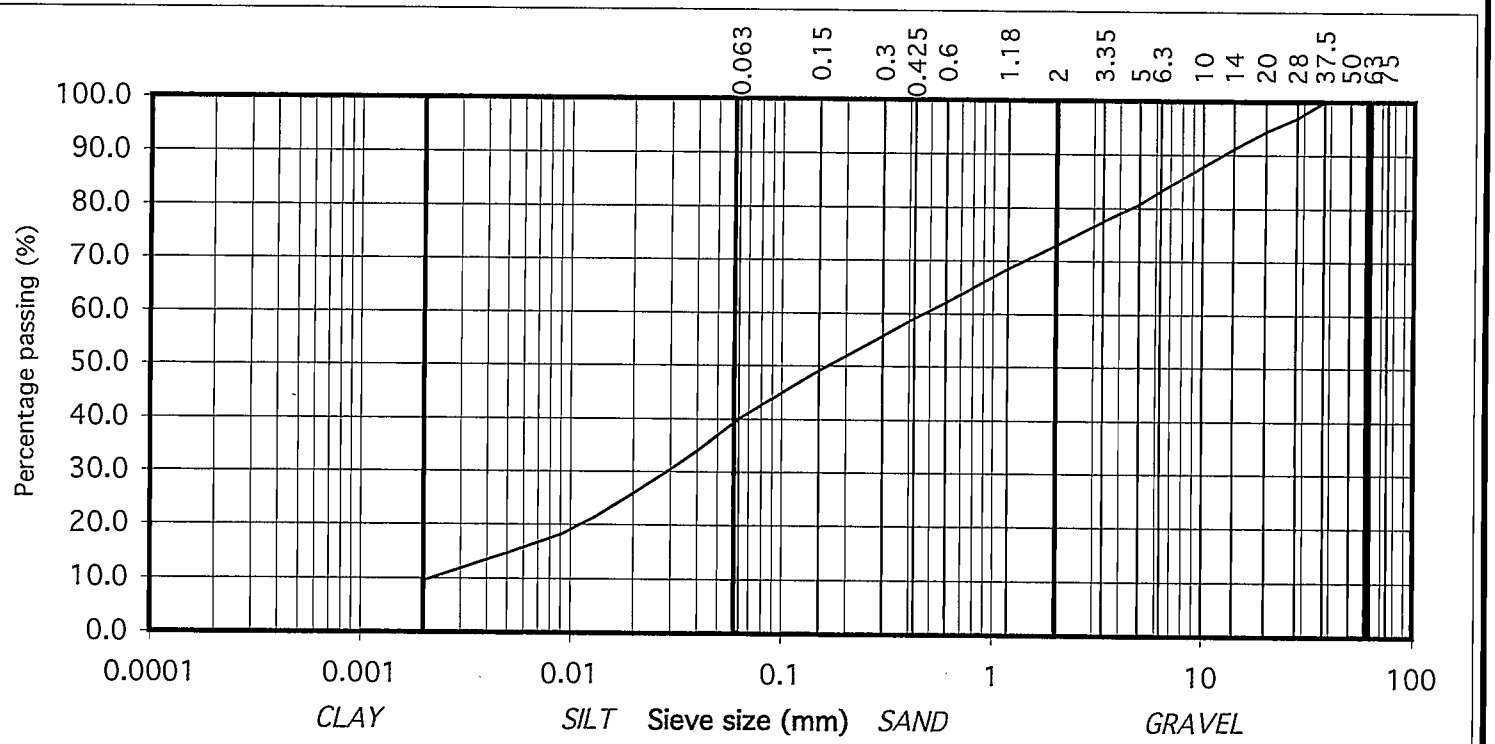
Compiled by:	Date:	Checked by:	Date:	Page no:
D CONNOLLY	28/06/2005			

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	
50	100.0	
37.5	100.0	
28	96.9	
20	94.3	GRAVEL
14	91.1	
10	87.8	
6.3	83.2	
5	80.6	
3.35	77.4	
2	72.8	
1.18	68.4	
0.6	62.1	SAND
0.425	59.0	
0.3	55.7	
0.15	49.1	
0.063	40.0	
0.04	33.8	
0.03	30.3	
0.02	25.8	SILT/CLAY
0.013	21.4	
0.009	18.2	
0.005	14.6	
0.002	9.5	

Contract No:	10741
Contract:	Swords Housing Development
BH/TP No:	BH11
SAMPLE No.:	0058
DEPTH (m):	4.00
TEST METHOD:	Wet sieve and hydrometer
DESCRIPTION:	Grey black slightly sandy, slightly gravelly, CLAY



IGSL

Compiled by:	Date:	Checked by:	Date:	Page no:
D CONNOLLY	28/06/2005			

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100.0	COBBLES
63	100.0	
50	100.0	
37.5	100.0	
28	95.8	
20	92.4	GRAVEL
14	91.1	
10	87.2	
6.3	81.6	
5	78.7	
3.35	73.3	
2	68.7	
1.18	64.8	
0.6	59.7	SAND
0.425	57.2	
0.3	54.2	
0.15	48.3	
0.063	40.3	
0.04	33.4	
0.03	30.2	
0.02	25.7	SILT/CLAY
0.013	20.9	
0.009	18.3	
0.005	15.1	
0.002	9.9	

Contract No: 10741

Contract: Swords Housing Development

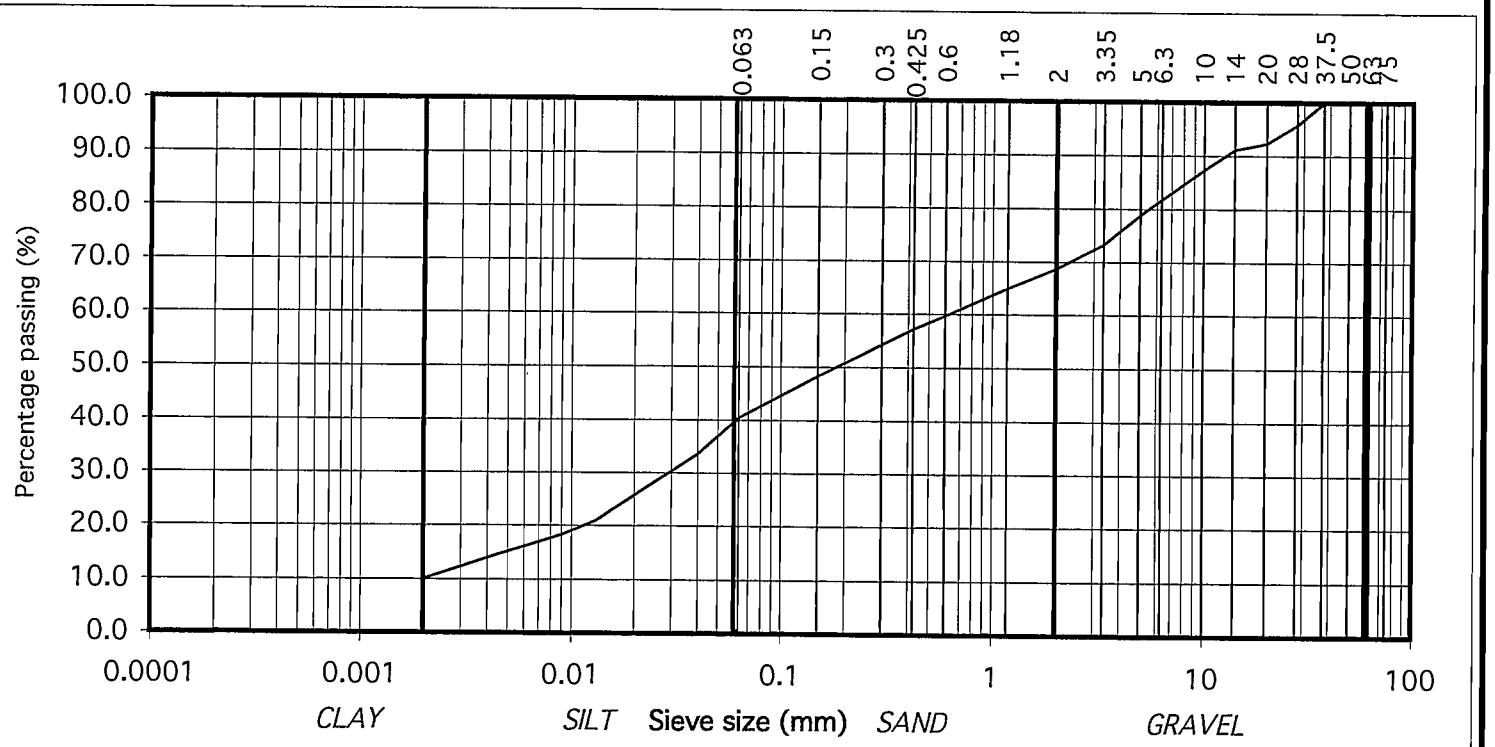
BH/TP No: BH11

SAMPLE No.: 0061

DEPTH (m): 7.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Grey black slightly sandy, slightly gravelly, CLAY



IGSL	Compiled by:	Date:	Checked by:	Date:	Page no:
	D CONNOLLY	28/06/2005			

REPORT NO.	SULPHATE ANALYSIS								IGSL
CONTRACT:	Swords Housing Development							CONTRACT NO	10741
BH/TP NO.	DEPTH (M)	SAMPLE NO.	SAMPLE TYPE	TEST CODE	% Passing 2mm	SULPHUR TRIOXIDE		(so3 X 1.2)	pH
						WATER SO3 g/L	TOTAL SOIL so3 %	TOTAL SOIL so 4 %	VALUE
BH3	1.00	5601	D	S	80		0.032	0.038	7.8
BH5	3.00	0047	D	S	65		0.082	0.098	7.8
BH6	1.00	5629	D	S	69		0.047	0.056	7.8
BH7	1.00	5609	D	S	74		0.039	0.047	7.5
BH8	1.00	5676	D	S	86		0.026	0.031	7.6
BH11	1.00	0055	D	S	73		0.033	0.040	8.0

TEST CODE: W = WATER S = SOIL A = AQUEOUS SOIL EXTRACT(2:1)

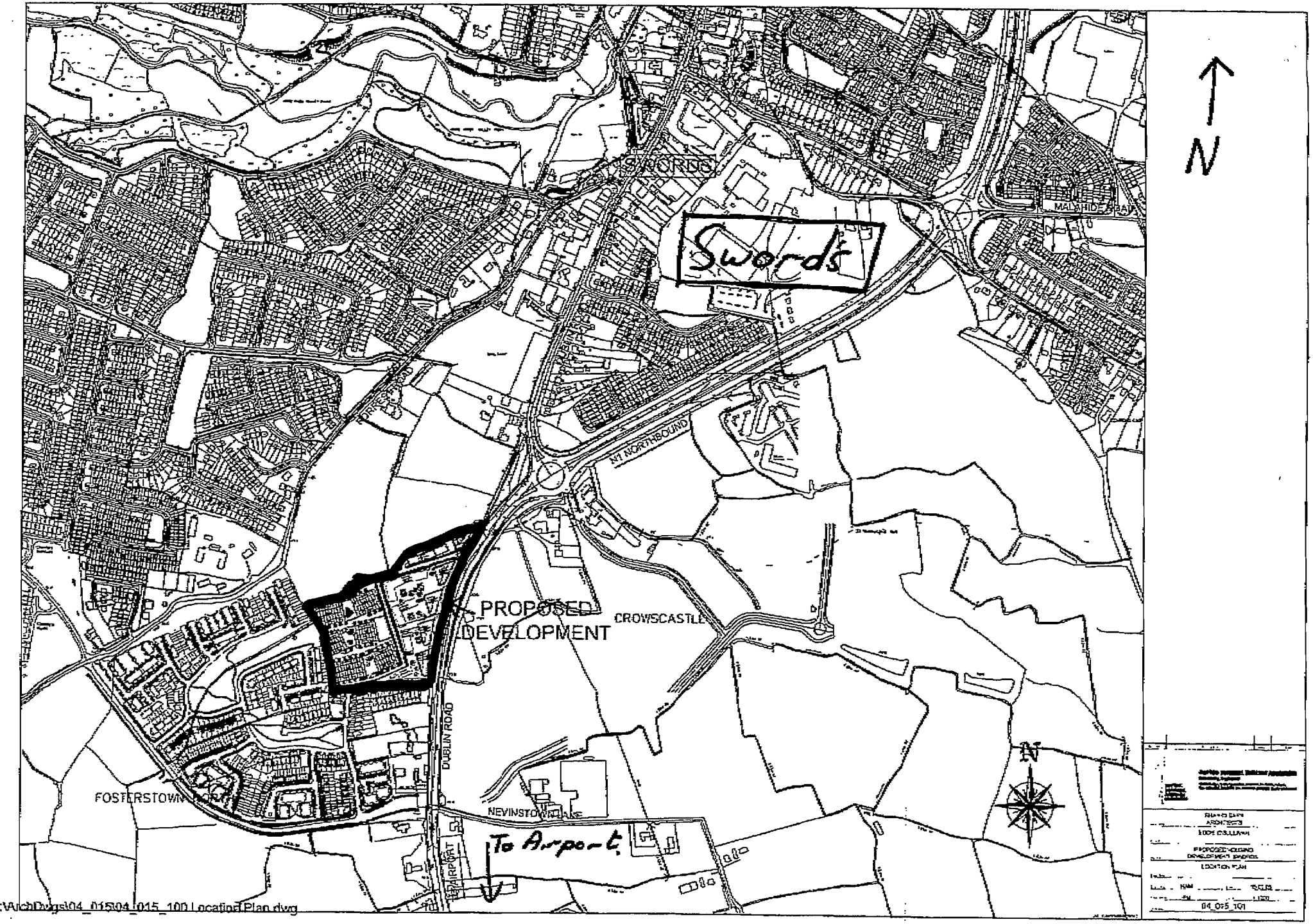
Report No.	CALIFORNIA BEARING RATIO	I.G.S.L.

Contract: Swords Housing Development DATE: 28/6/05 CONTRACT No 10741

Location	Sample No.	Depth of Sample	Sample Description	Water Content %	Test Code	Water Content Top %	Water Content Bottom %	Bulk Density Mg/M3	% Passing 20mm	C.B.R. Top %	C.B.R. Base %	C.B.R. Average %
TP1	8573	0.50	Brown sandy gravelly SILT/CLAY with root hairs	23	L/St	23	22	1.95	96.2	3.7	3.6	3.7
TP2	8570	0.50	Mottled grey brown sandy gravelly SILT/CLAY	20	L/St	20	20	2.01	97.8	0.8	0.8	0.8
TP2	8572	2.40	Grey black sandy gravelly SILT/CLAY	11	L/St	11	11	2.19	89.0	20.3	16.0	18.1
TP3	8585	0.50	Mottled orange brown sandy gravelly SILT/CLAY	26	L/St	26	27	1.92	94.6	2.3	1.7	2.0
TP4	8576	0.50	Mottled grey brown sandy gravelly SILT/CLAY	15	L/St	15	16	2.15	79.0	4.0	4.1	4.0
TP5	8567	0.50	Brown sandy gravelly SILT/CLAY with root hairs	22	L/St	24	24	1.91	98.5	3.0	1.5	2.2
TP5	8569	2.50	Grey black sandy gravelly SILT/CLAY	9.7	L/St	9.8	9.6	2.19	98.4	19.2	13.5	16.3
TP6	8582	0.50	Mottled brown sandy gravelly SILT/CLAY with roots	23	L/St	23	23	1.91	100.0	1.2	1.7	1.5
TP7	8579	0.50	Mottled grey brown sandy gravelly SILT/CLAY	15	L/St	15	15	2.07	87.1	2.8	1.0	1.9
TP8	8564	0.50	Mottled grey brown sandy gravelly SILT/CLAY	18	L/St	17	18	2.08	100.0	1.6	1.1	1.3
TP8	8566	2.30	Grey black sandy gravelly SILT/CLAY	9.6	L/St	9.8	9.5	2.18	89.4	21.7	21.7	21.7

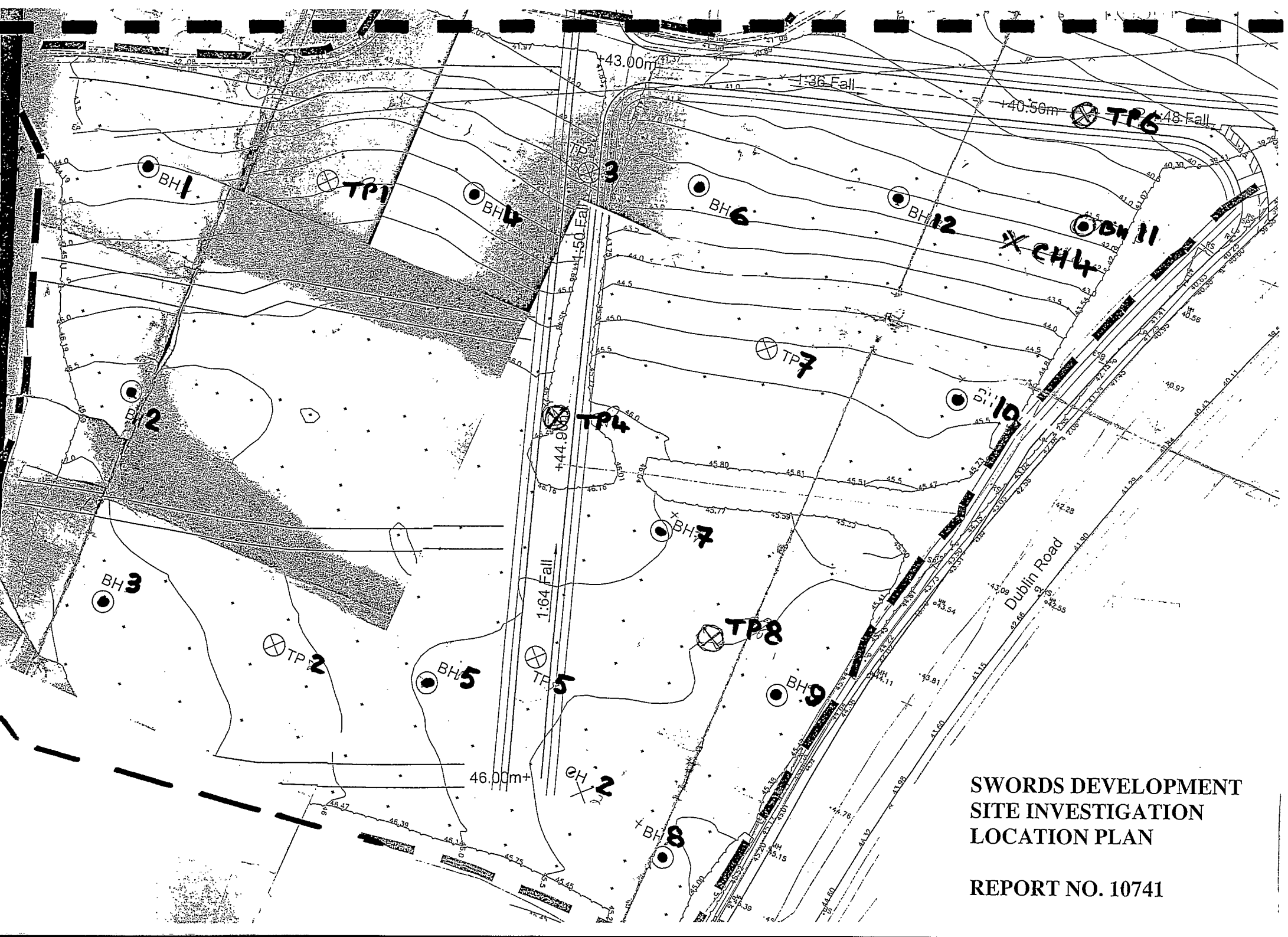
Test Code: U.-Undisturbed Sample L.-2.5Kg. Rammer A/5.-5% Air Voids Ratio V.- Vibrating Hammer
D.-Dynamic Compaction H.-4.5Kg. Rammer A10.-10% Air Voids Ratio M.- Method Number
St.-Static compaction RN29.- Road Note 29 (St. 95% H.)

Appendix V – Site Plan



W:\ArchDwgs\04_015\04_015_100 Location Plan.dwg

16/03/2005 18:15 USER: 04_015_101



SWORDS DEVELOPMENT
SITE INVESTIGATION
LOCATION PLAN

REPORT NO. 10741

XX

X

XX

I. Infiltration Rate Testing November 2019

INFILTRATION RATE TESTING

Per

BRE Digest 365 TEST METHOD

Applicant: J Murphy Developments Ltd.

Site Location: Fosterstown North, Swords, Co. Dublin

DATE OF REPORT: 11th November 2019

Prepared by

HYDROCARE ENVIRONMENTAL LTD

HYDROCARE ENVIRONMENTAL LTD

Environmental Consultants
Cooperhill Rd., Beamore,
Drogheda, Co. Meath

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HCE Ref: 19-491

Waterman Moylan
Block S, Eastpoint Business Park,
Alfie Byrne Road,
Dublin,
D03 H3F4

11th November 2019

FAO: Laura Ruiz Garrido, Graduate Civil Engineer

Applicant: J Murphy Developments Ltd.
Site Location: Fosterstown North, Swords, Co. Dublin

Infiltration testing was carried out on 24th October 2019 at the above location per BRE digest 365 method. Results of testing are summarised below for your information.

Test Hole No.	*Depth of Hole [mBGL]*	*Water Table Level [mBGL] (N/A if not encounterd)*	*Bedrock Level [mBGL] (N/A if not encounterd)*	*Infiltration Rate [m/s]*
1	1.30	NA	NA	8.67E-08
2	1.20	1.30	NA	1.93E-08
3	1.15	1.25	NA	2.20E-08
4	1.30	NA	NA	1.09E-07

Due to very poor drainage, the tests were stopped after 24 hrs and the infiltration rate was extrapolated based on the total infiltration which occurred in the 24 hrs.

Further information relating to specific test details are appended herewith for your information.

Yours sincerely,

Daniel Nolan, BA BAI, Msc Environmental Engineering, FETAC Site Assessor, MIEI

Hydrocare Environmental Ltd. - BRE365 Design Calculations

CLIENT:	**J Murphy Developments Ltd.**
LOCATION:	**Fosterstown North, Swords, Co. Dublin**
TEST HOLE NO.:	**1**

Infiltration Rate

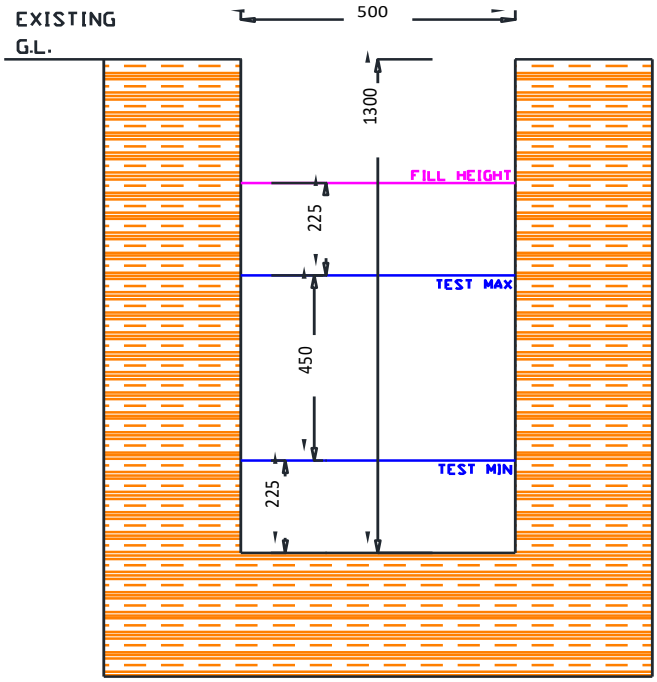
Test Hole Information:	
Length [m]	1.00
Width [m]	0.50
Depth of hole [m]	1.30
Water filled to [mBGL]	0.40
Water Table [mBGL]	NA
Base of Test [mBGL]	1.30
Bedrock [mBGL]	NA
Drop Time [min]	23386

V_{p75-25} = 1 x 0.5 x (0.675 - 0.225) = 0.225 m^3

A_{p50} = (1 x 0.45 x 2) + (0.5 x 0.45 x 2) + (1 x 0.5) = 1.85 m^2

$$f = \frac{0.225}{1.85 \times 23385.8267716535 \times 60} = 8.67E\text{-}08 \text{ m/s}$$

Note: Base of test is bottom of test hole unless water table is encountered



BRE 365 TEST HOLE

Date: 24th October 2019
Client: J Murphy Developments Ltd.
Location: Fosterstown North, Swords, Co. Dublin

Hydrocare Environmental Ltd. - BRE365 Design Calculations

CLIENT:	**J Murphy Developments Ltd.**
LOCATION:	**Fosterstown North, Swords, Co. Dublin**
TEST HOLE NO.:	**2**

Infiltration Rate

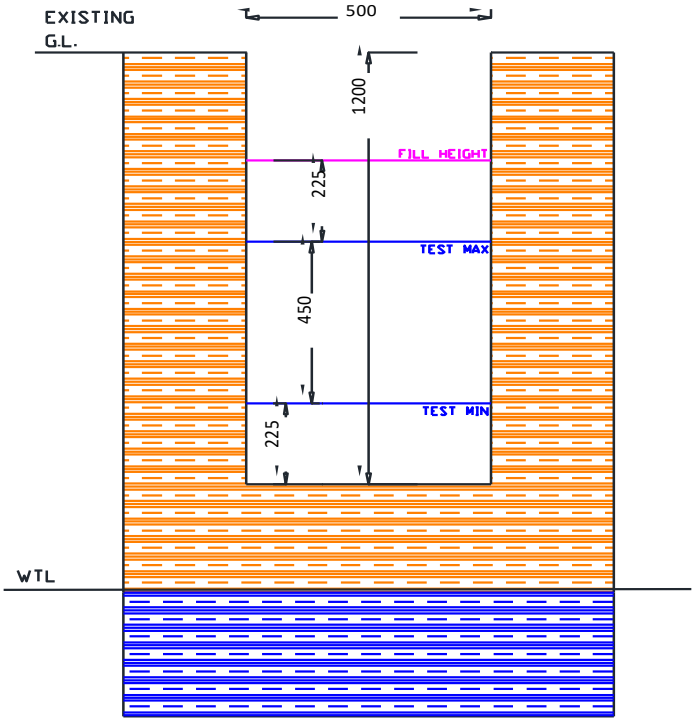
Test Hole Information:	
Length [m]	0.90
Width [m]	0.50
Depth of hole [m]	1.20
Water filled to [mBGL]	0.30
Water Table [mBGL]	1.30
Base of Test [mBGL]	1.20
Bedrock [mBGL]	NA
Drop Time [min]	102047

V_{p75-25} = 0.9 x 0.5 x (0.675 - 0.225) = 0.2025 m^3

A_{p50} = (0.9 x 0.45 x 2) + (0.5 x 0.45 x 2) + (0.9 x 0.5) = 1.71 m^2

$$f = \frac{0.2025}{1.71 \times 102047.244094488 \times 60} = 1.93E\text{-}08 \text{ m/s}$$

Note: Base of test is bottom of test hole unless water table is encountered



BRE 365 TEST HOLE

Date: 24th October 2019
Client: J Murphy Developments Ltd.
Location: Fosterstown North, Swords, Co. Dublin

Hydrocare Environmental Ltd. - BRE365 Design Calculations

CLIENT:	**J Murphy Developments Ltd.**
LOCATION:	**Fosterstown North, Swords, Co. Dublin**
TEST HOLE NO.:	**3**

Infiltration Rate

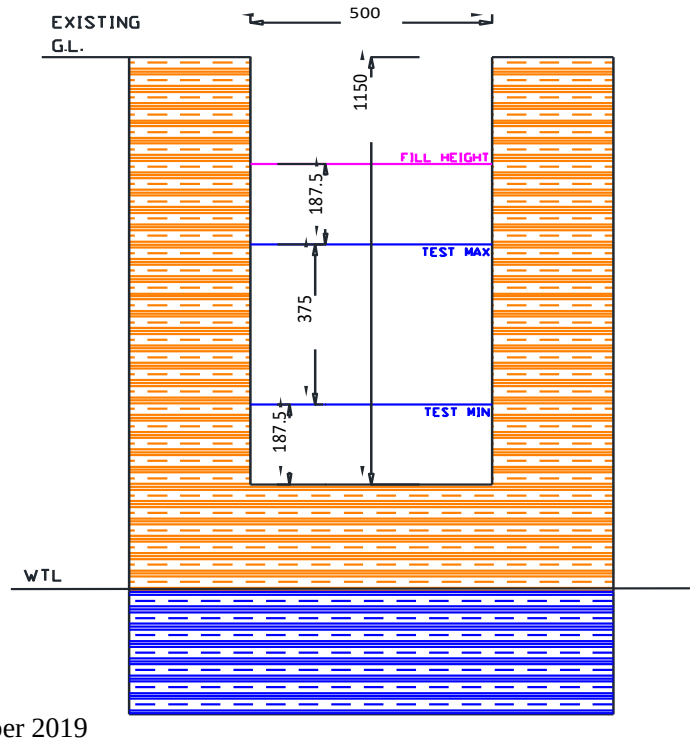
Test Hole Information:	
Length [m]	0.90
Width [m]	0.50
Depth of hole [m]	1.15
Water filled to [mBGL]	0.40
Water Table [mBGL]	1.25
Base of Test [mBGL]	1.15
Bedrock [mBGL]	NA
Drop Time [min]	85039

V_{p75-25} = 0.9 x 0.5 x (0.5625 - 0.1875) = 0.16875 m^3

A_{p50} = (0.9 x 0.375 x 2) + (0.5 x 0.375 x 2) + (0.9 x 0.5) = 1.5 m^2

$$f = \frac{0.16875}{1.5 \times 85039.3700787401 \times 60} = 2.20E\text{-}08 \text{ m/s}$$

Note: Base of test is bottom of test hole unless water table is encountered



BRE 365 TEST HOLE

Date: 24th October 2019
Client: J Murphy Developments Ltd.
Location: Fosterstown North, Swords, Co. Dublin

Hydrocare Environmental Ltd. - BRE365 Design Calculations

CLIENT:	**J Murphy Developments Ltd.**
LOCATION:	**Fosterstown North, Swords, Co. Dublin**
TEST HOLE NO.:	**4**

Infiltration Rate

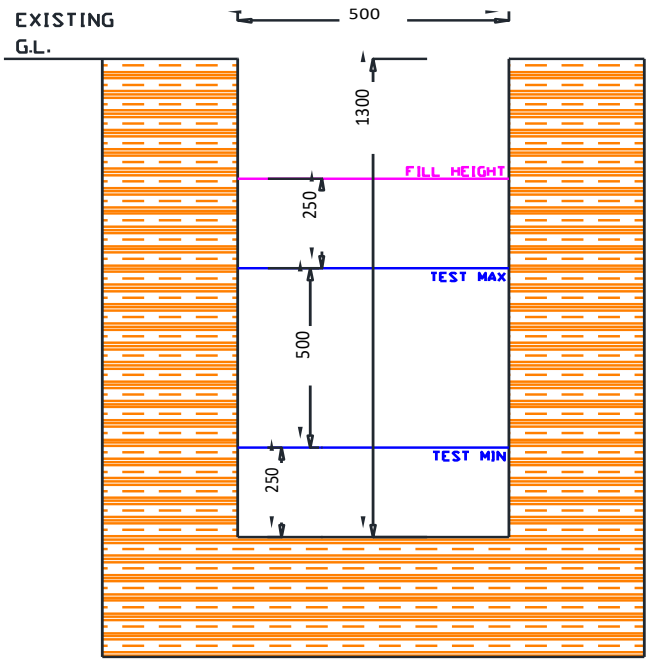
Test Hole Information:	
Length [m]	0.90
Width [m]	0.50
Depth of hole [m]	1.30
Water filled to [mBGL]	0.30
Water Table [mBGL]	NA
Base of Test [mBGL]	1.30
Bedrock [mBGL]	NA
Drop Time [min]	18602

V_{p75-25} = 0.9 x 0.5 x (0.75 - 0.25) = 0.225 m^3

A_{p50} = (0.9 x 0.5 x 2) + (0.5 x 0.5 x 2) + (0.9 x 0.5) = 1.85 m^2

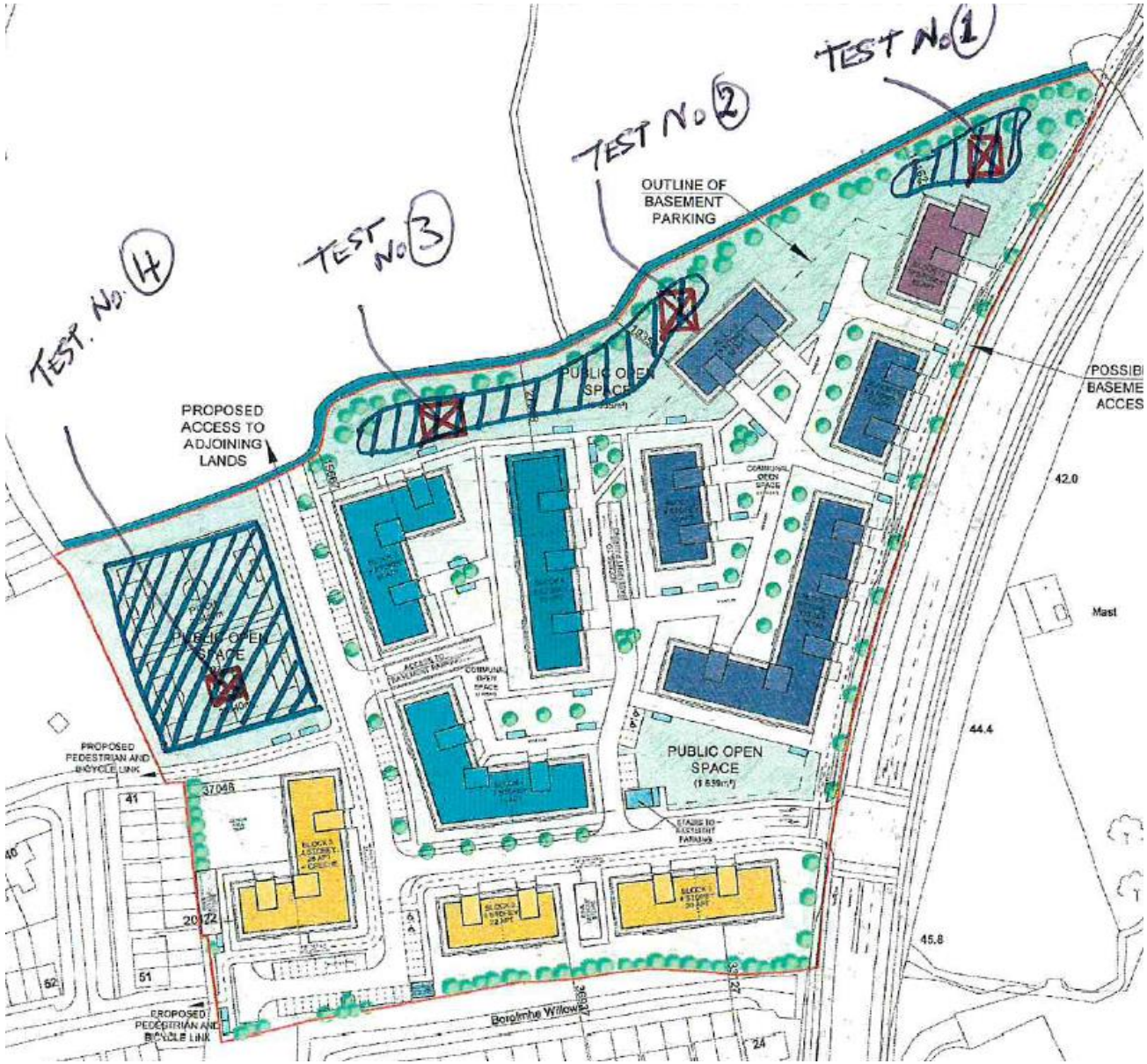
$$f = \frac{0.225}{1.85 \times 18602.3622047244 \times 60} = 1.09E\text{-}07 \text{ m/s}$$

Note: Base of test is bottom of test hole unless water table is encountered



BRE 365 TEST HOLE

Date: 24th October 2019
Client: J Murphy Developments Ltd.
Location: Fosterstown North, Swords, Co. Dublin


TEST No. 1
TEST No. 2
TEST No. 3
TEST No. 4
OUTLINE OF BASEMENT PARKING
PROPOSED ACCESS TO ADJOINING LANDS
PUBLIC OPEN SPACE
PUBLIC OPEN SPACE
PUBLIC OPEN SPACE
PROPOSED PEDESTRIAN AND CYCLE LINK
PROPOSED PEDESTRIAN AND CYCLE LINK
Boroimhe Willows
42.0
44.4
45.8
Mast

UK and Ireland Office Locations