OCSC

O'CONNOR · SUTTON · CRONIN

MULTIDISCIPLINARY CONSULTING ENGINEERS

B1054: MOUNTGORRY LRD

ENGINEERING SERVICES REPORT

For

Bartra Propco 23 Limited.

25 September 2024

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DOCUMENT CONTROL & HISTORY

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1 INTRODUCTION

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by Bartra Propco 23 Limited. to carry out the design of the Civil Engineering services (surface water and wastewater drainage, and watermain infrastructure) associated with the proposed development located on a greenfield site bounded by the R106 and Malahide Road, Swords.

1.1 ADMINISTRATIVE JURISDICTION

The proposed development is located in the jurisdiction of Fingal City Council (FCC) and therefore the engineering services design was carried out with reference to the following:

- Fingal County Development Plan (2023 – 2029).
- GDSDS - Greater Dublin Strategic Drainage Study (2005).
- The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government and the Office of Public Works, 2009).

1.2 SITE LOCATION

The subject site is located on a greenfield site bounded by the R106 and Malahide Road, Swords as indicated in Figure 1.

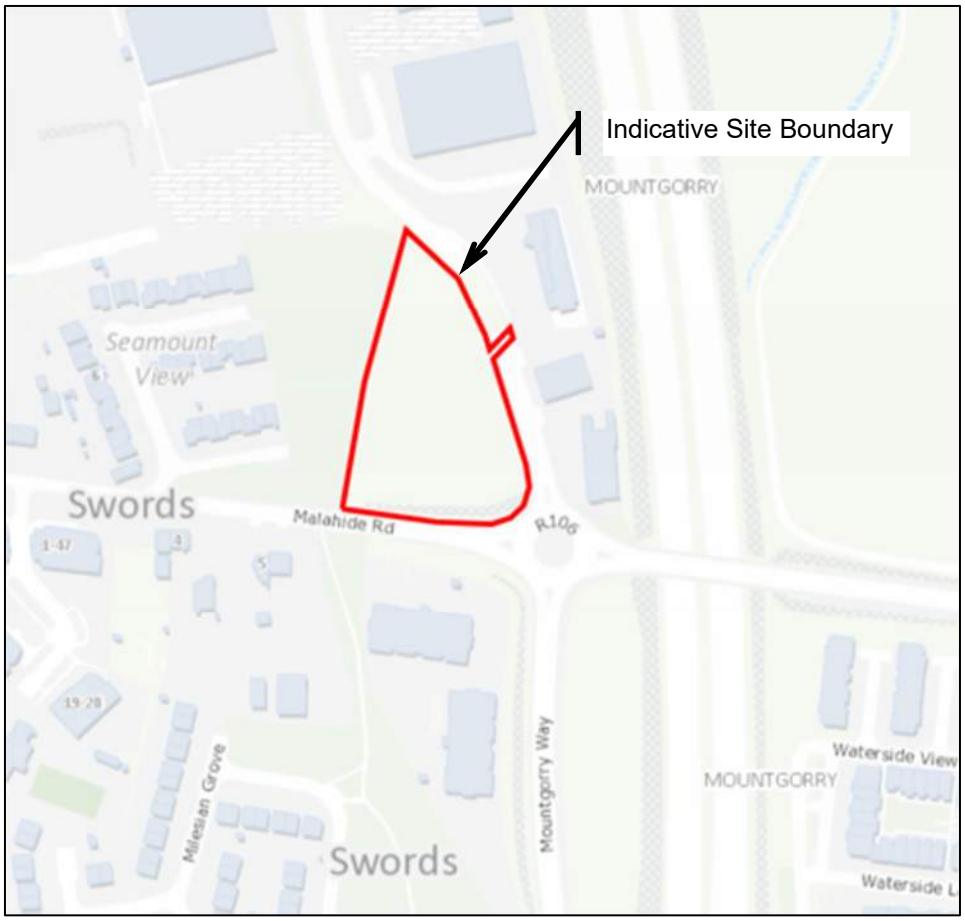


Figure 1 Site Location

1.3 EXISTING SITE OVERVIEW

The existing site comprises of a c. 0.873 hectare greenfield site.

1.4 PROPOSED DEVELOPMENT CONTEXT

Bartra Propco 23 Limited intend to apply for permission for development for a Large-scale Residential Development (LRD) at this c. 0.8731 Ha site fronting the Swords to Malahide Road (R106), Mountgorry, Swords, Co. Dublin. The site is bounded to the west by open space, with Seamount View Housing Estate further beyond, to the south by the R106, to the east by an access road to the Applegreen Service Station and to the north by Swords Business Park.

The development's surface water drainage network shall discharge from the site into the existing manhole located along the access road to the east of the site. The development site area and drainage work areas will provide a total application site area of c. 0.8792 Ha.

The proposed development will principally consist of: the construction of 123 No. residential units (55 No. one bed apartments and 68 No. two bed apartments). The development will be provided in a courtyard block arrangement ranging in height from part 4 No. to part 5 No. storeys. The proposed development has a gross floor area of c. 10,291 sq m.

The proposed development will also provide: vehicular access from the access road to the east; 24 No. car parking spaces; bicycle parking spaces; motorcycle parking spaces; pedestrian/cycle entrances at the south-west and north of the site, and along the western boundary connecting into the adjoining open space; a footpath and bicycle path around the south, east and north of the site perimeter and a shared cycle/pedestrian path along the western boundary; balconies and terraces facing all directions; hard and soft landscaping; boundary treatments; green roofs; lift overrun; PV panels; lighting; ESB substation; switchroom; plant; and all associated works above and below ground.

Refer to Figure 2 for the development layout.

Figure 2 Architectural Site Layout

2 SCOPE OF REPORT

This Drainage and Water Infrastructure Services Report was prepared by reviewing the available data from the Local Authority sources and national bodies i.e., Dublin City Council, Uisce Éireann, The OPW, and the wider Design Team. The following services are addressed within this report, with respect to the proposed development:

- Surface Water Drainage.
- Wastewater Drainage.
- Potable Water Supply.

This report should be read in conjunction with the set of OCSC Civil Engineering design drawings (refer to the B1054-OCSC-XX-XX-DR-C-**0500** drawing series) that accompany this submission.

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

- Fingal County Development Plan (2023 – 2029)
- GDSDS - Greater Dublin Strategic Drainage Study (2005).
- Greater Dublin Regional Code of Practice for Drainage Works (2006).
- Irish Water Code of Practice for Wastewater, IW-CDS-5030-03 (2020).
- Irish Water Code of Practice for Water Supply, IW-CDS-5020-03 (2020).
- The Building Regulations – Technical Guidance Document Part H (2010).
- BE EN 752 – Drainage Outside Buildings (2017).
- The Office of Public Works, the Planning System and Flood Risk Management (2009).

Members of the wider design team cover all other elements of the application pertaining to planning and architectural detail.

3 SURFACE WATER DRAINAGE INFRASTRUCTURE

3.1 DESIGN GUIDELINES

With respect to the design of surface and storm water systems, the Planning Authority will have regard to the standards set out in the Greater Dublin Strategic Drainage Study (GDSDS). In particular, all new developments shall be designed to:

- Ensure the separation of foul and surface water discharges through the provision of separate networks.
- Surface water is appropriately collected on site to prevent flow onto the public roadway, adjoining properties or into the public foul sewer / sewage treatment plant.
- Ensure the implementation of Sustainable Urban Drainage Systems (SUDS) in accordance with the Fingal County Council SuDS Policy to ensure surface water runoff is managed for maximum benefit. In particular to require proposed developments to meet the design criteria of each of the four pillars of SuDS design: Water Quality, Water Quantity, Amenity and Biodiversity.
- Promote the use of green infrastructure, such as swales and wetlands, where feasible as landscape features in new development to provide storm / surface runoff storage and reduce pollutants, as well as habitat, recreation, and aesthetic functions.

As noted within the Strategic Flood Risk Assessment of the development plan which specifically deals with the assessment of flood risk and the techniques to be applied to avoid or minimise flood risk. One of these methods is the manipulation of the layout and design of a development to provide flood 'routes' i.e. in the event of surface water sewers, or a nearby culverted stream failing, the development shall be so laid out that the resultant flood waters can take a natural route through the site without having to flow through people's homes. A further aspiration of the SuDS protocol is to increase the overall water quality of surface water runoff before it enters a natural watercourse or a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of surface water quality.

Development discharge rates are to be restricted to 2.6L/s maximum from site. SuDS are designed in accordance with best practice and the CIRIA C753 (The SuDS Manual) guidance material.

3.2 DESIGN STRATEGY OVERVIEW

Due to the proposed layout of the existing site and its restricted red line boundary noting the aspiration of the Development plan to reduce overall demand in flood events on the network drainage, our goal for retaining water on site is to utilise pervious paving and filter drains.

3.3 EXISTING SURFACE WATER DRAINAGE

3.3.1 EXISTING SURFACE WATER INFRASTRUCTURE

Existing public services records do not indicate an extensive surface water network in the vicinity of the proposed site as shown in Figure 3.

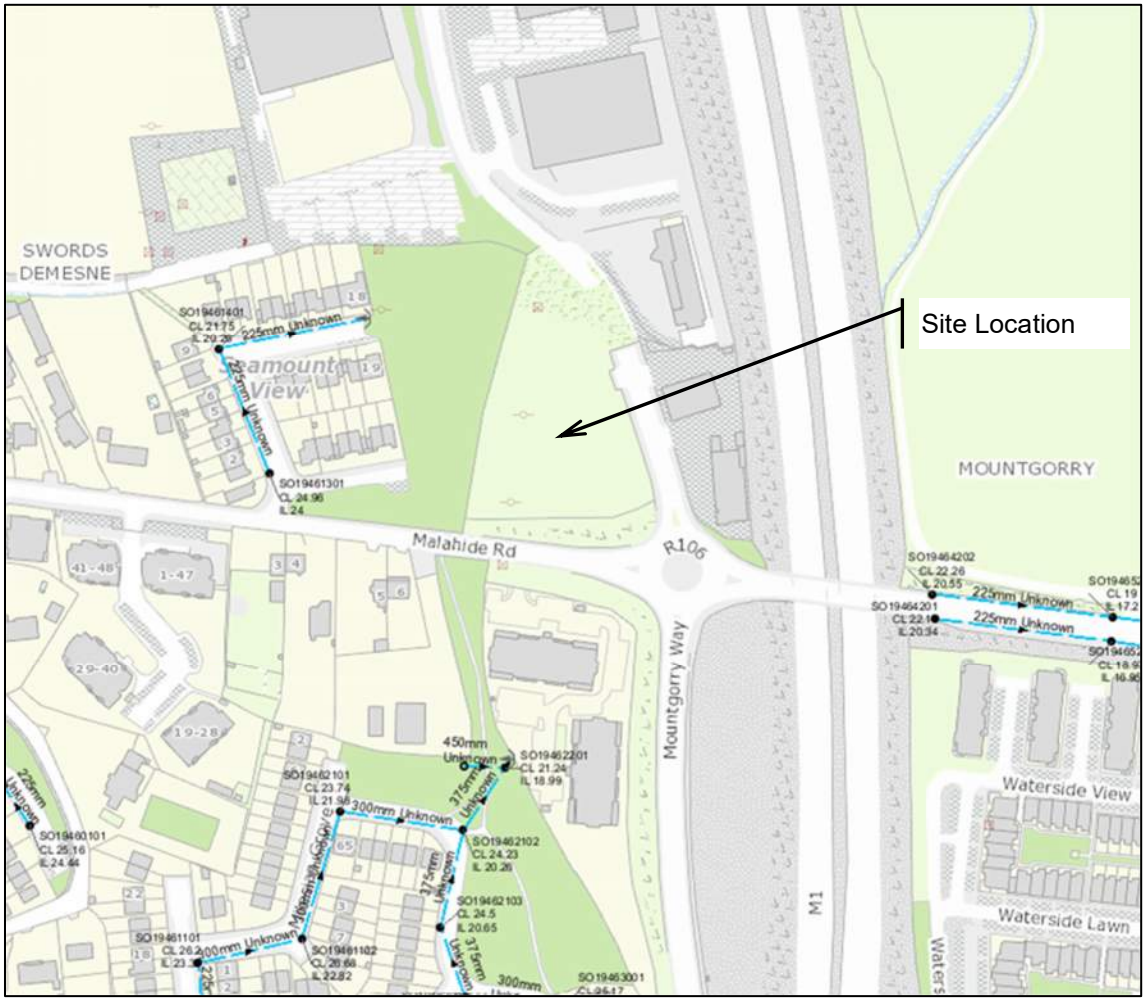


Figure 3 Existing Services – Surface Water

However, a site-specific utility and topographical survey (refer to Figure 4) has revealed a surface water network not visible on the existing public services records along the eastern boundary of the site. This 300mm dia. surface water network is draining in a northerly direction towards the industrial lands.

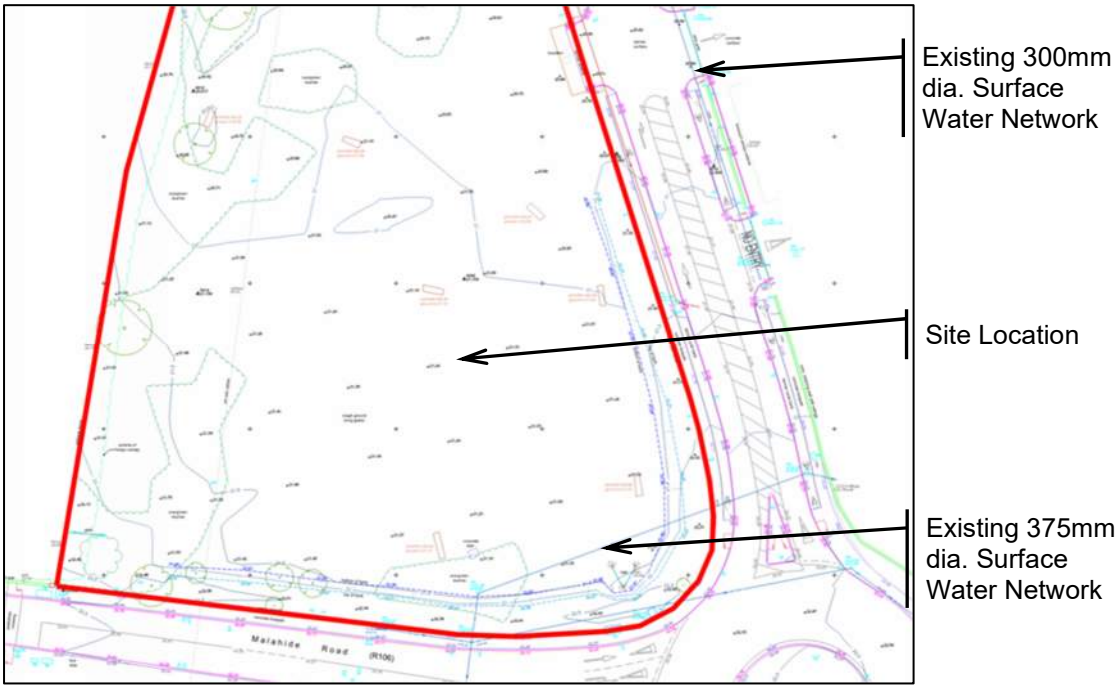


Figure 4 Site Specific Utility & Topographical Survey (Refer to Appendix B)

In addition, and as also highlighted above, there is a 375mm surface water sewer traversing the southeast corner of the site. It is noted that this sewer will require diversion given its proximity to the proposed development. This sewer does not appear on the local records, however, given its routing and size it is expected to be in the charge of Fingal County Council. This diversion strategy is in line with the previously approved development at the site under Planning Register Reference: F17A/0714 & F19A/0521.

The topography of the site sloping towards the northern boundary makes this an ideal discharge point for a gravity network as part of the development.

3.3.2 EXISTING SITE RAINFALL RUNOFF AND CATCHMENT AREAS

The existing catchment comprises of a c. 0.873 hectare greenfield site with a SAAR value of 730.5mm. Q_{BAR} for the site is calculated to be 2.6L/s.

3.4 PROPOSED SURFACE WATER DESIGN STRATEGY

3.4.1 OVERVIEW

It is proposed to separate the surface water and wastewater drainage networks which will serve the proposed development.

3.4.2 SOFTWARE DESIGN CRITERIA

Sizing of the volumes of attenuation needed have been calculated using Causeway Flow design software. A copy of the rainfall simulation settings and results has been provided in the appendices

3.4.3 CLIMATE CHANGE ALLOWANCE

The proposed surface water network has been designed to allow for an additional **20%** increase in rainfall intensity, to allow for Climate Change projections, in accordance with the Fingal County Development Plan and the GDSDS.

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

3.5 SURFACE WATER MANAGEMENT PLAN

As the proposed development's surface water design includes the provision of pervious paving and landscaped areas throughout where feasible, there will be a high percolation rate. Private drainage from the apartment units will enter the surface water network which will pass through a 150mm dia. perforated pipe surrounded by washed gravels. This 600mm wide filter drain will offer both attenuation and SUD's qualities. Runoff on site will be restricted within the surface water network by a flow restriction manhole (Hydrobrake or similar approved) limiting flow to 2.6L/s before falling to the existing 300mm dia. surface water network located to the northeast of the site.

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

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

3.5.1 RAINFALL RUNOFF AND DEVELOPMENT DISCHARGE

It is proposed to reduce and restrict the rainfall runoff discharging from the proposed development to 2.6 L/s.

The overall development discharge rate is to be restricted to a total maximum flow rate of **2.6L/s**, as calculated– for all design rainfall events up to, and including, the 1% AEP. This is achieved by providing a hydrobrake or similar approved product at the flow control manhole prior to connecting to the existing surface water network.

3.5.2 SURFACE WATER OUTFALL LOCATION

The proposed development is to discharge the surface water runoff to the local surface water drainage infrastructure located to the northeast of the sire as shown in drawing B1054-OCSC-XX-XX-DR-C-0500.

3.5.3 SUSTAINABLE DRAINAGE SYSTEMS AND FEATURES

The development is to comprise of Sustainable Drainage Systems such as tree pits, filter drains and pervious paving where possible that are to be integrated with the overall development itself. These are shown within the OCSC drainage design drawing B1054-OCSC-XX-00-DR-C-0500.

Pervious Paving

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

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

Pervious paving will be provided within the car parking spaces of the proposed development as shown in Figure 5 below.

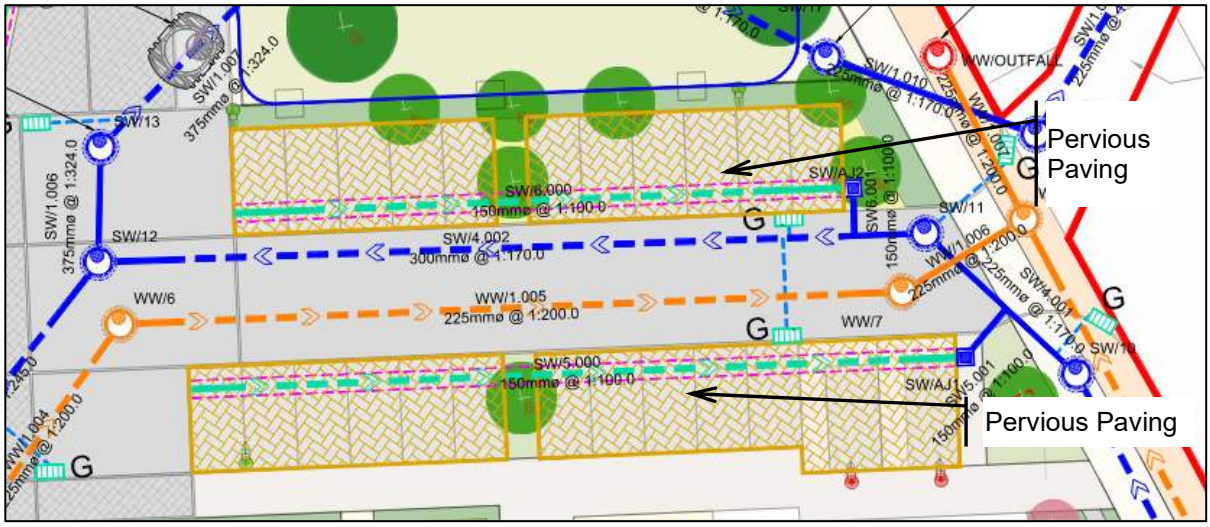


Figure 5 Pervious Paving Car Parking

Blue Roofs

Blue roof infrastructure is the main SuDS and attenuation measure at the development. These are designed to intercept and retain initial rainfall, which reduces the volume and rate at which it enters the surface water network while also acting as a treatment measure to improve the quality of the water discharged.

The extent of blue roof to be provided, in accordance with Appendix 11 of the Fingal Development Plan Standard, is shown in Figure 6.

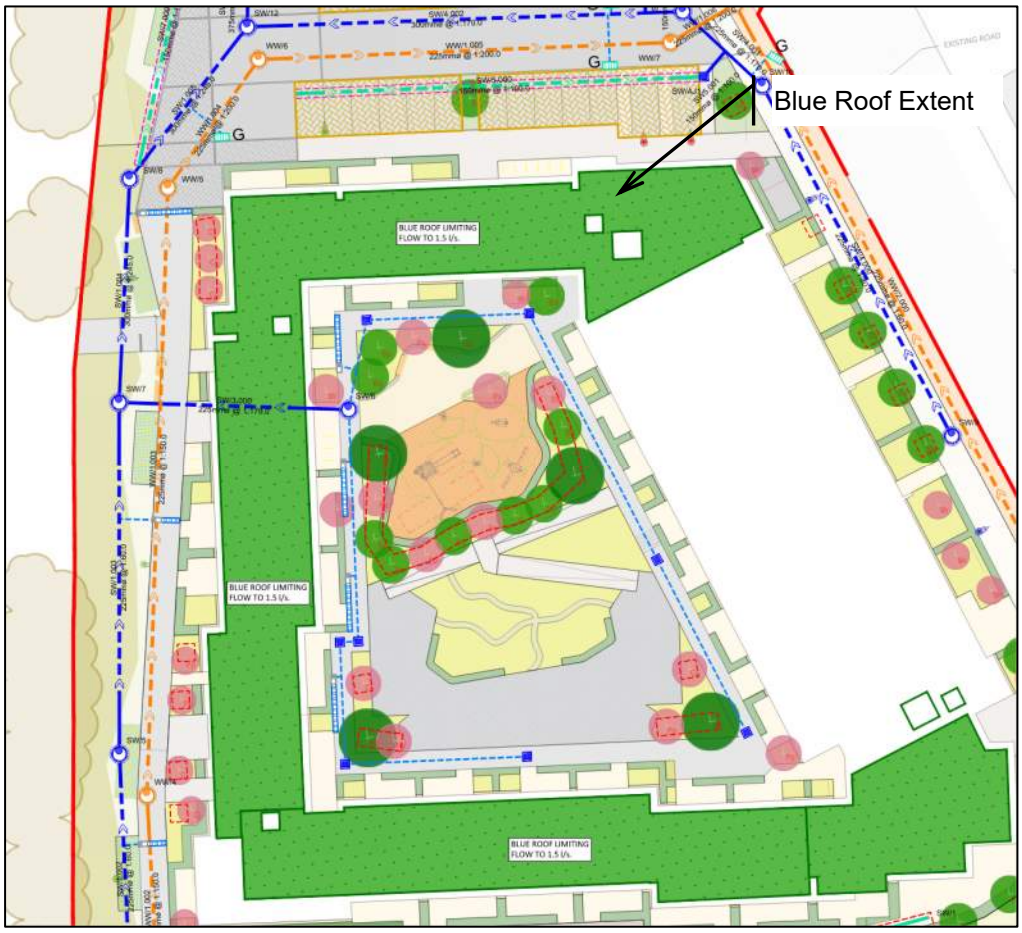


Figure 6 Extent of Blue Roof Provided

SuDS Tree Pits

SuDS Tree pits incorporate the planting of trees within a development and are designed to collect runoff from the surrounds. These tree pits can be designed with a free draining soil which will provide temporary storage prior to allowing the water to drain to an underdrain, which also acts as a growth medium for the tree whilst it's watered during rainfall events.

Tree pits will be provided for the development, with interconnected underdrains to allow for overflow to the main surface water network as illustrated in Figure 7.

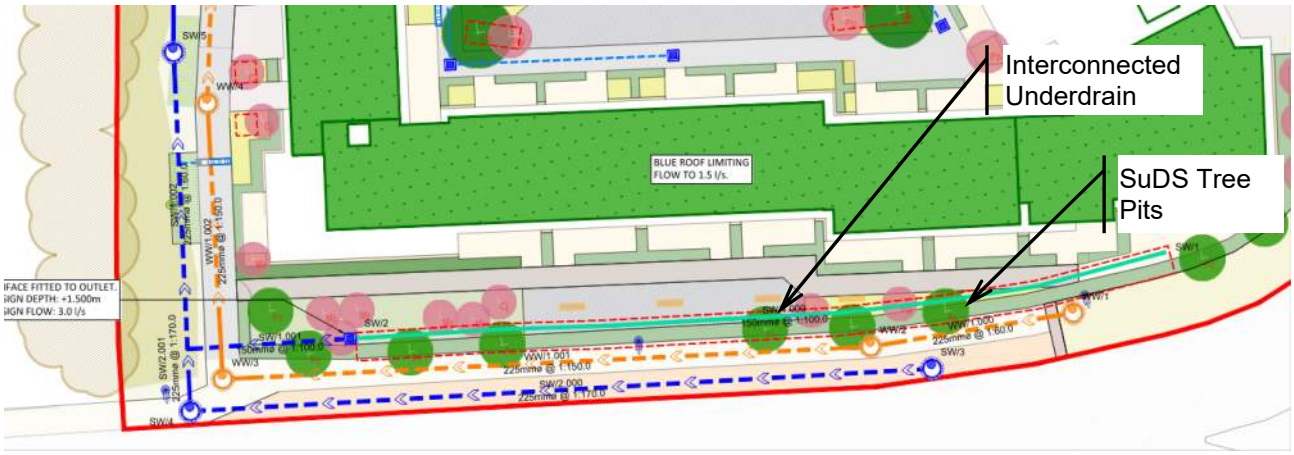


Figure 7 Proposed SuDS Tree Pits

Filter Drains

Filter drains provide conveyance as well as temporary storage, allowing for infiltration to occur should existing ground conditions permit. These typically incorporate a rectangular trench with free draining stone and a perforated pipe running along the invert of the trench.

It's proposed that filter drains be provided along the boundary of the green space to the west side of the development as in Figure 8 below.

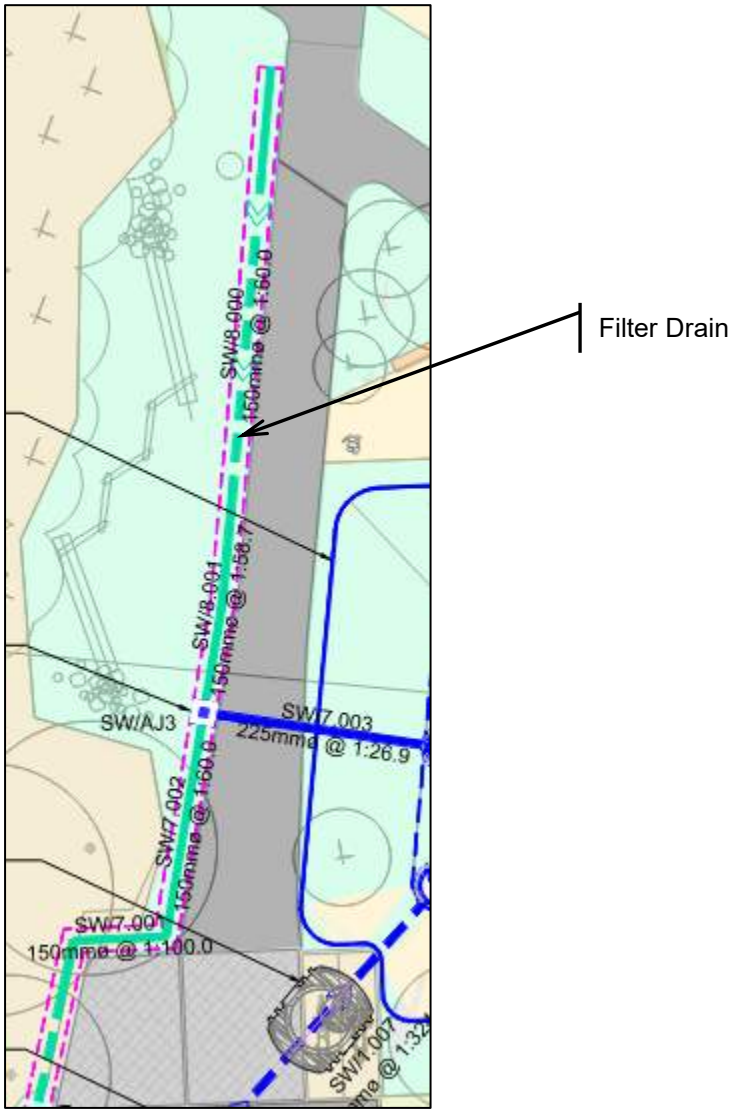


Figure 8 Proposed Filter Drains

Detention Basin

Detention basins are a form of SuDS that provides open public space but serves as storage during rainfall events, allowing water to be attenuated prior to discharge to the existing surface water network.

A detention basin is provided at the northeast corner of the site, with 1:5 side slopes and c. 100m3 of storage prior to discharging via a flow control manhole to the existing network as shown in Figure 9 below.

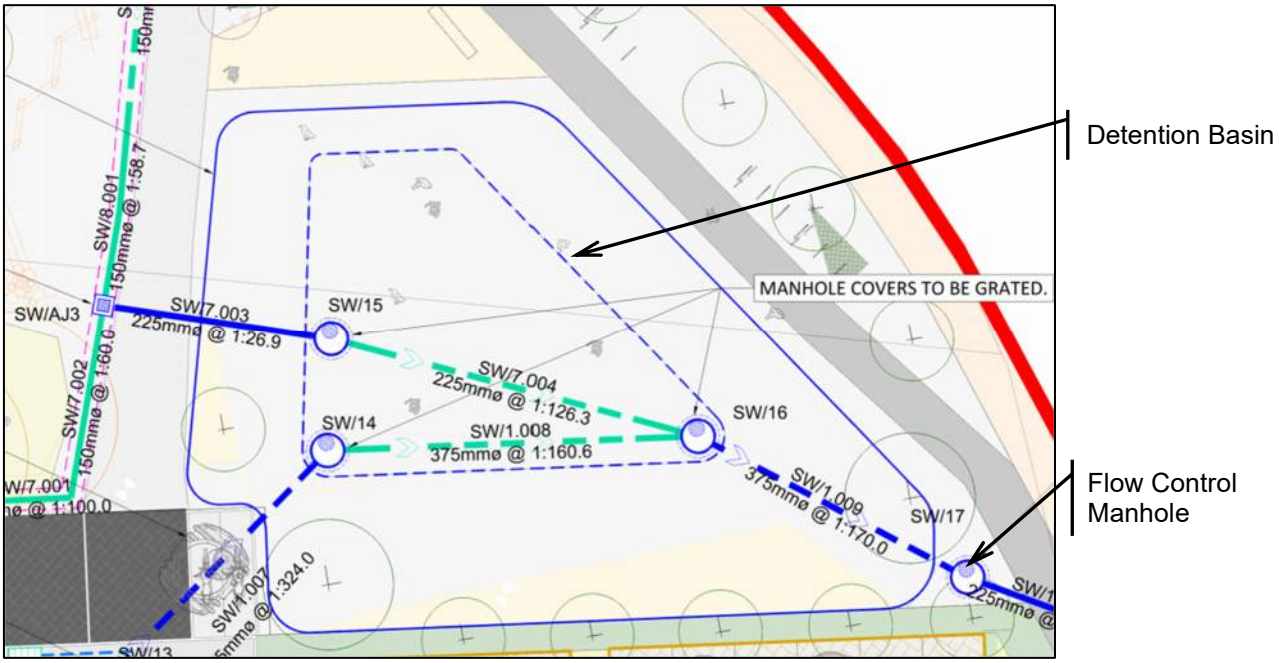


Figure 9 Proposed Detention Basin

Flow Controls

All drainage from the external catchment areas i.e., outside of building extent, shall have flow rates restricted using a Hydrobrake Vortex (or similar approved) flow control device, or protected orifice plates, prior to discharge to the main surface water drainage network.

3.5.4 ATTENUATION STORAGE

Attenuation of rainfall runoff on site is to be provided at source by the various SuDs features such as pervious paving, landscaping, and filter drain. The flow control manhole is strategically placed downstream from the detention basin which will act as the attenuation feature for surface water within the network.

3.5.5 WATER QUALITY

The water quality of the surface water discharging from site is to be greatly improved by implementation of the aforementioned SuDS strategy, which shall help remove suspended solids, silt etc... from the rainfall runoff before it enters the main surface water network.

3.5.6 MAINTENANCE

The SuDS features across the site are to be regularly inspected and maintained by the to-be-appointed development maintenance contractor, with appropriate management plan in place.

4 WASTEWATER DRAINAGE INFRASTRUCTURE

4.1 CONSULTATION

A Pre-Connection Enquiry form (application number: CDS24000501) has been submitted to Uisce Éireann for the proposed development, with a proposed discharge rate that serves the LRD. A Confirmation of Feasibility Letter has been received from Uisce Éireann and can be found in Appendix C of this document.

We have engaged in correspondence with Uisce Éireann throughout the design vetting process. During this period, we submitted our wastewater long sections and layout. Under application number CDS2400501, we received a statement of design acceptance. Please refer to the Appendix I for a copy of this document.

4.2 DESIGN GUIDELINES

The wastewater network that is to serve the proposed development has been designed in accordance with Uisce Éireann's Code of Practice for Wastewater Infrastructure and the Building Regulations, Part H.

4.3 EXISTING WASTEWATER DRAINAGE INFRASTRUCTURE

The public wastewater infrastructure in the immediate vicinity of the subject site is as shown below in Figure 10.

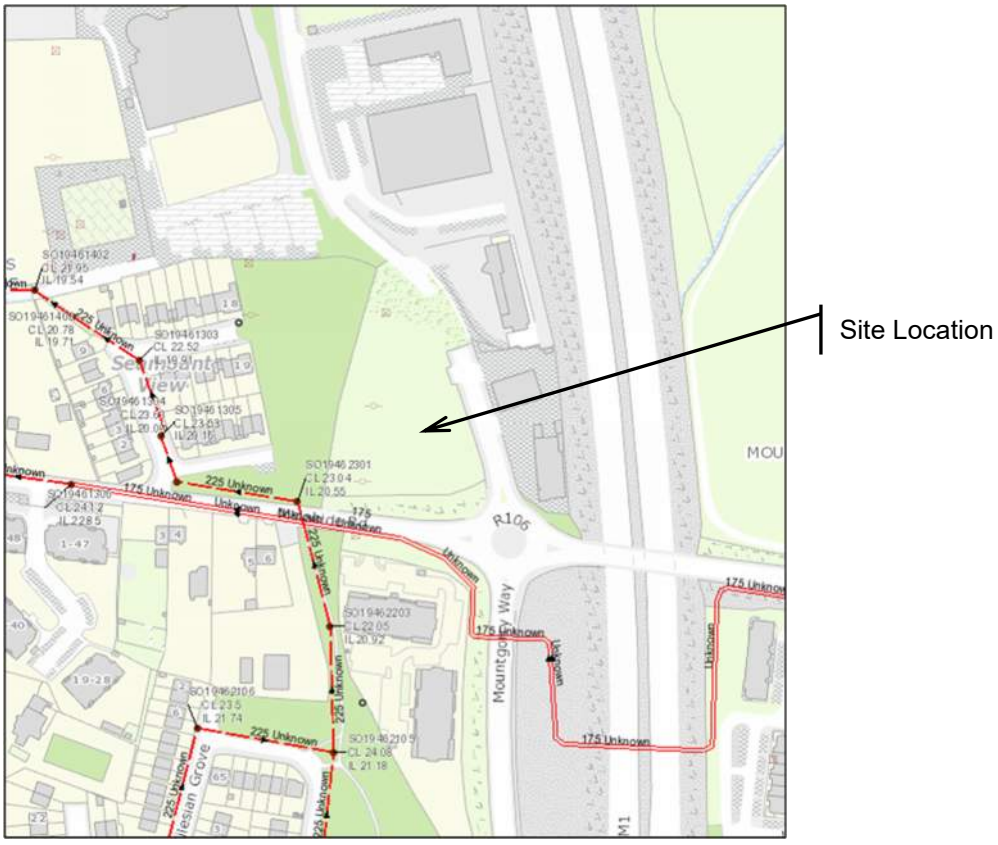


Figure 10 Existing Services – Wastewater

Based on existing records the ground levels on site would require significant alteration to accommodate discharge to the existing wastewater network shown to the south of the site. However, a site specific topographical and utility survey (refer to Figure 11) revealed a 225mm wastewater network at the northeast corner of the site which has invert levels that are more achievable and is the proposed connection location.

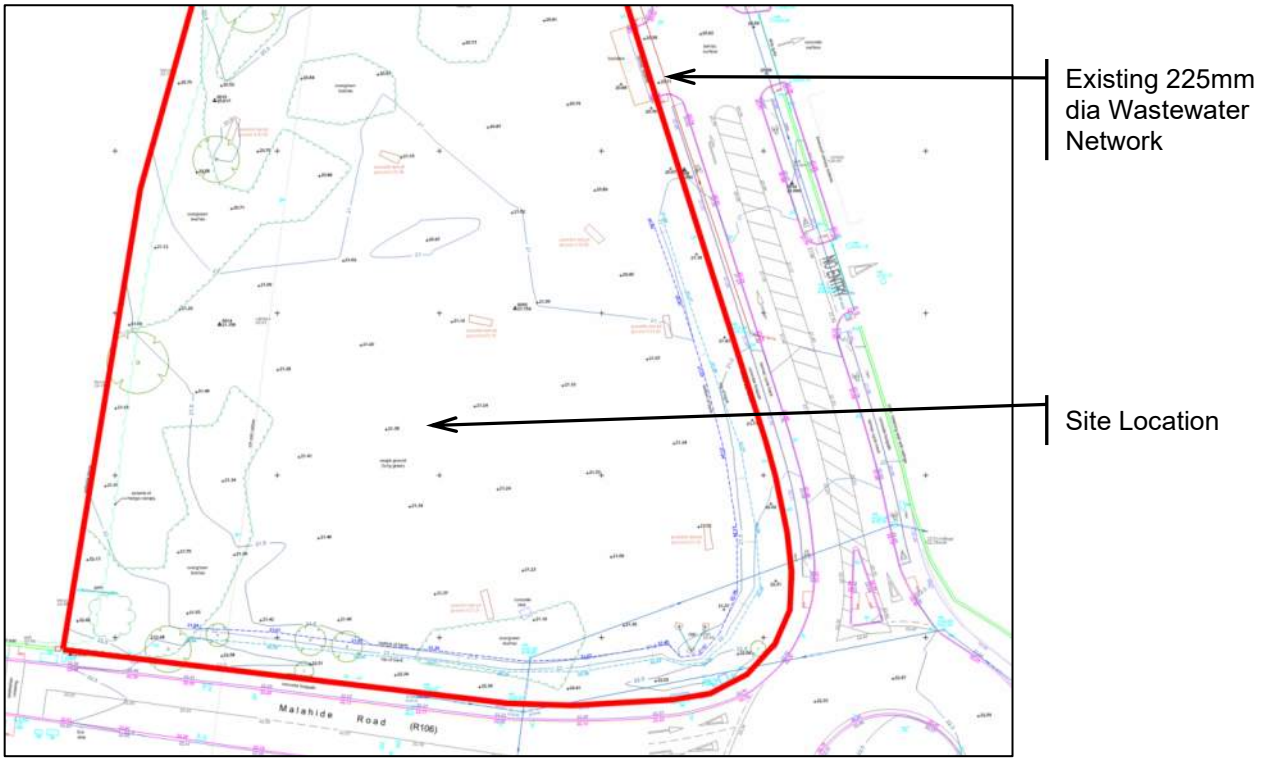


Figure 11 Site Specific Utility & Topographical Survey

4.3.1 OVERVIEW

All wastewater generated from the new development site is to discharge to the Uisce Éireann local wastewater drainage network.

4.3.2 DESIGN CRITERIA

Using Uisce Éireann guidelines, a daily, per capita flow rate of 150 l/person/day and a population of 2.7 persons/unit, has been used as part of the Pre-Connection Enquiry to Uisce Éireann.

4.3.3 DEVELOPMENT CONNECTION LOCATION

It is our proposal to connect to the existing 225mm dia. wastewater network pipeline located to the northeast of the site as outlined in drawing B1054-OCSC-XX-XX-DR-C-0500.

4.4 TAKING IN CHARGE

The infrastructure that is to be installed in order to serve the subject development is intended to be taken in charge, subject to agreement with FCC / UÉ.

5 POTABLE WATER INFRASTRUCTURE

5.1 CONSULTATION

A Pre-Connection Enquiry form (application number: CDS24000501) has been submitted to Uisce Éireann for the proposed development, with a proposed demand for LRD. A Confirmation of Feasibility Letter has been received from Uisce Éireann and can be found in Appendix C of this document.

We have engaged in correspondence with Uisce Éireann throughout the design vetting process. During this period, we submitted our watermain layout. Under application number CDS2400501, we received a statement of design acceptance. Please refer to the Appendix I for a copy of this document.

5.2 DESIGN GUIDELINES

The watermain network that is to serve the proposed development has been designed in accordance with Uisce Éireann's Code of Practice for Water Infrastructure.

5.3 EXISTING WATERMAIN INFRASTRUCTURE

As shown in Figure 12 there is a 150mm UPVC main to the northeast of the site. This is the proposed connection location for the LRD.

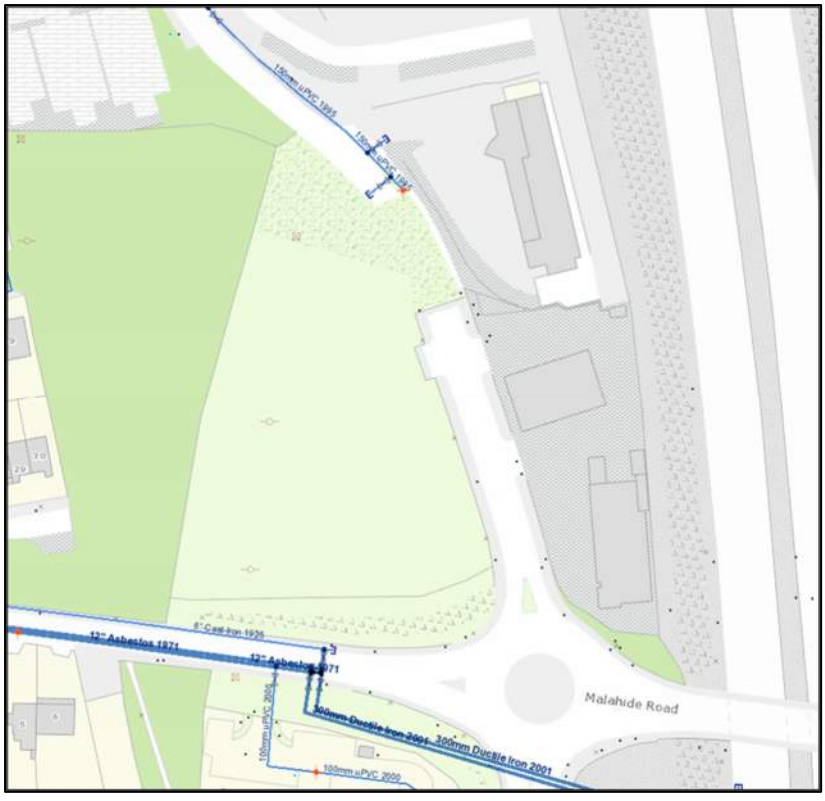


Figure 12 Existing Services – Water Supply

5.4 PROPOSED WATER SUPPLY STRATEGY

5.4.1 DESIGN CRITERIA

Using Uisce Éireann guidelines, a daily, per capita flow rate of 150 l/person/day and a population of 2.7 persons/unit, has been used as part of the Pre-Connection Enquiry to Uisce Éireann.

5.4.2 DEVELOPMENT CONNECTION LOCATION AND WATER METERS

A bulk water meter is to be provided at the connection to the public watermain, at the development entrance, with additional metering to be provided in accordance with Irish Water's requirements.as outlined in drawing B1054-OCSC-XX-XX-DR-0550

5.5 TAKING IN CHARGE

The infrastructure that is to be installed in order to serve the subject development is intended to be taken in charge, subject to agreement with FCC / UÉ.

6 SITE-SPECIFIC FLOOD RISK ASSESSMENT

This Site-Specific Flood Risk Assessment has been prepared in order to inform the Planning Authority of potential flood risk associated with the subject development. This section of the report assesses the site and development proposals in accordance with the requirements of "The Planning System and Flood Risk Management Guidelines for Planning Authorities," which is referred to as the PFRM Guidelines henceforth within this report.

This assessment clarifies the site's flood zone category and presents information that would facilitate an informed decision of the planning application in the context of flood risk. The section also outlines appropriate flood risk mitigation and management measures for any residual flood risk, where necessary.

The assessment was prepared by reviewing the available data and online flood mapping from the Local Authority sources and national bodies i.e., Fingal County Council, Uisce Eireann, The OPW, and the wider Design Team.

6.1 THE PLANNING SYSTEM & FLOOD RISK MANAGEMENT GUIDELINES

"The Planning System and Flood Risk Management Guidelines for Planning Authorities," November 2009 and its Technical Appendices outline the requirements for a site-specific flood risk assessment. These guidelines recommend a precautionary approach when considering flood risk management in the planning system.

6.1.1 SEQUENTIAL APPROACH

The core principle of the guidelines is to adopt a flood risk sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for river and coastal flooding.

The guidelines include definitions of Flood Zones A, B and C, as noted below. It should be noted that these do not take into account the presence of flood defences, as there remain risks of overtopping and breach of the defences.

Table 1 - Flood Zone Designation

Flood Zone	Type of Flooding	Annual Exceedance Probability (AEP)
Flood Zone A	**Coastal**	Less than a 1:200 (0.5% AEP) year event
	Fluvial	Less than a 1:100 (1% AEP) year event
Flood Zone B	**Coastal**	Greater than a 1:200 (0.5% AEP) year event; and less than a 1:1000 (0.1% AEP) year event.
	Fluvial	Greater than a 1:100 (1% AEP) year event; and less than a 1:1000 (0.1% AEP) year event.
Flood Zone C	**Coastal**	Greater than a 1:1000 (0.1% AEP) year event
	Fluvial	Greater than a 1:1000 (0.1% AEP) year event

This site-specific flood risk assessment will initially use existing flood risk information to determine the flood zone category of the site i.e., to check if the PFRM Guidelines Sequential Approach has been applied.

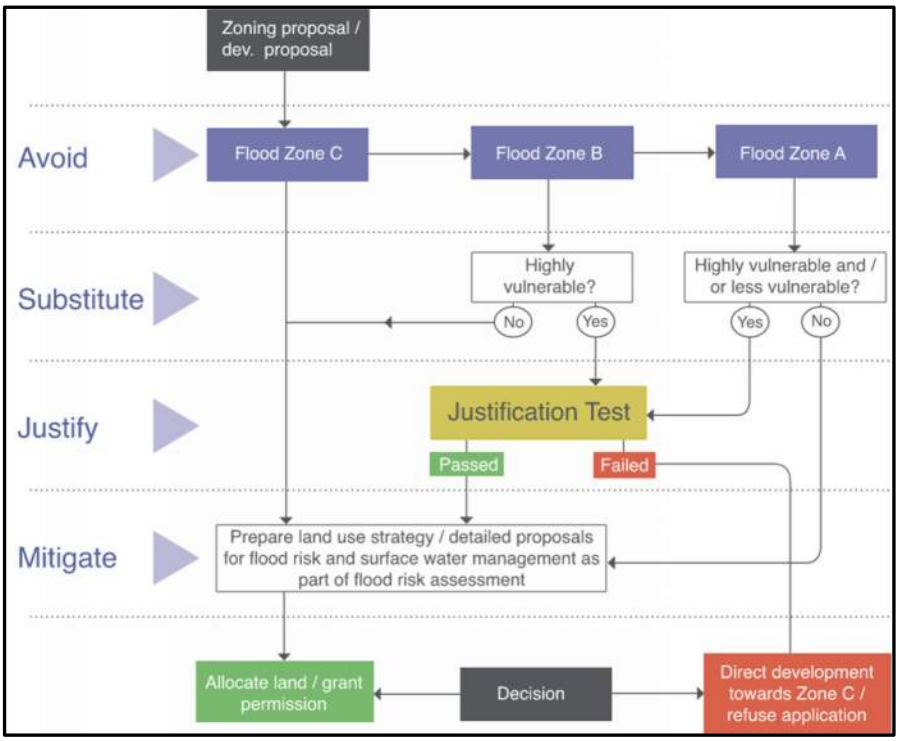


Figure 13 Sequential Approach Mechanism (from PFRM Guidelines)

The sequential approach makes use of flood risk assessment and of prior identification of flood zones for river and coastal flooding and classification of the vulnerability to flooding of different types of developments, as illustrated in Table 3.1 of the PFRM Guidelines. The general principles applied in the sequential approach of flood risk management is illustrated in the figure below.

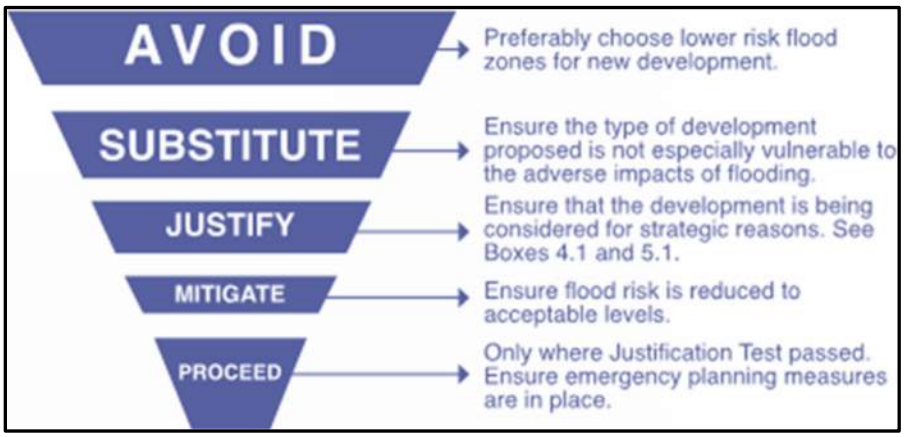


Figure 14 Sequential Approach Principles in Flood Risk Management

The *PSFRM Guidelines* classify potential development in terms of its vulnerability to flooding. The types of development falling within each vulnerability class are described in *Table 3.1* of the *PSFRM Guidelines*, which is reproduced in the table below.

Table 2: Development Vulnerability Class

Vulnerability Class	Land uses and types of development which include:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; *Dwelling houses*, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

As the proposed development is defined as "residential" and is considered as '***Highly Vulnerable***' in accordance with the PFRM Guidelines. The appropriateness of developments, based on their vulnerability, is summarised below in *Table 3* of this report.

Table 3 - Matrix of Vulnerability Vs Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable Development (incl. essential infrastructure)	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water-Combatable Development	Appropriate	Appropriate	Appropriate

It is essential that the risk potentially arising from other sources of flooding are also taken into account, which are summarised in further sections of this section of this ESR.

6.1.2 CLIMATE CHANGE

Both the Greater Dublin Strategic Drainage Study (GDSDS, 2005) and PFRM Guidelines require that account be taken of the effects of climate change over the design life of a development, typically 100 years. Design parameters to take account of climate change were established in the GDSDS and revised following later studies and Climate Change Sectorial Adaptation Plan Flood Risk Management (2015-2019) published by the OPW. These parameters are set out in *Table 4*, below.

Table 4 - Climate Change Impact Requirements

Design Category	Recommended Impact of Climate Change
Tidal / Coastal	Sea level rise of 500mm
Fluvial (River)	20% increase in flow rates
Pluvial (Rainfall)	20% increase in rainfall intensity

6.1.3 FLOOD RISK ASSESSMENT

The assessment of flood risk requires an understanding of where the water comes from (i.e., the source), how and where it flows (i.e., the pathways) and the people and assets that it affects (i.e., the receptors). This is illustrated further in the figure below, as sourced from the PFRM Guidelines.

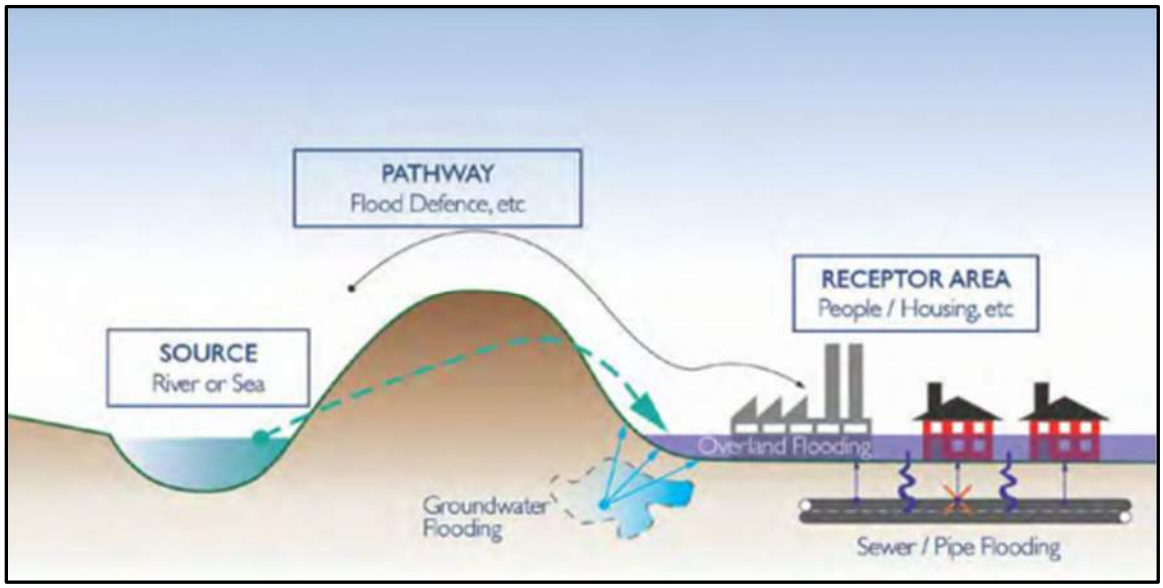


Figure 6 Source - Pathway - Receptor Model

The main sources of flooding are rainfall or higher than normal sea or river levels.

The main pathways include rivers, streams, sewers, drains, overland flow, and river and coastal floodplains and their assets.

Receptors typically include people, their property and their environment.

All three elements of this model must be examined as part of the flood risk assessment, including the vulnerability and exposure of receptors. In order to determine its potential consequence.

Risks to people, property and the environment should be assessed over the full range of probabilities, including extreme events. Flood risk assessment should cover all sources of flooding, including effects of run-off from a development locally and beyond the development site.

6.1.4 FLOOD RISK ASSESSMENT STAGES

Once a flood zone has been identified, the PFRM Guidelines sets out the different types of development appropriate to each zone. Exceptions to the restriction of development due to potential flood risks are provided for through the use of the Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated. This recognises that there will be a need for future development in existing towns and urban centres that lie within flood risk zones, and that the avoidance of all future development in these areas would be unsustainable.

A three staged approach to undertaking an FRA is recommended:

- **Stage 1: Flood Risk Identification** – Identification of any issues relating to the site that will require further investigation through a Flood Risk Assessment;

- **Stage 2: Initial Flood Risk Assessment** – Involves establishment of the sources of flooding, the extent of the flood risk, potential impacts of the development and possible mitigation measure;
- **Stage 3: Detailed Flood Risk Assessment** – Assess flood risk issues in sufficient detail to provide quantitative appraisal of potential flood risk of the development, impacts of the flooding elsewhere and the effectiveness of any proposed mitigation measures.

This assessment addresses the requirements for *Stage 1: Flood Risk Identification*, as the following sections of this chapter confirm that the subject site is not located within an identified Flood Zone.

6.2 STAGE 1- FLOOD RISK IDENTIFICATION

The proposed site is not located in the immediate vicinity of any watercourse, with the nearest element being the Broadmeadow Estuary, which is located over 1km north of the development site.

Figure 15: Local Hydrological Environment

The OPWs national flood information portal, floodinfo.ie, provides location specific access to flood risk & flood management information. However, the area surrounding the proposed development site is currently under review on the portal. As a result of the review, this portal in conjunction with the Fingal Development Plan 2023-2029, was used to obtain flood information maps which are detailed in the following sections.

6.2.1 COASTAL FLOOD RISK

Coastal flooding results from sea levels which are higher than normal and result in sea water overflowing onto the land. Coastal flooding is influenced by the following three factors which often work in combination:

- high tide level;
- storm surges; and
- wave action.

The subject site is located approximately 1.0km south of the Broadmeadow Estuary and approximately 4.5km west of the Malahide coastline; as a result, there is no risk associated with coastal flooding for this site, with typical ground levels for the site also being much higher than expected extreme coastal flood levels.

6.2.2 FLUVIAL FLOOD RISK

Fluvial flooding is the result of a river exceeding its capacity and excess water spilling out onto the adjacent floodplain.

Flood mapping included in the Fingal Development Plan 2023 – 2029 indicates that the proposed development is not located in either Flood Zone A or B, and that there is no fluvial flood risk to the site of the proposed development.

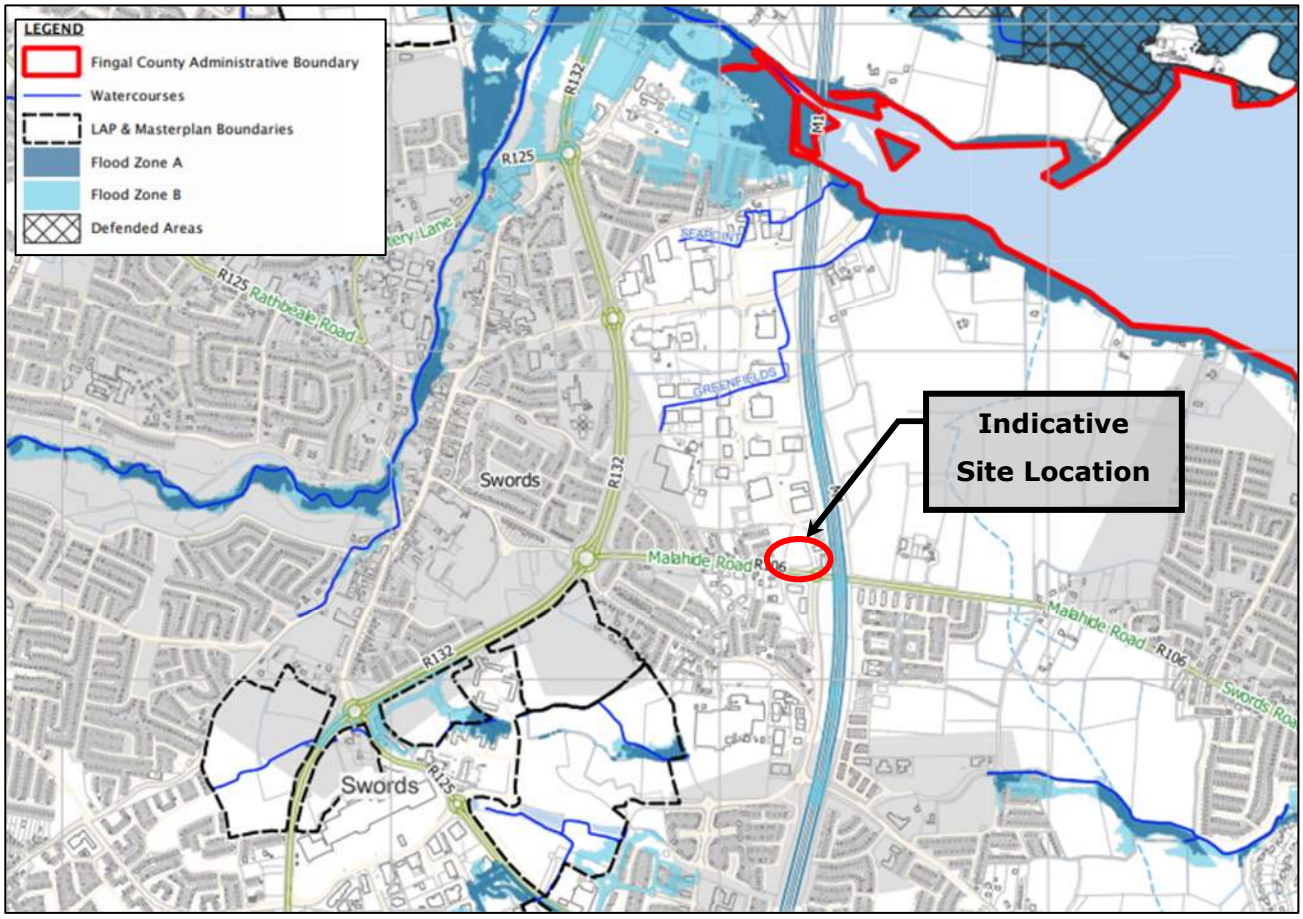


Figure 16: Fingal Development Plan 2023-2029 Indicative Flood Zones

6.2.3 PLUVIAL FLOOD RISK

There is no indication of any pluvial flood risk with no mapping apparent in the Fingal Development Plan.

6.2.4 PRIVATE / DEVELOPMENT DRAINAGE

The proposed surface water drainage network on site is designed to cater for up to and including the 100-year rainfall return period plus 20% climate change allowance. No expected flooding will occur on site for design rainfall events up to this return period, in accordance with the Local Authority requirements.

6.2.5 OPW FLOOD MAPS

The OPW Flood Hazard Mapping Website is a record of historic flood events. This database indicates that there is no record of flooding incidents in the area of the proposed development, as illustrated in the figure below.

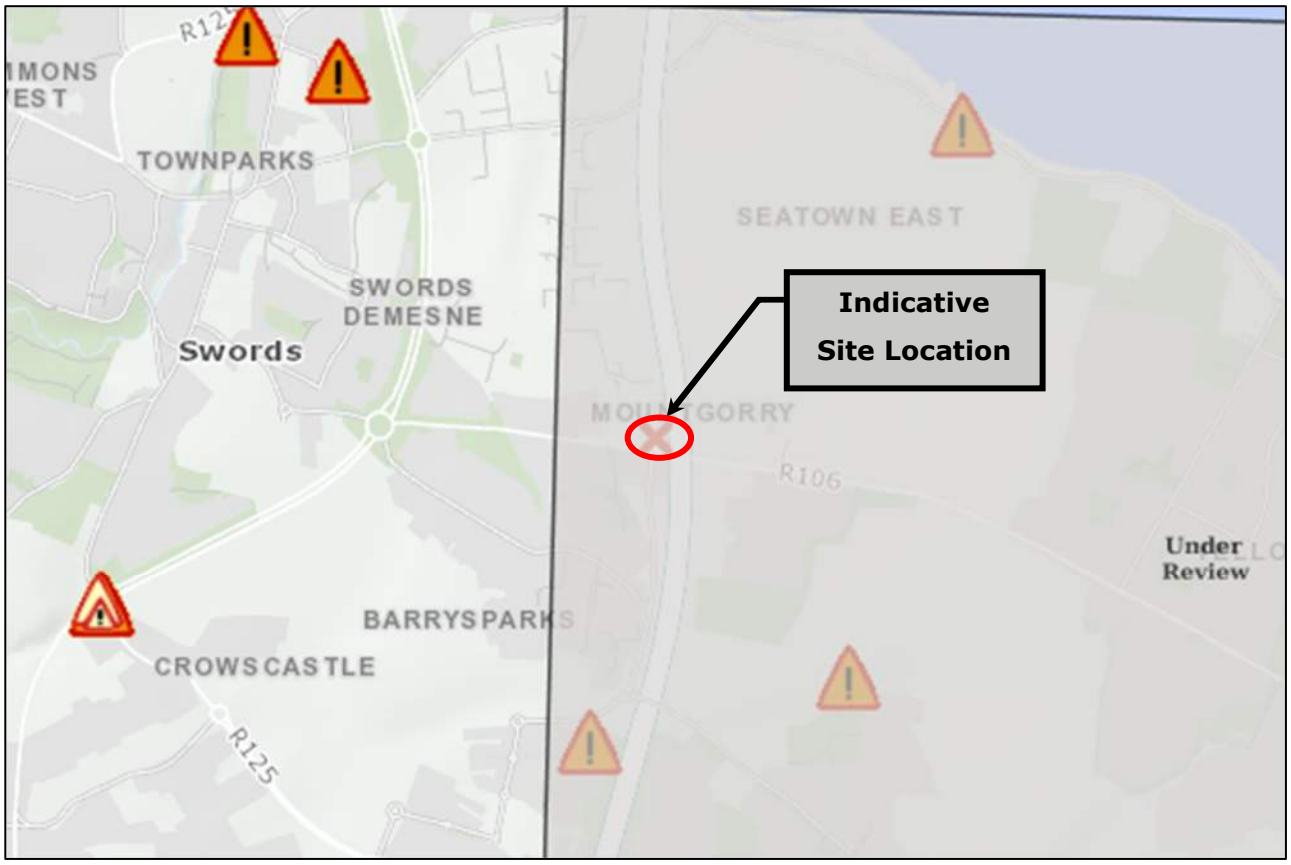


Figure 17: Historical Flood Events (www.floodinfo.ie)

6.3 FLOOD RISK SUMMARY

This assessment concluded that the development of the site is envisaged to present "*no significant increase in risk of flooding either within the site or downstream of the site*."

The proposed development site has been assessed in accordance with the "The Planning System and Flood Risk Management" Guidelines. As part of the sequential test, the OPW flood hazard maps have been consulted, as have the Catchment Flood Risk Assessment Maps produced by the OPW, and the Strategic Flood Risk Assessment mapping in the Fingal Development Plan.

In all cases it was found that the development is located outside the extent of Flood Zones A and B, at low risk of flooding, and the 'Vulnerable Development' is deemed appropriate within the proposed site location. Therefore, a Stage 2 – Initial Flood Risk Assessment is deemed not required, as per the PFRM Guidelines.

7 VERIFICATION

This report was compiled and verified by:

Ciarán O'Reilly
Civil Engineer
O'Connor Sutton Cronin & Associates

APPENDIX A CAUSEWAY FLOW+ SURFACE WATER DESIGN & SIMULATION RESULTS

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	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	15.300	Minimum Backdrop Height (m)	0.200
Ratio-R	0.274	Preferred Cover Depth (m)	0.900
CV	1.000	Include Intermediate Ground	x
Time of Entry (mins)	5.00	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)
ROOF - SOUTH	0.052	5.00	23.000	1200	719251.298	746342.226	1.050
SW/1	0.020	5.00	22.000	1200	719267.481	746335.069	0.500
SW/2	0.006	5.00	21.950	250	719209.594	746340.038	1.033
SW/3	0.024	5.00	21.950	1200	719249.799	746330.665	1.467
SW/4			21.950	1200	719197.532	746336.960	1.777
SADDLE	0.003	5.00	21.950	325	719198.016	746340.759	1.800
SW/5	0.012	5.00	21.450	1200	719200.848	746362.223	1.661
SW/6	0.073	5.00	20.950	1200	719225.740	746388.197	1.554
ROOF - WEST	0.062	5.00	22.000	1200	719214.723	746381.896	1.050
SW/7	0.020	5.00	21.450	1200	719206.217	746392.326	2.246
SW/8	0.002	5.00	21.450	1200	719210.536	746411.269	2.325
SW/9	0.108	5.00	21.950	1200	719276.922	746376.694	1.542
ROOF - NORTH	0.034	5.00	21.500	1200	719261.210	746402.446	1.000
SW/10	0.017	5.00	21.000	1200	719266.075	746409.551	1.025
PERF. PIPE1	0.012	5.00	21.450	600	719225.549	746416.082	1.039
SW/AJ1	0.009	5.00	21.000	600	719260.765	746411.284	0.944
SADDLE1			21.000	325	719263.437	746413.071	1.051
SW/11	0.020	5.00	21.000	1200	719260.407	746417.107	1.081
PERF. PIPE2		5.00	21.150	600	719229.002	746423.645	0.866
SW/AJ2			21.000	600	719257.511	746419.715	1.004

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SADDLE2			21.150	400	719257.209	746417.620	1.325
SW/12	0.016	5.00	21.150	1350	719222.929	746422.478	2.168
SW/13			21.150	1350	719223.963	746427.626	2.184
SW/14			20.700	1350	719234.079	746434.938	1.773
PERF. PIPE3	0.004	5.00	21.450	250	719211.526	746412.266	1.150
PERF. PIPE4	0.007	5.00	21.150	250	719221.031	746435.304	1.099
PERF. PIPE5	0.007	5.00	21.150	250	719224.053	746434.891	1.130
PERF. PIPE6	0.008	5.00	21.000	250	719232.541	746462.542	0.746
PERF. PIPE7	0.005	5.00	21.000	250	719227.848	746445.440	1.042
SW/AJ3			21.150	325	719226.599	746441.962	1.330
SW/15			20.700	1200	719234.973	746439.147	1.699
SW/16	0.043	5.00	20.700	1350	719248.134	746432.974	1.943
SW/17			21.100	1350	719257.367	746425.830	2.412
SW/18			20.900	1200	719266.188	746420.672	2.272
SW/OUTFALL			20.330	1200	719274.017	746429.643	1.772

Links

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)
ROOF - SOUTH	ROOF - SOUTH	SW/1	17.695	0.600	21.950	21.754	0.196	90.3	150	5.28	50.0
SW/1.000	SW/1	SW/2	58.271	0.600	21.500	20.917	0.583	100.0	150	6.25	50.0
SW/1.001	SW/2	SADDLE	11.600	0.600	20.917	20.801	0.116	100.0	150	6.44	50.0
SW/2.000	SW/3	SW/4	52.646	0.600	20.483	20.173	0.310	170.0	225	5.88	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
ROOF - SOUTH	1.058	18.7	9.4	0.900	0.096	0.052	0.0	75	1.060
SW/1.000	1.005	17.8	13.0	0.350	0.883	0.072	0.0	96	1.097
SW/1.001	1.005	17.8	14.2	0.883	0.999	0.078	0.0	102	1.114
SW/2.000	1.000	39.7	4.3	1.242	1.552	0.024	0.0	50	0.657

Links

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)
SW/2.001	SW/4	SADDLE	3.830	0.600	20.173	20.150	0.023	170.0	225	5.94	50.0
SW/1.002	SADDLE	SW/5	21.650	0.600	20.150	19.789	0.361	60.0	225	6.65	50.0
SW/1.003	SW/5	SW/7	30.578	0.600	19.789	19.279	0.510	60.0	225	6.95	50.0
SW/3.000	SW/6	SW/7	19.955	0.600	19.396	19.279	0.117	170.0	225	5.33	50.0
ROOF - WEST	ROOF - WEST	SW/7	13.459	0.600	20.950	20.723	0.227	59.3	150	5.17	50.0
SW/1.004	SW/7	SW/8	19.429	0.600	19.204	19.125	0.079	245.0	300	7.28	49.3
SW/1.005	SW/8	SW/12	16.710	0.600	19.125	19.057	0.068	245.0	300	7.56	48.5
SW/4.000	SW/9	SW/10	34.601	0.600	20.408	19.975	0.433	80.0	225	5.39	50.0
ROOF - NORTH	ROOF - NORTH	SW/10	8.611	0.600	20.500	20.355	0.145	59.4	100	5.14	50.0
SW/4.001a	SW/10	SADDLE1	4.399	0.600	19.975	19.949	0.026	170.0	225	5.47	50.0
SW/5.000	PERF. PIPE1	SW/AJ1	35.541	0.600	20.411	20.056	0.355	100.0	150	5.59	50.0
SW5.001	SW/AJ1	SADDLE1	3.214	0.600	20.056	20.024	0.032	100.0	150	5.64	50.0
SW/4.001b	SADDLE1	SW/11	5.047	0.600	19.949	19.919	0.030	170.0	225	5.73	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
SW/2.001	1.000	39.7	4.3	1.552	1.575	0.024	0.0	50	0.657
SW/1.002	1.691	67.2	19.1	1.575	1.436	0.106	0.0	82	1.464
SW/1.003	1.691	67.2	21.3	1.436	1.946	0.118	0.0	87	1.502
SW/3.000	1.000	39.7	13.1	1.329	1.946	0.073	0.0	89	0.901
ROOF - WEST	1.308	23.1	11.1	0.900	0.577	0.062	0.0	74	1.298
SW/1.004	1.000	70.7	48.4	1.946	2.025	0.272	0.0	183	1.074
SW/1.005	1.000	70.7	48.0	2.025	1.793	0.274	0.0	182	1.073
SW/4.000	1.463	58.2	19.6	1.317	0.800	0.108	0.0	90	1.325
ROOF - NORTH	1.001	7.9	6.1	0.900	0.545	0.034	0.0	66	1.104
SW/4.001a	1.000	39.7	28.7	0.800	0.826	0.159	0.0	142	1.086
SW/5.000	1.005	17.8	4.3	0.889	0.794	0.024	0.0	51	0.833
SW5.001	1.005	17.8	6.0	0.794	0.826	0.033	0.0	60	0.908
SW/4.001b	1.000	39.7	34.7	0.826	0.856	0.192	0.0	163	1.122

Links

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)
SW/4.002a	SW/11	SADDLE2	3.239	0.600	19.919	19.900	0.019	170.0	225	5.78	50.0
SW/6.000	PERF. PIPE2	SW/AJ2	28.779	0.600	20.284	19.996	0.288	100.0	150	5.48	50.0
SW6.001	SW/AJ2	SADDLE2	2.117	0.600	19.996	19.975	0.021	100.0	150	5.51	50.0
SW/4.002b	SADDLE2	SW/12	34.623	0.600	19.825	19.621	0.204	170.0	300	6.26	50.0
SW/1.006	SW/12	SW/13	5.251	0.600	18.982	18.966	0.016	324.0	375	7.64	48.3
SW/1.007	SW/13	SW/14	12.482	0.600	18.966	18.927	0.039	324.0	375	7.85	47.7
SW/1.008	SW/14	SW/16	14.192	0.600	18.927	18.839	0.088	160.6	375	8.02	47.3
SW/7.000	PERF. PIPE3	PERF. PIPE4	24.922	0.600	20.300	20.051	0.249	100.0	150	5.41	50.0
SW/7.001	PERF. PIPE4	PERF. PIPE5	3.050	0.600	20.051	20.020	0.031	100.0	150	5.46	50.0
SW/7.002	PERF. PIPE5	SW/AJ3	7.515	0.600	20.020	19.895	0.125	60.0	150	5.56	50.0
SW/8.000	PERF. PIPE6	PERF. PIPE7	17.734	0.600	20.254	19.958	0.296	60.0	150	5.23	50.0
SW/8.001	PERF. PIPE7	SW/AJ3	3.695	0.600	19.958	19.895	0.063	58.7	150	5.27	50.0
SW/7.003	SW/AJ3	SW/15	8.847	0.600	19.820	19.491	0.329	26.9	225	5.62	50.0
SW/7.004	SW/15	SW/16	14.537	0.600	19.001	18.915	0.086	170.0	225	5.86	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
SW/4.002a	1.000	39.7	38.3	0.856	1.025	0.212	0.0	178	1.134
SW/6.000	1.005	17.8	3.4	0.716	0.854	0.019	0.0	44	0.774
SW6.001	1.005	17.8	3.4	0.854	1.025	0.019	0.0	44	0.774
SW/4.002b	1.203	85.0	41.7	1.025	1.229	0.231	0.0	149	1.198
SW/1.006	1.001	110.5	90.8	1.793	1.809	0.520	0.0	260	1.112
SW/1.007	1.001	110.5	89.7	1.809	1.398	0.520	0.0	257	1.110
SW/1.008	1.427	157.6	88.9	1.398	1.486	0.520	0.0	202	1.468
SW/7.000	1.005	17.8	0.7	1.000	0.949	0.004	0.0	20	0.484
SW/7.001	1.005	17.8	1.9	0.949	0.980	0.010	0.0	33	0.649
SW/7.002	1.301	23.0	3.2	0.980	1.105	0.018	0.0	38	0.919
SW/8.000	1.301	23.0	1.5	0.596	0.892	0.008	0.0	26	0.736
SW/8.001	1.315	23.2	2.4	0.892	1.105	0.013	0.0	33	0.851
SW/7.003	2.532	100.7	5.6	1.105	0.984	0.031	0.0	36	1.370
SW/7.004	1.000	39.7	5.6	1.474	1.560	0.031	0.0	57	0.709

Links

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)
SW/1.009	SW/16	SW/17	11.674	0.600	18.757	18.688	0.069	170.0	375	8.16	46.9
SW/1.010	SW/17	SW/18	10.218	0.600	18.688	18.628	0.060	170.0	225	8.33	46.5
SW/1.011	SW/18	SW/OUTFALL	11.907	0.600	18.628	18.558	0.070	170.0	225	8.53	46.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
SW/1.009	1.386	153.1	100.8	1.568	2.037	0.595	0.0	222	1.476
SW/1.010	1.000	39.7	99.9	2.187	2.047	0.595	0.0	225	1.018
SW/1.011	1.000	39.7	98.9	2.047	1.547	0.595	0.0	225	1.018

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
ROOF - SOUTH	17.695	90.3	150	Circular	23.000	21.950	0.900	22.000	21.754	0.096
SW/1.000	58.271	100.0	150	Circular	22.000	21.500	0.350	21.950	20.917	0.883
SW/1.001	11.600	100.0	150	Circular	21.950	20.917	0.883	21.950	20.801	0.999
SW/2.000	52.646	170.0	225	Circular	21.950	20.483	1.242	21.950	20.173	1.552
SW/2.001	3.830	170.0	225	Circular	21.950	20.173	1.552	21.950	20.150	1.575
SW/1.002	21.650	60.0	225	Circular	21.950	20.150	1.575	21.450	19.789	1.436
SW/1.003	30.578	60.0	225	Circular	21.450	19.789	1.436	21.450	19.279	1.946

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
ROOF - SOUTH	ROOF - SOUTH	1200	Manhole	Adoptable	SW/1	1200	Manhole	Adoptable
SW/1.000	SW/1	1200	Manhole	Adoptable	SW/2	250	Manhole	Junction
SW/1.001	SW/2	250	Manhole	Junction	SADDLE	325	Manhole	Junction
SW/2.000	SW/3	1200	Manhole	Adoptable	SW/4	1200	Manhole	Adoptable
SW/2.001	SW/4	1200	Manhole	Adoptable	SADDLE	325	Manhole	Junction
SW/1.002	SADDLE	325	Manhole	Junction	SW/5	1200	Manhole	Adoptable
SW/1.003	SW/5	1200	Manhole	Adoptable	SW/7	1200	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
SW/3.000	19.955	170.0	225	Circular	20.950	19.396	1.329	21.450	19.279	1.946
ROOF - WEST	13.459	59.3	150	Circular	22.000	20.950	0.900	21.450	20.723	0.577
SW/1.004	19.429	245.0	300	Circular	21.450	19.204	1.946	21.450	19.125	2.025
SW/1.005	16.710	245.0	300	Circular	21.450	19.125	2.025	21.150	19.057	1.793
SW/4.000	34.601	80.0	225	Circular	21.950	20.408	1.317	21.000	19.975	0.800
ROOF - NORTH	8.611	59.4	100	Circular	21.500	20.500	0.900	21.000	20.355	0.545
SW/4.001a	4.399	170.0	225	Circular	21.000	19.975	0.800	21.000	19.949	0.826
SW/5.000	35.541	100.0	150	Circular	21.450	20.411	0.889	21.000	20.056	0.794
SW5.001	3.214	100.0	150	Circular	21.000	20.056	0.794	21.000	20.024	0.826
SW/4.001b	5.047	170.0	225	Circular	21.000	19.949	0.826	21.000	19.919	0.856
SW/4.002a	3.239	170.0	225	Circular	21.000	19.919	0.856	21.150	19.900	1.025
SW/6.000	28.779	100.0	150	Circular	21.150	20.284	0.716	21.000	19.996	0.854
SW6.001	2.117	100.0	150	Circular	21.000	19.996	0.854	21.150	19.975	1.025
SW/4.002b	34.623	170.0	300	Circular	21.150	19.825	1.025	21.150	19.621	1.229

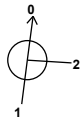
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
SW/3.000	SW/6	1200	Manhole	Adoptable	SW/7	1200	Manhole	Adoptable
ROOF - WEST	ROOF - WEST	1200	Manhole	Adoptable	SW/7	1200	Manhole	Adoptable
SW/1.004	SW/7	1200	Manhole	Adoptable	SW/8	1200	Manhole	Adoptable
SW/1.005	SW/8	1200	Manhole	Adoptable	SW/12	1350	Manhole	Adoptable
SW/4.000	SW/9	1200	Manhole	Adoptable	SW/10	1200	Manhole	Adoptable
ROOF - NORTH	ROOF - NORTH	1200	Manhole	Adoptable	SW/10	1200	Manhole	Adoptable
SW/4.001a	SW/10	1200	Manhole	Adoptable	SADDLE1	325	Manhole	Junction
SW/5.000	PERF. PIPE1	600	Manhole	AJ	SW/AJ1	600	Manhole	AJ
SW5.001	SW/AJ1	600	Manhole	AJ	SADDLE1	325	Manhole	Junction
SW/4.001b	SADDLE1	325	Manhole	Junction	SW/11	1200	Manhole	Adoptable
SW/4.002a	SW/11	1200	Manhole	Adoptable	SADDLE2	400	Manhole	Junction
SW/6.000	PERF. PIPE2	600	Manhole	AJ	SW/AJ2	600	Manhole	AJ
SW6.001	SW/AJ2	600	Manhole	AJ	SADDLE2	400	Manhole	Junction
SW/4.002b	SADDLE2	400	Manhole	Junction	SW/12	1350	Manhole	Adoptable

Pipeline Schedule

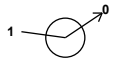
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
SW/1.006	5.251	324.0	375	Circular	21.150	18.982	1.793	21.150	18.966	1.809
SW/1.007	12.482	324.0	375	Circular	21.150	18.966	1.809	20.700	18.927	1.398
SW/1.008	14.192	160.6	375	Circular	20.700	18.927	1.398	20.700	18.839	1.486
SW/7.000	24.922	100.0	150	Circular	21.450	20.300	1.000	21.150	20.051	0.949
SW/7.001	3.050	100.0	150	Circular	21.150	20.051	0.949	21.150	20.020	0.980
SW/7.002	7.515	60.0	150	Circular	21.150	20.020	0.980	21.150	19.895	1.105
SW/8.000	17.734	60.0	150	Circular	21.000	20.254	0.596	21.000	19.958	0.892
SW/8.001	3.695	58.7	150	Circular	21.000	19.958	0.892	21.150	19.895	1.105
SW/7.003	8.847	26.9	225	Circular	21.150	19.820	1.105	20.700	19.491	0.984
SW/7.004	14.537	170.0	225	Circular	20.700	19.001	1.474	20.700	18.915	1.560
SW/1.009	11.674	170.0	375	Circular	20.700	18.757	1.568	21.100	18.688	2.037
SW/1.010	10.218	170.0	225	Circular	21.100	18.688	2.187	20.900	18.628	2.047
SW/1.011	11.907	170.0	225	Circular	20.900	18.628	2.047	20.330	18.558	1.547

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
SW/1.006	SW/12	1350	Manhole	Adoptable	SW/13	1350	Manhole	Adoptable
SW/1.007	SW/13	1350	Manhole	Adoptable	SW/14	1350	Manhole	Adoptable
SW/1.008	SW/14	1350	Manhole	Adoptable	SW/16	1350	Manhole	Adoptable
SW/7.000	PERF. PIPE3	250	Manhole	Junction	PERF. PIPE4	250	Manhole	Junction
SW/7.001	PERF. PIPE4	250	Manhole	Junction	PERF. PIPE5	250	Manhole	Junction
SW/7.002	PERF. PIPE5	250	Manhole	Junction	SW/AJ3	325	Manhole	Junction
SW/8.000	PERF. PIPE6	250	Manhole	Junction	PERF. PIPE7	250	Manhole	Junction
SW/8.001	PERF. PIPE7	250	Manhole	Junction	SW/AJ3	325	Manhole	Junction
SW/7.003	SW/AJ3	325	Manhole	Junction	SW/15	1200	Manhole	Adoptable
SW/7.004	SW/15	1200	Manhole	Adoptable	SW/16	1350	Manhole	Adoptable
SW/1.009	SW/16	1350	Manhole	Adoptable	SW/17	1350	Manhole	Adoptable
SW/1.010	SW/17	1350	Manhole	Adoptable	SW/18	1200	Manhole	Adoptable
SW/1.011	SW/18	1200	Manhole	Adoptable	SW/OUTFALL	1200	Manhole	Adoptable

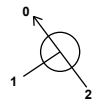
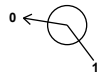
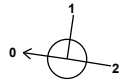
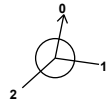
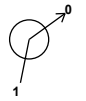
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
ROOF - SOUTH	719251.298	746342.226	23.000	1.050	1200				
						0	ROOF - SOUTH	21.950	150
SW/1	719267.481	746335.069	22.000	0.500	1200		1	ROOF - SOUTH	21.754	150
							0	SW/1.000	21.500	150
SW/2	719209.594	746340.038	21.950	1.033	250		1	SW/1.000	20.917	150
							0	SW/1.001	20.917	150
SW/3	719249.799	746330.665	21.950	1.467	1200					
						0	SW/2.000	20.483	225
SW/4	719197.532	746336.960	21.950	1.777	1200		1	SW/2.000	20.173	225
							0	SW/2.001	20.173	225
SADDLE	719198.016	746340.759	21.950	1.800	325		1	SW/2.001	20.150	225
							2	SW/1.001	20.801	150
							0	SW/1.002	20.150	225
SW/5	719200.848	746362.223	21.450	1.661	1200		1	SW/1.002	19.789	225
							0	SW/1.003	19.789	225
SW/6	719225.740	746388.197	20.950	1.554	1200					
						0	SW/3.000	19.396	225

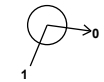
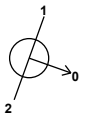
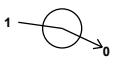
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
ROOF - WEST	719214.723	746381.896	22.000	1.050	1200				
						0	ROOF - WEST	20.950	150
SW/7	719206.217	746392.326	21.450	2.246	1200				
						1	ROOF - WEST	20.723	150
						2	SW/3.000	19.279	225
						3	SW/1.003	19.279	225
						0	SW/1.004	19.204	300
SW/8	719210.536	746411.269	21.450	2.325	1200				
						1	SW/1.004	19.125	300
						0	SW/1.005	19.125	300
SW/9	719276.922	746376.694	21.950	1.542	1200				
						0	SW/4.000	20.408	225
ROOF - NORTH	719261.210	746402.446	21.500	1.000	1200				
						0	ROOF - NORTH	20.500	100
SW/10	719266.075	746409.551	21.000	1.025	1200				
						1	ROOF - NORTH	20.355	100
						2	SW/4.000	19.975	225
						0	SW/4.001a	19.975	225
PERF. PIPE1	719225.549	746416.082	21.450	1.039	600				
						0	SW/5.000	20.411	150
SW/AJ1	719260.765	746411.284	21.000	0.944	600				
						1	SW/5.000	20.056	150
						0	SW5.001	20.056	150

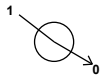
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SADDLE1	719263.437	746413.071	21.000	1.051	325	1	SW5.001	20.024	150
						 2	SW/4.001a	19.949	225
						0	SW/4.001b	19.949	225
SW/11	719260.407	746417.107	21.000	1.081	1200	1	SW/4.001b	19.919	225
									
						0	SW/4.002a	19.919	225
PERF. PIPE2	719229.002	746423.645	21.150	0.866	600				
						0	SW/6.000	20.284	150
SW/AJ2	719257.511	746419.715	21.000	1.004	600	1	SW/6.000	19.996	150
									
						0	SW6.001	19.996	150
SADDLE2	719257.209	746417.620	21.150	1.325	400	1	SW6.001	19.975	150
						 2	SW/4.002a	19.900	225
						0	SW/4.002b	19.825	300
SW/12	719222.929	746422.478	21.150	2.168	1350	1	SW/4.002b	19.621	300
						 2	SW/1.005	19.057	300
						0	SW/1.006	18.982	375
SW/13	719223.963	746427.626	21.150	2.184	1350	1	SW/1.006	18.966	375
									
						0	SW/1.007	18.966	375
SW/14	719234.079	746434.938	20.700	1.773	1350	1	SW/1.007	18.927	375
									
						0	SW/1.008	18.927	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
PERF. PIPE3	719211.526	746412.266	21.450	1.150	250				
						0	SW/7.000	20.300	150
PERF. PIPE4	719221.031	746435.304	21.150	1.099	250	1	SW/7.000	20.051	150
									
						0	SW/7.001	20.051	150
PERF. PIPE5	719224.053	746434.891	21.150	1.130	250	 1	SW/7.001	20.020	150
						0	SW/7.002	20.020	150
PERF. PIPE6	719232.541	746462.542	21.000	0.746	250				
						0	SW/8.000	20.254	150
PERF. PIPE7	719227.848	746445.440	21.000	1.042	250	 1	SW/8.000	19.958	150
						0	SW/8.001	19.958	150
SW/AJ3	719226.599	746441.962	21.150	1.330	325	1	SW/8.001	19.895	150
						2	SW/7.002	19.895	150
									
						0	SW/7.003	19.820	225
SW/15	719234.973	746439.147	20.700	1.699	1200	1	SW/7.003	19.491	225
									
						0	SW/7.004	19.001	225
SW/16	719248.134	746432.974	20.700	1.943	1350	1	SW/7.004	18.915	225
						2	SW/1.008	18.839	375
									
						0	SW/1.009	18.757	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW/17	719257.367	746425.830	21.100	2.412	1350	1	SW/1.009	18.688	375
									
						0	SW/1.010	18.688	225
SW/18	719266.188	746420.672	20.900	2.272	1200	1	SW/1.010	18.628	225
									
						0	SW/1.011	18.628	225
SW/OUTFALL	719274.017	746429.643	20.330	1.772	1200	1	SW/1.011	18.558	225
									

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal	5 year (l/s)	3.2
FSR Region	Scotland and Ireland	Skip Steady State	x	30 year (l/s)	4.3
M5-60 (mm)	15.300	Drain Down Time (mins)	240	100 year (l/s)	5.2
Ratio-R	0.274	Additional Storage (m³/ha)	20.0	Check Discharge Volume	x
Summer CV	1.000	Check Discharge Rate(s)	✓		
Winter CV	1.000	1 year (l/s)	2.2		

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 %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	20	0	0	100	20	0	0
30	20	0	0				

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.37	Growth Factor 100 year	1.96	Q 30 year (l/s)	4.3
Greenfield Method	IH124	Region	11	Betterment (%)	0	Q 100 year (l/s)	5.2
Positively Drained Area (ha)	0.872	Growth Factor 1 year	0.83	QBar	2.6		
SAAR (mm)	730	Growth Factor 5 year	1.20	Q 1 year (l/s)	2.2		
Soil Index	3	Growth Factor 30 year	1.65	Q 5 year (l/s)	3.2		

Node SW/17 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	18.688	Product Number	CTL-SHE-0067-2600-1800-2600
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.6	Min Node Diameter (mm)	1200

Node SW/AJ3 Online Orifice Control

Flap Valve	x	Invert Level (m)	19.820	Design Flow (l/s)	3.0	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	1.500	Diameter (m)	0.034		

Node SW/2 Online Orifice Control

Flap Valve	x	Invert Level (m)	20.917	Design Flow (l/s)	3.0	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	1.500	Diameter (m)	0.034		

Node ROOF - NORTH Online Orifice Control

Flap Valve	x	Invert Level (m)	20.500	Design Flow (l/s)	1.5	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.100	Diameter (m)	0.090		

Node ROOF - WEST Online Orifice Control

Flap Valve	x	Invert Level (m)	20.950	Design Flow (l/s)	1.5	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.100	Diameter (m)	0.090		

Node ROOF - SOUTH Online Orifice Control

Flap Valve	x	Invert Level (m)	21.950	Design Flow (l/s)	1.5	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.100	Diameter (m)	0.090		

Node SW/2 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	SW/1.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	20.917	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	180	Diameter (mm)	600

Node PERF. PIPE4 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	SW/7.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	20.051	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	600

Node PERF. PIPE5 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	SW/7.001
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	20.020	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	600

Node PERF. PIPE7 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	SW/8.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	19.958	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	600

Node SW/AJ3 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	SW/8.001
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	19.895	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	600

Node SW/AJ3 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	SW/7.002
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	19.895	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	600

Node SW/AJ2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Width (m)	4.800	Depth (m)	0.200
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	19.996	Length (m)	27.891	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	400.0		

Node SW/AJ1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Width (m)	4.800	Depth (m)	0.200
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	20.056	Length (m)	35.091	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	400.0		

Node ROOF - NORTH Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	20.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	340.0	0.0	0.150	340.0	0.0	0.151	0.0	0.0

Node ROOF - WEST Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	20.950
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	620.0	0.0	0.150	620.0	0.0	0.151	0.0	0.0

Node ROOF - SOUTH Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	21.950
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	520.0	0.0	0.150	520.0	0.0	0.151	0.0	0.0

Node SW/16 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.757
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	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	425.0	0.0	0.679	425.0	0.0	0.680	0.0	0.0

Node SW/16 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	19.736
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)
0.000	140.0	0.0	0.960	425.0	0.0

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	ROOF - SOUTH	600	21.978	0.028	1.7	14.5471	0.0000	OK
15 minute summer	SW/1	11	21.553	0.053	4.9	0.1033	0.0000	OK
60 minute summer	SW/2	43	21.306	0.389	4.8	1.5336	0.0000	SURCHARGED
15 minute summer	SW/3	10	20.541	0.058	5.8	0.0840	0.0000	OK
15 minute summer	SW/4	11	20.233	0.060	5.7	0.0680	0.0000	OK
15 minute summer	SADDLE	11	20.200	0.050	7.5	0.0060	0.0000	OK
2880 minute summer	SW/5	1980	19.997	0.208	1.5	0.2659	0.0000	OK
2880 minute summer	SW/6	1980	19.996	0.600	2.3	1.2375	0.0000	SURCHARGED
960 minute summer	ROOF - WEST	600	20.979	0.029	2.0	18.1081	0.0000	OK
2880 minute summer	SW/7	1980	19.996	0.792	4.3	1.0350	0.0000	SURCHARGED
2880 minute summer	SW/8	1980	19.996	0.871	3.2	1.0013	0.0000	SURCHARGED
15 minute summer	SW/9	10	20.513	0.105	26.3	0.2650	0.0000	OK
480 minute summer	ROOF - NORTH	312	20.524	0.024	1.7	8.3653	0.0000	OK
15 minute summer	SW/10	11	20.163	0.188	30.1	0.2750	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)
960 minute summer	ROOF - SOUTH	Orifice	SW/1	0.6				
15 minute summer	SW/1	SW/1.000	SW/2	4.8	0.436	0.271	0.6759	
60 minute summer	SW/2	Orifice	SADDLE	1.5				
15 minute summer	SW/3	SW/2.000	SW/4	5.7	0.705	0.143	0.4320	
15 minute summer	SW/4	SW/2.001	SADDLE	5.6	0.742	0.141	0.0289	
15 minute summer	SADDLE	SW/1.002	SW/5	7.4	1.006	0.111	0.1604	
2880 minute summer	SW/5	SW/1.003	SW/7	1.5	0.686	0.023	1.1945	
2880 minute summer	SW/6	SW/3.000	SW/7	-1.4	0.437	-0.034	0.7936	
960 minute summer	ROOF - WEST	Orifice	SW/7	0.7				
2880 minute summer	SW/7	SW/1.004	SW/8	3.2	0.474	0.046	1.3682	
2880 minute summer	SW/8	SW/1.005	SW/12	3.0	0.490	0.043	1.1767	
15 minute summer	SW/9	SW/4.000	SW/10	26.0	0.973	0.447	0.9208	
480 minute summer	ROOF - NORTH	Orifice	SW/10	0.5				
15 minute summer	SW/10	SW/4.001a	SADDLE1	29.4	0.860	0.739	0.1533	

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	PERF. PIPE1	10	20.451	0.040	2.8	0.0203	0.0000	OK
15 minute summer	SW/5.000:50%	10	20.293	0.059	5.8	0.0886	0.0000	OK
15 minute summer	SW/AJ1	13	20.138	0.082	10.3	2.2994	0.0000	OK
15 minute summer	SADDLE1	12	20.133	0.184	29.4	0.0153	0.0000	OK
15 minute summer	SW/11	12	20.098	0.179	32.6	0.2678	0.0000	OK
15 minute summer	PERF. PIPE2	1	20.284	0.000	0.0	0.0000	0.0000	OK
15 minute summer	SW/6.000:50%	10	20.195	0.055	4.6	0.0000	0.0000	OK
30 minute summer	SW/AJ2	20	20.043	0.047	4.3	0.7655	0.0000	OK
2880 minute summer	SADDLE2	1980	19.996	0.171	3.4	0.0215	0.0000	OK
2880 minute summer	SW/12	1980	19.996	1.014	6.7	1.6009	0.0000	SURCHARGED
2880 minute summer	SW/13	1980	19.995	1.029	6.7	1.4726	0.0000	SURCHARGED
2880 minute summer	SW/14	1980	19.994	1.067	6.5	1.5274	0.0000	SURCHARGED
15 minute summer	PERF. PIPE3	11	20.323	0.023	0.9	0.0026	0.0000	OK
60 minute summer	PERF. PIPE4	42	20.252	0.201	2.0	0.3974	0.0000	SURCHARGED
60 minute summer	PERF. PIPE5	42	20.252	0.232	2.7	0.1621	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 summer	PERF. PIPE1	SW/5.000	SW/5.000:50%	2.8	0.545	0.156	0.0909	
15 minute summer	PERF. PIPE1	SW/5.000	SW/AJ1	5.7	0.935	0.323	0.1386	
15 minute summer	SW/AJ1	SW5.001	SADDLE1	7.6	0.877	0.426	0.0378	
15 minute summer	SADDLE1	SW/4.001b	SW/11	28.9	0.841	0.728	0.1736	
15 minute summer	SW/11	SW/4.002a	SADDLE2	32.6	1.043	0.820	0.1009	
15 minute summer	PERF. PIPE2	SW/6.000	SW/6.000:50%	0.0	0.000	0.000	0.0416	
15 minute summer	PERF. PIPE2	SW/6.000	SW/AJ2	4.6	0.998	0.258	0.0707	
30 minute summer	SW/AJ2	SW6.001	SADDLE2	3.1	0.696	0.173	0.0093	
2880 minute summer	SADDLE2	SW/4.002b	SW/12	3.4	0.595	0.040	1.9365	
2880 minute summer	SW/12	SW/1.006	SW/13	6.7	0.468	0.061	0.5792	
2880 minute summer	SW/13	SW/1.007	SW/14	6.5	0.529	0.059	1.3767	
2880 minute summer	SW/14	SW/1.008	SW/16	6.3	0.553	0.040	1.5653	
15 minute summer	PERF. PIPE3	SW/7.000	PERF. PIPE4	0.9	0.318	0.051	0.2325	
60 minute summer	PERF. PIPE4	SW/7.001	PERF. PIPE5	1.4	0.470	0.081	0.0537	
60 minute summer	PERF. PIPE5	SW/7.002	SW/AJ3	1.7	0.495	0.076	0.1323	

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	PERF. PIPE6	10	20.284	0.030	2.0	0.0080	0.0000	OK
60 minute summer	PERF. PIPE7	42	20.252	0.294	2.4	0.5327	0.0000	SURCHARGED
60 minute summer	SW/AJ3	42	20.252	0.432	3.0	0.6837	0.0000	SURCHARGED
2880 minute summer	SW/15	1980	19.993	0.992	0.5	1.1223	0.0000	SURCHARGED
2880 minute summer	SW/16	1980	19.993	1.236	7.6	149.3248	0.0000	SURCHARGED
2880 minute summer	SW/17	1980	19.993	1.305	5.2	1.8679	0.0000	SURCHARGED
2880 minute summer	SW/18	1980	18.665	0.037	2.2	0.0417	0.0000	OK
2880 minute summer	SW/OUTFALL	1980	18.594	0.036	2.2	0.0000	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 summer	PERF. PIPE6	SW/8.000	PERF. PIPE7	2.0	0.541	0.086	0.1780	
60 minute summer	PERF. PIPE7	SW/8.001	SW/AJ3	1.5	0.450	0.066	0.0650	
60 minute summer	SW/AJ3	Orifice	SW/15	1.6				
2880 minute summer	SW/15	SW/7.004	SW/16	1.0	0.305	0.025	0.5782	
2880 minute summer	SW/16	SW/1.009	SW/17	5.2	0.110	0.034	1.2876	
2880 minute summer	SW/17	SW/1.010	SW/18	2.2	0.523	0.056	0.0433	
2880 minute summer	SW/18	SW/1.011	SW/OUTFALL	2.2	0.535	0.056	0.0493	283.9

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	ROOF - SOUTH	585	21.987	0.037	2.4	19.4748	0.0000	OK
15 minute summer	SW/1	11	21.566	0.066	7.3	0.1277	0.0000	OK
120 minute summer	SW/2	84	21.463	0.546	5.0	3.0554	0.0000	SURCHARGED
15 minute summer	SW/3	10	20.553	0.070	8.5	0.1026	0.0000	OK
2160 minute summer	SW/4	1740	20.284	0.111	0.9	0.1261	0.0000	OK
2160 minute summer	SADDLE	1740	20.282	0.132	2.0	0.0158	0.0000	OK
1440 minute summer	SW/5	1350	20.276	0.487	3.0	0.6226	0.0000	SURCHARGED
1440 minute summer	SW/6	1350	20.276	0.880	2.5	1.8164	0.0000	SURCHARGED
960 minute summer	ROOF - WEST	600	20.989	0.039	2.8	24.2448	0.0000	OK
1440 minute summer	SW/7	1350	20.275	1.071	6.3	1.3998	0.0000	SURCHARGED
1440 minute summer	SW/8	1350	20.275	1.150	5.6	1.3223	0.0000	SURCHARGED
15 minute summer	SW/9	10	20.539	0.131	38.4	0.3330	0.0000	OK
480 minute summer	ROOF - NORTH	304	20.533	0.033	2.5	11.3736	0.0000	OK
1440 minute summer	SW/10	1320	20.280	0.305	4.9	0.4449	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)
960 minute summer	ROOF - SOUTH	Orifice	SW/1	1.0				
15 minute summer	SW/1	SW/1.000	SW/2	7.1	0.489	0.400	0.7293	
120 minute summer	SW/2	Orifice	SADDLE	1.8				
15 minute summer	SW/3	SW/2.000	SW/4	8.3	0.779	0.209	0.5718	
2160 minute summer	SW/4	SW/2.001	SADDLE	1.6	0.299	0.039	0.0838	
2160 minute summer	SADDLE	SW/1.002	SW/5	2.5	0.692	0.037	0.6921	
1440 minute summer	SW/5	SW/1.003	SW/7	3.3	0.766	0.049	1.2161	
1440 minute summer	SW/6	SW/3.000	SW/7	2.5	0.522	0.063	0.7936	
960 minute summer	ROOF - WEST	Orifice	SW/7	1.0				
1440 minute summer	SW/7	SW/1.004	SW/8	5.5	0.551	0.077	1.3682	
1440 minute summer	SW/8	SW/1.005	SW/12	5.8	0.531	0.082	1.1767	
15 minute summer	SW/9	SW/4.000	SW/10	38.0	1.064	0.654	1.1045	
480 minute summer	ROOF - NORTH	Orifice	SW/10	0.8				
1440 minute summer	SW/10	SW/4.001a	SADDLE1	4.9	0.539	0.122	0.1750	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	PERF. PIPE1	10	20.460	0.049	4.1	0.0247	0.0000	OK
15 minute summer	SW/5.000:50%	10	20.306	0.073	8.4	0.1327	0.0000	OK
2160 minute summer	SW/AJ1	1740	20.277	0.221	1.4	9.3370	0.0000	SURCHARGED
1440 minute summer	SADDLE1	1320	20.275	0.326	6.0	0.0271	0.0000	SURCHARGED
1440 minute summer	SW/11	1320	20.279	0.360	6.7	0.5378	0.0000	SURCHARGED
1440 minute summer	PERF. PIPE2	1410	20.289	0.005	0.0	0.0014	0.0000	OK
1440 minute summer	SW/6.000:50%	1320	20.274	0.134	0.6	0.0000	0.0000	OK
2160 minute summer	SW/AJ2	1740	20.275	0.279	0.9	7.8373	0.0000	SURCHARGED
2160 minute summer	SADDLE2	1740	20.275	0.450	5.4	0.0566	0.0000	SURCHARGED
1440 minute summer	SW/12	1320	20.281	1.299	13.2	2.0513	0.0000	SURCHARGED
1440 minute summer	SW/13	1350	20.273	1.307	12.7	1.8705	0.0000	SURCHARGED
1440 minute summer	SW/14	1320	20.270	1.343	12.5	1.9223	0.0000	SURCHARGED
60 minute summer	PERF. PIPE3	45	20.370	0.070	1.0	0.0079	0.0000	OK
60 minute summer	PERF. PIPE4	43	20.369	0.318	2.7	0.9545	0.0000	SURCHARGED
60 minute summer	PERF. PIPE5	43	20.369	0.349	2.5	0.2581	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 summer	PERF. PIPE1	SW/5.000	SW/5.000:50%	4.1	0.608	0.228	0.1189	
15 minute summer	PERF. PIPE1	SW/5.000	SW/AJ1	8.3	0.958	0.470	0.2029	
2160 minute summer	SW/AJ1	SW5.001	SADDLE1	3.4	0.493	0.193	0.0566	
1440 minute summer	SADDLE1	SW/4.001b	SW/11	6.0	0.603	0.150	0.2007	
1440 minute summer	SW/11	SW/4.002a	SADDLE2	6.7	0.701	0.168	0.1288	
1440 minute summer	PERF. PIPE2	SW/6.000	SW/6.000:50%	0.0	0.004	0.002	0.1195	
1440 minute summer	PERF. PIPE2	SW/6.000	SW/AJ2	0.6	0.452	0.034	0.2461	
2160 minute summer	SW/AJ2	SW6.001	SADDLE2	0.9	0.425	0.050	0.0373	
2160 minute summer	SADDLE2	SW/4.002b	SW/12	5.3	0.673	0.062	2.4381	
1440 minute summer	SW/12	SW/1.006	SW/13	12.7	0.508	0.114	0.5792	
1440 minute summer	SW/13	SW/1.007	SW/14	12.5	0.574	0.113	1.3767	
1440 minute summer	SW/14	SW/1.008	SW/16	12.4	0.579	0.079	1.5653	
60 minute summer	PERF. PIPE3	SW/7.000	PERF. PIPE4	1.0	0.269	0.056	0.3192	
60 minute summer	PERF. PIPE4	SW/7.001	PERF. PIPE5	1.2	0.436	0.067	0.0537	
60 minute summer	PERF. PIPE5	SW/7.002	SW/AJ3	2.3	0.521	0.100	0.1323	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	PERF. PIPE6	44	20.369	0.115	2.2	0.0311	0.0000	OK
60 minute summer	PERF. PIPE7	44	20.369	0.411	3.6	0.9404	0.0000	SURCHARGED
60 minute summer	SW/AJ3	44	20.369	0.549	2.9	0.9685	0.0000	SURCHARGED
1440 minute winter	SW/15	1380	20.269	1.268	0.7	1.4347	0.0000	SURCHARGED
1440 minute winter	SW/16	1380	20.269	1.512	11.1	220.9156	0.0000	SURCHARGED
1440 minute winter	SW/17	1380	20.269	1.581	5.8	2.2631	0.0000	SURCHARGED
1440 minute winter	SW/18	1380	18.667	0.039	2.4	0.0436	0.0000	OK
1440 minute winter	SW/OUTFALL	1380	18.595	0.037	2.4	0.0000	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)
60 minute summer	PERF. PIPE6	SW/8.000	PERF. PIPE7	2.2	0.399	0.096	0.2850	
60 minute summer	PERF. PIPE7	SW/8.001	SW/AJ3	1.6	0.450	0.069	0.0650	
60 minute summer	SW/AJ3	Orifice	SW/15	1.8				
1440 minute winter	SW/15	SW/7.004	SW/16	0.7	0.330	0.018	0.5782	
1440 minute winter	SW/16	SW/1.009	SW/17	5.8	0.207	0.038	1.2876	
1440 minute winter	SW/17	SW/1.010	SW/18	2.4	0.536	0.061	0.0462	
1440 minute winter	SW/18	SW/1.011	SW/OUTFALL	2.4	0.549	0.061	0.0526	195.7

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute summer	ROOF - SOUTH	450	21.995	0.045	3.6	23.6777	0.0000	OK
240 minute summer	SW/1	168	21.608	0.108	3.6	0.2091	0.0000	OK
240 minute summer	SW/2	168	21.603	0.686	4.4	4.6299	0.0000	SURCHARGED
15 minute summer	SW/3	10	20.564	0.081	11.0	0.1178	0.0000	OK
1440 minute winter	SW/4	1380	20.530	0.357	2.2	0.4035	0.0000	SURCHARGED
1440 minute winter	SADDLE	1380	20.530	0.380	2.3	0.0456	0.0000	SURCHARGED
1440 minute winter	SW/5	1380	20.531	0.742	2.6	0.9490	0.0000	SURCHARGED
1440 minute winter	SW/6	1380	20.533	1.137	2.1	2.3471	0.0000	SURCHARGED
720 minute summer	ROOF - WEST	465	20.997	0.047	4.2	29.3677	0.0000	OK
1440 minute winter	SW/7	1380	20.530	1.326	5.9	1.7331	0.0000	SURCHARGED
1440 minute winter	SW/8	1380	20.523	1.398	6.0	1.6080	0.0000	SURCHARGED
15 minute summer	SW/9	11	20.597	0.189	49.7	0.4784	0.0000	OK
480 minute summer	ROOF - NORTH	304	20.540	0.040	3.1	13.8239	0.0000	OK
1440 minute summer	SW/10	1440	20.526	0.551	6.0	0.8052	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)
720 minute summer	ROOF - SOUTH	Orifice	SW/1	1.3				
240 minute summer	SW/1	SW/1.000	SW/2	3.5	0.343	0.199	0.9074	
240 minute summer	SW/2	Orifice	SADDLE	2.0				
15 minute summer	SW/3	SW/2.000	SW/4	10.8	0.833	0.272	0.6908	
1440 minute winter	SW/4	SW/2.001	SADDLE	1.5	0.315	0.039	0.1523	
1440 minute winter	SADDLE	SW/1.002	SW/5	2.3	0.694	0.034	0.8610	
1440 minute winter	SW/5	SW/1.003	SW/7	2.5	0.724	0.037	1.2161	
1440 minute winter	SW/6	SW/3.000	SW/7	2.0	0.480	0.050	0.7936	
720 minute summer	ROOF - WEST	Orifice	SW/7	1.4				
1440 minute winter	SW/7	SW/1.004	SW/8	5.9	0.528	0.083	1.3682	
1440 minute winter	SW/8	SW/1.005	SW/12	5.9	0.510	0.084	1.1767	
15 minute summer	SW/9	SW/4.000	SW/10	47.5	1.219	0.816	1.3037	
480 minute summer	ROOF - NORTH	Orifice	SW/10	1.1				
1440 minute summer	SW/10	SW/4.001a	SADDLE1	6.0	0.559	0.151	0.1750	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	PERF. PIPE1	1290	20.519	0.108	0.3	0.0547	0.0000	OK
2160 minute summer	SW/5.000:50%	1680	20.518	0.285	1.1	2.0462	0.0000	SURCHARGED
1440 minute summer	SW/AJ1	1440	20.521	0.465	2.0	9.4549	0.0000	SURCHARGED
1440 minute winter	SADDLE1	1380	20.521	0.572	5.2	0.0475	0.0000	SURCHARGED
1440 minute summer	SW/11	1440	20.543	0.624	8.2	0.9320	0.0000	SURCHARGED
1440 minute summer	PERF. PIPE2	1440	20.524	0.240	0.1	0.0680	0.0000	SURCHARGED
1440 minute summer	SW/6.000:50%	1440	20.523	0.383	0.8	0.0000	0.0000	SURCHARGED
1440 minute summer	SW/AJ2	1440	20.533	0.537	2.1	7.9104	0.0000	SURCHARGED
1440 minute winter	SADDLE2	1380	20.521	0.696	6.3	0.0877	0.0000	SURCHARGED
2160 minute summer	SW/12	1980	20.525	1.543	12.4	2.4358	0.0000	SURCHARGED
1440 minute winter	SW/13	1380	20.525	1.559	11.5	2.2305	0.0000	SURCHARGED
1440 minute winter	SW/14	1380	20.520	1.593	11.5	2.2802	0.0000	FLOOD RISK
1440 minute winter	PERF. PIPE3	1410	20.515	0.215	0.1	0.0245	0.0000	SURCHARGED
1440 minute winter	PERF. PIPE4	1410	20.515	0.464	0.3	1.7017	0.0000	SURCHARGED
1440 minute winter	PERF. PIPE5	1410	20.515	0.495	0.5	0.3782	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)
1440 minute winter	PERF. PIPE1	SW/5.000	SW/5.000:50%	0.4	0.293	0.024	0.2770	
1440 minute winter	PERF. PIPE1	SW/5.000	SW/AJ1	1.5	0.415	0.084	0.3129	
1440 minute summer	SW/AJ1	SW5.001	SADDLE1	1.4	0.576	0.079	0.0566	
1440 minute winter	SADDLE1	SW/4.001b	SW/11	5.2	0.584	0.130	0.2007	
1440 minute summer	SW/11	SW/4.002a	SADDLE2	8.0	0.736	0.202	0.1288	
1440 minute summer	PERF. PIPE2	SW/6.000	SW/6.000:50%	0.2	0.013	0.013	0.2533	
1440 minute summer	PERF. PIPE2	SW/6.000	SW/AJ2	0.8	0.489	0.045	0.2533	
1440 minute summer	SW/AJ2	SW6.001	SADDLE2	-1.4	0.483	-0.078	0.0373	
1440 minute winter	SADDLE2	SW/4.002b	SW/12	5.9	0.679	0.070	2.4381	
2160 minute summer	SW/12	SW/1.006	SW/13	12.0	0.463	0.109	0.5792	
1440 minute winter	SW/13	SW/1.007	SW/14	11.5	0.573	0.104	1.3767	
1440 minute winter	SW/14	SW/1.008	SW/16	11.4	0.560	0.072	1.5653	
1440 minute winter	PERF. PIPE3	SW/7.000	PERF. PIPE4	0.1	0.210	0.006	0.4387	
1440 minute winter	PERF. PIPE4	SW/7.001	PERF. PIPE5	0.3	0.342	0.017	0.0537	
1440 minute winter	PERF. PIPE5	SW/7.002	SW/AJ3	0.5	0.450	0.022	0.1323	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	PERF. PIPE6	1410	20.515	0.261	0.2	0.0705	0.0000	SURCHARGED
1440 minute winter	PERF. PIPE7	1410	20.515	0.557	0.3	1.4967	0.0000	SURCHARGED
1440 minute winter	SW/AJ3	1410	20.515	0.695	1.4	1.3254	0.0000	SURCHARGED
1440 minute winter	SW/15	1410	20.515	1.514	0.8	1.7124	0.0000	FLOOD RISK
1440 minute winter	SW/16	1410	20.515	1.758	13.2	303.5892	0.0000	FLOOD RISK
1440 minute winter	SW/17	1410	20.515	1.827	5.3	2.6144	0.0000	SURCHARGED
1440 minute winter	SW/18	1410	18.668	0.040	2.6	0.0451	0.0000	OK
1440 minute winter	SW/OUTFALL	1410	18.597	0.039	2.6	0.0000	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)
1440 minute winter	PERF. PIPE6	SW/8.000	PERF. PIPE7	0.2	0.346	0.009	0.3122	
1440 minute winter	PERF. PIPE7	SW/8.001	SW/AJ3	0.9	0.448	0.038	0.0650	
1440 minute winter	SW/AJ3	Orifice	SW/15	0.8				
1440 minute winter	SW/15	SW/7.004	SW/16	0.7	0.330	0.018	0.5782	
1440 minute winter	SW/16	SW/1.009	SW/17	5.3	0.130	0.035	1.2876	
1440 minute winter	SW/17	SW/1.010	SW/18	2.6	0.546	0.065	0.0485	
1440 minute winter	SW/18	SW/1.011	SW/OUTFALL	2.6	0.559	0.065	0.0552	209.6

APPENDIX B WASTEWATER DESIGN REPORT

Design Settings

Frequency of use (kDU)	1.00	Additional Flow (%)	0	Preferred Cover Depth (m)	0.900
Flow per dwelling per day (l/day)	4000	Minimum Velocity (m/s)	1.00	Include Intermediate Ground	✓
Domestic Flow (l/s/ha)	465.0	Connection Type	Level Soffits		
Industrial Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
WW/1	21.950	Adoptable	719260.340	746332.789	1.125
WW/2	21.950	Adoptable	719245.804	746332.972	1.396
WW/3	21.950	Adoptable	719200.196	746338.798	1.695
WW/4	21.450	Adoptable	719202.568	746358.250	1.326
WW/5	21.450	Adoptable	719213.680	746409.924	1.678
WW/6	21.150	Adoptable	719223.398	746419.510	1.446
WW/7	20.900	Adoptable	719258.894	746414.661	1.375
WW/8	21.950	Adoptable	719283.105	746361.931	1.456
WW/9	20.900	Adoptable	719264.982	746416.944	1.395
WW/OUTFALL	20.370	Adoptable	719262.431	746424.984	0.900

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
WW/1.000	WW/1	WW/2	16.243	1.500	20.825	20.554	0.271	60.0	225
WW/1.001	WW/2	WW/3	44.822	1.500	20.554	20.255	0.299	150.0	225
WW/1.002	WW/3	WW/4	19.596	1.500	20.255	20.124	0.131	150.0	225
WW/1.003	WW/4	WW/5	52.855	1.500	20.124	19.772	0.352	150.0	225
WW/1.004	WW/5	WW/6	13.650	1.500	19.772	19.704	0.068	200.0	225
WW/1.005	WW/6	WW/7	35.826	1.500	19.704	19.525	0.179	200.0	225
WW/1.006	WW/7	WW/9	4.033	1.500	19.525	19.505	0.020	200.0	225
WW/2.000	WW/8	WW/9	59.322	1.500	20.494	19.505	0.989	60.0	225
WW/1.007	WW/9	WW/OUTFALL	7.035	1.500	19.505	19.470	0.035	200.0	225

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Pro Depth (mm)	Pro Velocity (m/s)
WW/1.000	0.000	1.483	59.0	0.0	0.900	1.171	0.000	0	0.000
WW/1.001	0.000	0.936	37.2	0.0	1.171	1.470	0.000	0	0.000
WW/1.002	0.000	0.936	37.2	0.0	1.470	1.101	0.000	0	0.000
WW/1.003	0.000	0.936	37.2	0.0	1.101	1.453	0.000	0	0.000
WW/1.004	0.000	0.810	32.2	0.0	1.453	1.221	0.000	0	0.000
WW/1.005	0.000	0.810	32.2	0.0	1.221	1.150	0.000	0	0.000
WW/1.006	0.000	0.810	32.2	0.0	1.150	1.170	0.000	0	0.000
WW/2.000	0.000	1.483	59.0	0.0	1.231	1.170	0.000	0	0.000
WW/1.007	0.000	0.810	32.2	0.0	1.170	0.675	0.000	0	0.000

Pipeline Schedule

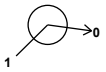
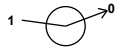
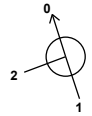
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
WW/1.000	16.243	60.0	225	Circular	21.950	20.825	0.900	21.950	20.554	1.171
WW/1.001	44.822	150.0	225	Circular	21.950	20.554	1.171	21.950	20.255	1.470
WW/1.002	19.596	150.0	225	Circular	21.950	20.255	1.470	21.450	20.124	1.101
WW/1.003	52.855	150.0	225	Circular	21.450	20.124	1.101	21.450	19.772	1.453
WW/1.004	13.650	200.0	225	Circular	21.450	19.772	1.453	21.150	19.704	1.221
WW/1.005	35.826	200.0	225	Circular	21.150	19.704	1.221	20.900	19.525	1.150
WW/1.006	4.033	200.0	225	Circular	20.900	19.525	1.150	20.900	19.505	1.170
WW/2.000	59.322	60.0	225	Circular	21.950	20.494	1.231	20.900	19.505	1.170
WW/1.007	7.035	200.0	225	Circular	20.900	19.505	1.170	20.370	19.470	0.675

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
WW/1.000	WW/1	1200	Manhole	Adoptable	WW/2	1200	Manhole	Adoptable
WW/1.001	WW/2	1200	Manhole	Adoptable	WW/3	1200	Manhole	Adoptable
WW/1.002	WW/3	1200	Manhole	Adoptable	WW/4	1200	Manhole	Adoptable
WW/1.003	WW/4	1200	Manhole	Adoptable	WW/5	1200	Manhole	Adoptable
WW/1.004	WW/5	1200	Manhole	Adoptable	WW/6	1200	Manhole	Adoptable
WW/1.005	WW/6	1200	Manhole	Adoptable	WW/7	1200	Manhole	Adoptable
WW/1.006	WW/7	1200	Manhole	Adoptable	WW/9	1200	Manhole	Adoptable
WW/2.000	WW/8	1200	Manhole	Adoptable	WW/9	1200	Manhole	Adoptable
WW/1.007	WW/9	1200	Manhole	Adoptable	WW/OUTFALL	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
WW/1	719260.340	746332.789	21.950	1.125	1200				
						0	WW/1.000	20.825	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
WW/2	719245.804	746332.972	21.950	1.396	1200	1	WW/1.000	20.554	225
									
						0	WW/1.001	20.554	225
WW/3	719200.196	746338.798	21.950	1.695	1200	1	WW/1.001	20.255	225
									
						0	WW/1.002	20.255	225
WW/4	719202.568	746358.250	21.450	1.326	1200	1	WW/1.002	20.124	225
									
						0	WW/1.003	20.124	225
WW/5	719213.680	746409.924	21.450	1.678	1200	1	WW/1.003	19.772	225
									
						0	WW/1.004	19.772	225
WW/6	719223.398	746419.510	21.150	1.446	1200	1	WW/1.004	19.704	225
									
						0	WW/1.005	19.704	225
WW/7	719258.894	746414.661	20.900	1.375	1200	1	WW/1.005	19.525	225
									
						0	WW/1.006	19.525	225
WW/8	719283.105	746361.931	21.950	1.456	1200				
						0	WW/2.000	20.494	225
WW/9	719264.982	746416.944	20.900	1.395	1200	1	WW/2.000	19.505	225
						2	WW/1.006	19.505	225
									
						0	WW/1.007	19.505	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
WW/OUTFALL	719262.431	746424.984	20.370	0.900	1200	1	WW/1.007	19.470	225

APPENDIX C UISCE ÉIREANN CONFIRMATION OF FEASIBILITY

CONFIRMATION OF FEASIBILITY

Ciaran O'Reilly

OCSC
9 Prussia Street
Stoneybatter
Dublin
D07 KT57

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

11 March 2024

Our Ref: CDS24000501 Pre-Connection Enquiry
Greenfield Site Mountgorry, Malahide Road, Swords, Dublin

Dear Applicant/Agent,

We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 130 unit(s) at Greenfield Site Mountgorry, Malahide Road, Swords, Dublin, (the **Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible without infrastructure upgrade by Uisce Éireann
- **Wastewater Connection** - Feasible without infrastructure upgrade by Uisce Éireann

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

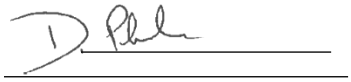
Where can you find more information?

- **Section A -** What is important to know?

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections, email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,



Dermot Phelan
Connections Delivery Manager

Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Uisce Éireann connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Uisce Éireann's network(s)?	• Requests for maps showing Uisce Éireann's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

APPENDIX D SURFACE WATER MANAGEMENT DESIGN STATEMENT

Existing Scenario: **Surface Water Statement**	**(250 words max)** *separate sheet may be included*
Description of existing subject site outlining the drainage characteristics - topography, ground conditions, suitability for infiltration, natural directions and paths for water movement, existing surface water flood risk.	The site is currently un-maintained greenfield which would have very low overland flow. As outlined within the SSFRA chapter there is no apparent flood risks for the proposed development site. Site investigations revealed poor infiltration on site [please refer to appropriate appendix] As per topo survey the site is sloping from north to south.
Proposed Scenario: **Surface Water Management Design Statement**	**(250 words max)** *separate sheet may be included*
This shall be a clear concise summary of the surface water design proposal. Applicants shall provide a brief explanation of how they have responded to the principles of Sustainable Drainage Systems (SuDS) Design contained in this policy. This could include implications of SuDS on design of other aspects of the development and price comparisons. We encourage that proposals are mindful of future implications from the beginning and present outline designs based on realistic options including maintenance activities and how they are resourced. Applicants shall be required to clearly demonstrate how the design makes a significant and positive contribution to the amenity value of the open space provision and shall state how the usability of these areas by the public has been addressed. Reference shall also be made on how the design considered the access and use of maintenance machinery in terms of slopes and any hard structures (e.g. head walls) located within the open space areas.	SUD's features such as tree pits, green / blue roofs, filter drains and detention basins have been utilised for there source control, attenuation and cleansing purposes within the surface water design. These SUD's features have also been implemented and designed in such a way that they carry out there primary function whilst offering a positive contribution to the local environment. For example the tree pits scattered across the site require very low maintenance and offer attenuation and source control properties whilst also being a positive environmental and landscaping aspect. The attenuation system does not contain headwalls instead having grated covers within manholes. It has been designed with slopes at 1:5 to allow machinery to cross whilst also allowing for a play area. Due to the perforated pipe and stone underneath this basin it will also be dry for the majority of the year encouraging its use as a play area. A silt trap manhole and fuel interceptor have been included in the design upstream from the system to limit and localise the maintenance required.

APPENDIX E FINGAL SUDS SELECTION HIREARCHY SHEET

SuDS Measures	Measures to be used on this site	Rationale for selecting/not selecting measure	Area of Feature (m^2)	Attenuation volume of feature (m^3)
Source Control				
Swales		other SUD's features utlised instead		
Integrated constructed Tree Pits	Y	offers mulitple purposes [SUD's, enviromental, landscape]	242.4	72.4
Rainwater Butts		architectural design		
Downpipe Planters		other SUD's features utlised instead		
Rainwater harvesting		other SUD's features utlised instead		
Soakaways		poor infiltration on site		
Infiltration trenches		poor infiltration on site		
Permeable pavement (Grasscrete, Block paving, Porous Asphalt etc.)	Y	pervious paving proposed for carparking spaces	296.95	40.088
Green Roofs	Y	source control of rainwater at roof level	1261.6	179.8
Green wall		other SUD's features utlised instead		
Filter strips	Y	offers both drainage and attenuation purposes under pervious paving	50.434	9.078
Bio-retention systems/Raingardens		other SUD's features utlised instead		
Blue Roofs	Y	source control of rainwater at roof level	refer to green roof above	refer to green roof above
Filter Drain	Y	offers both drainage and attenuation purposes	80	14.4
Site Control				
Detention Basins	Y	required for attenuation	425	272
Retentions basins		not required for SW design		
Regional Control				
Ponds		not required for SW design		
Wetlands		not required for SW design		
Other				
Petrol/Oil interceptor	Y	more than 9 spaces proposed	N/A	N/A

Attenuation tank – only as a last resort where other measures are not feasible		not required for SW design		
Oversized pipes– only as a last resort where other measures are not feasible		not required for SW design		

Notes:

1. Fingal has a preference for above ground Green Infrastructure rather than tanks or oversized 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 and swale 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. Please submit evidence of infiltration rates
7. To account for climate change in the design of the drainage system rainfall intensities should be factored up by 20%
8. The Applicant must provide Suds checklists in accordance with the Appendix B of the Ciria Suds manual C753

Appendix	**Name**
B3	Full planning
B4	Scheme design
B5	Health and safety
B6	Infiltration assessment
B7	Proprietary treatment
B9	filter strip
B11	filter drain
B13	swale
B15	bioretention
B16	pervious pavement
B17	attenuation tank
B19	basin
B21	pond wetland

APPENDIX F STATEMENT OF AREAS – GREEN / BLUE INFRASTUCTURE

Overall Development Site Area (m2)				8732							
% Permeable Areas (open space, green roofs, permeable surfacing etc)				44.3%							
% Hardstanding Areas (roof areas, road surfaces, concrete paved areas etc)				55.7%							
Park Type as per Table 12.5 of the Development Plan)	**Park size (m^2)**	**Area of Drainage green infrastructure in park (m^2)**	**Percentage of drainage infrastructure per park (%)**	**Swale (m^2)**	**Filter strip (m^2)**	**Bioretention area (m^2)**	**Retention basin (m^2)**	**Detention basin (m^2)**	**Pond (m^2)**	**Wetland ((m^2)**	**No. of head walls located on open**
Pocket Park (500m2- 0.2ha)	1114							425			0
Small Park (0.2ha to 2ha)											
Local Park (2-20ha)											
Urban Park Neighbourhood (20ha to 50ha)											
Regional Park (over 50 ha)											
Other permeable surfaces Grass margins/ Environmental open space ***Not part of open space provision**											

APPENDIX G SITE INVESTIGATION REPORT

S.I. Ltd Contract No: 6089

Client: Bartra Property Capital Group
Engineer: OCSC
Contractor: Site Investigations Ltd

Mountgorry,
Swords, Co. Dublin
Site Investigation Report

Prepared by:

.....
Stephen Letch

Issue Date:	10/08/2023
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Contents:

Appendices:

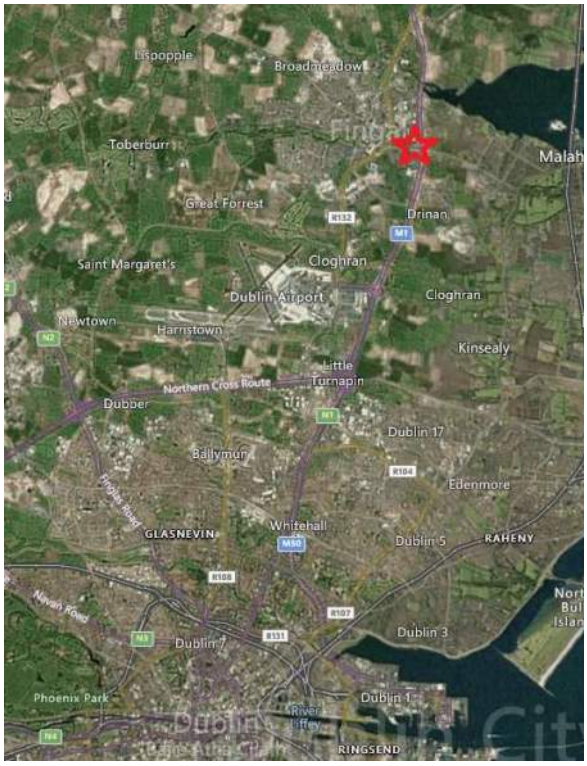
1. Introduction

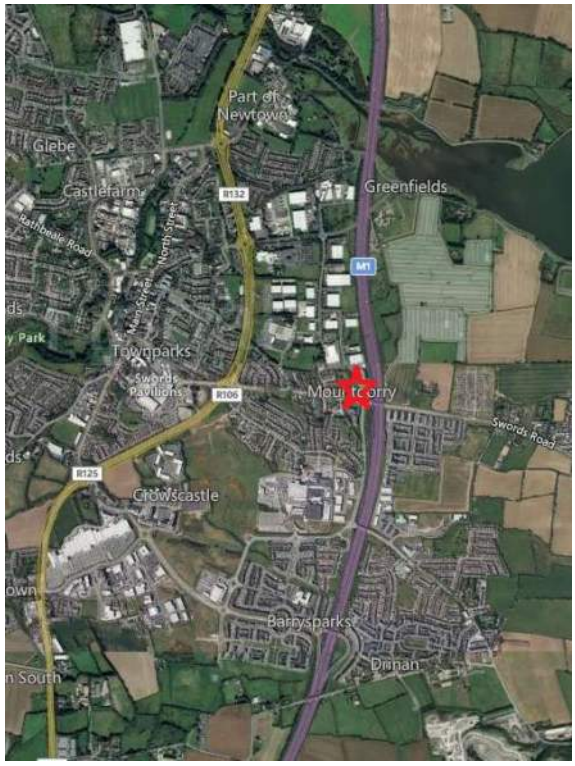
On the instructions of OCSC, Site Investigations Ltd (SIL) was appointed to complete a ground investigation at Mountgorry, Swords, Co. Dublin. The investigation was for a residential development on the site and was completed on behalf of the Client, Bartra Property Capital Group. This investigation was started in February and completed in May 2023.

This report presents the factual geotechnical data obtained from the field and laboratory testing with interpretation of the ground conditions discussed.

2. Site Location

Mountgorry is to the east of Swords town centre on the Malahide Road with the M1 motorway to the east. The first map below shows the location of Swords to the north of Dublin and the second map shows the location of the site to the east of the town centre.





3. Fieldwork

The fieldworks comprised a programme of cable percussive boreholes, trial pits, soakaway tests and California Bearing Ratio tests. All fieldwork was carried out in accordance with BS 5930:2015, Engineers Ireland GI Specification and Related Document 2nd Edition 2016 and Eurocode 7: Geotechnical Design. The fieldworks comprised of the following:

- 3 No. cable percussive boreholes with 2 No. rotary coreholes
- 5 No. trial pits
- 4 No. soakaway tests
- 3 No. California Bearing Ratio tests
- 4 No. slit trenches

3.1. Cable Percussive Boreholes and Rotary Coreholes

Cable percussion boring was undertaken at 3 No. locations using a Dando 150 rig and constructed 200mm diameter boreholes. After CAT scanning the locations, hand dug inspection pits were excavated to 1.00mbgl to check for underground services. It was not possible to collect undisturbed samples due to the granular soils encountered so bulk disturbed samples were recovered at regular intervals. The boreholes terminated at similar depths of 8.00mbgl (BH01 and BH03) and 8.10mbgl (BH02) after an hour and a half of chiselling was completed with no further progress.

To test the strength of the stratum, Standard Penetration Tests (SPT's) were performed at 1.00m intervals in accordance with BS 1377 (1990). In soils with high gravel and cobble content it is appropriate to use a solid cone (60°) (CPT) instead of the split spoon and this was used throughout the testing. The test is completed over 450mm and the cone is driven 150mm into the stratum to ensure that the test is conducted over an undisturbed zone. The cone is then driven the remaining 300mm and the blows recorded to report the N-Value. The report shows the N-Value with the 75mm incremental blows listed in brackets (e.g., BH01 at 1.00mbgl where N=13-(1,2/2,3,4,4)). Where refusal of 50 blows across the test zone was encountered was achieved during testing, the penetration depth is also reported (e.g., BH01 at 4.00mbgl where N=50-(3,7/50 for 255mm)).

At BH01 and BH03, groundwater standpipes were installed to allow for the equalisation of the water table and long-term monitoring. These included a gravel response zone around the slotted standpipe with bentonite seals at the top of the holes to stop migration of water from the surface.

Following completion of the cable percussive boreholes, rotary coreholes were completed adjacent to BH01 and BH02 using a Sondeq SS71 top drive rig and open hole drilling techniques were used to advance through the overburden to the bedrock. The coreholes were then terminated when the coreholes reached 13.00mbgl and no bedrock was encountered.

The combined cable percussive and rotary corehole logs and photographs are presented in Appendix 1.

3.2. Trial Pits

5 No. trial pits were excavated using a wheeled excavator. The pits were logged and photographed by SIL geotechnical engineer and representative disturbed bulk samples were recovered as the pits were excavated, which were returned to the laboratory for geotechnical testing. Any groundwater ingresses and pit wall stability were noted as the excavations progressed and then the pits were backfilled with the arisings.

The trial pit logs are presented in Appendix 2 along with the photographs.

3.3. Soakaway Tests

At 4 No. locations, soakaway tests were completed and logged by SIL geotechnical engineer. BRE Special Digest 365 stipulates that the pit should be filled three times and that the final cycle is used to provide the infiltration rate. The time taken for the water level to fall from 75% volume to 25% volume is required to calculate the rate of infiltration. However, if the water level does not fall at a steady rate, then the test is deemed to have failed and the area is unsuitable for storm water drainage.

The soakaway test results and photographs are presented in Appendix 3.

3.4. California Bearing Ratio Tests

At 3 No. locations, undisturbed cylindrical mould samples were recovered to complete California Bearing Ratio tests in the laboratory. The results facilitate the designing of the access roads and associated areas and are completed to BS1377: 1990: Part 4, Clause 7 ‘Determination of California Bearing Ratio’.

The results are presented in Appendix 4.

3.5. Slit Trenches

Slit trenching was completed at 4 No. locations by hand digging with machine assistance where possible. The trenches were completed to check the location and depth of ESB services on site. The trenches were logged and the services photographed before they were backfilled with the arisings.

The logs are presented in Appendix 5.

3.6. Groundwater Monitoring

Following the completion of the fieldworks, a groundwater measurement from the standpipe were taken. The measurement was then completed using a dip tape with a sensor at the end, which was lowered into the standpipe and set off a buzzer when the groundwater was encountered.

The groundwater reading is presented in Appendix 6.

3.7. Surveying

Following completion of all the fieldworks, a survey of the exploratory hole locations was completed using a GeoMax GPS Rover. The data is supplied on each individual log and along with a site plan in Appendix 9.

4. Laboratory Testing

Geotechnical laboratory testing was completed on representative soil samples in accordance with BS 1377 (1990). Testing included:

- 8 No. Moisture contents
- 8 No. Atterberg limits
- 8 No. Particle size gradings with hydrometers

Environmental testing was completed by ALS Environmental Ltd. and this consists of the following:

- 4 No. BRE Suite D1 analysis

The geotechnical laboratory test results are presented in Appendix 7 with the environmental test results in Appendix 8.

5. Ground Conditions

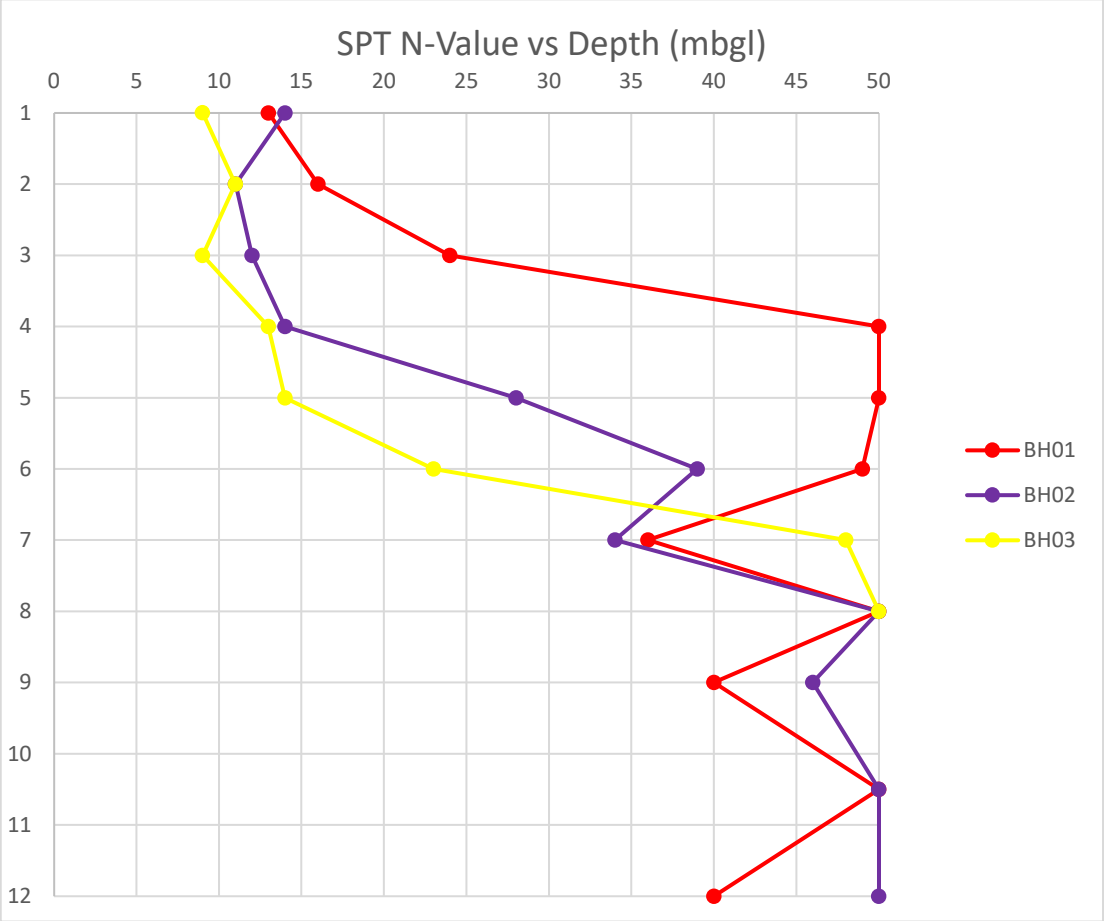
5.1. MADE GROUND

MADE GROUND was encountered across the site with shallowest deposits at TP01 and TP02 to the south west of the site and BH02 and TP03 near the centre of the site recorded the deepest deposits of fill material with 3.50mbgl and 2.50mbgl respectively. The material is generally brown, brown grey, black brown or black slightly sandy slightly gravelly silty clay with anthropogenic material of red brick, concrete, timber, steel and plastic fragments.

5.2. Overburden

The natural ground conditions are dominated by brown overlying grey slightly sandy slightly gravelly silty CLAY with low to medium cobble content. The coreholes were completed to 13.00mbgl and no bedrock was encountered with very stiff glacial till soils. These soils are common in North County Dublin and are deposited as part of Irelands glacial history.

The SPT N-values in BH01 and BH03 recorded values of 13 and 9 at 1.00mbgl, 16 and 11 at 2.00mbgl and 24 and 9 at 3.00mbgl. BH02 recorded fill material to 3.50mbgl with values of 14 and 28 at 4.00mbgl and 5.00mbgl. The graph below shows the SPT N-values vs depth.



Laboratory tests of the shallow cohesive soils show that CLAY soils record low to intermediate plasticity indexes of 12% to 20% recorded. The particle size distribution curves were poorly sorted straight-line curves with 19% to 62% fines content in the cohesive soils.

5.3. Groundwater

Groundwater details in the boreholes and trial pits during the fieldworks are noted on the logs in Appendices 1 and 2. Only one groundwater ingress was recorded during the fieldworks, at 3.50mbgl in BH02. This is at the boundary between the fill material and the natural soils recorded at this location.

6. Recommendations and Conclusions

Please note the following caveats:

The recommendations given, and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material

between the exploratory hole locations or below the final level of excavation, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for adjacent unexpected conditions that have not been revealed by the exploratory holes. It is further recommended that all bearing surfaces when excavated should be inspected by a suitably qualified Engineer to verify the information given in this report.

Excavated surfaces in clay strata should be kept dry to avoid softening prior to foundation placement. Foundations should always be taken to a minimum depth of 0.50mBGL to avoid the effects of frost action and possible seasonal shrinkage/swelling.

If it is intended that on-site materials are to be used as fill, then the necessary laboratory testing should be specified by the Client to confirm the suitability. Also, relevant lab testing should be specified where stability of side slopes to excavations is a concern, or where contamination may be an issue.

6.1. Shallow Foundations

Due to the unknown depth of foundation and no longer-term groundwater information, this analysis assumes the groundwater will not influence the construction or performance of these foundations.

MADE GROUND was encountered across the site to a maximum depth of 3.50mbgl at BH02. SIL do not recommend that narrow shallow foundations are placed on fill material due to the unknown compaction methods used during laying of man-made material. This unknown could result in softer spots and differential settlement once construction is completed. If shallow foundations are to be used and man-made soils are encountered below foundation level, then the soil should be removed and replaced with engineered fill which is compacted to the required standard.

BH01 and BH03 recorded natural soils at 1.20mbgl and 1.10mbgl with the SPT N-values of 13 and 9 extending into these natural soils. Using a correlation proposed by Stroud and Butler between SPT N-values and plasticity indices, the SPT N-value can be used to calculate the undrained shear strength. With the low plasticity indexes recorded in the laboratory for the soils, this correlation is C_u=6N. Therefore, using the lower value of 9, this indicates that the undrained shear strength of the CLAY is 54kN/m^2. This can be used to calculate the ultimate bearing capacity, and this has been calculated to be 293kN/m^2. Finally, a factor of safety is applied and with a factor of 3, an allowable bearing capacity of 100kN/m^2 would be anticipated using the lower SPT values.

The SPT N-values increase at BH01 but do not increase until the black glacial till is encountered at 5.50mbgl at BH03 with a value of 23 recorded, indicating a C_u of 138kN/m^2, an ultimate

bearing capacity of 794kN/m^2 and an allowable bearing capacity of 265kN/m^2 at this depth. As previously stated in Section 5.2., these soils are common across north Co. Dublin and the allowable bearing capacities for these soils are often increased to 150kN/m^2 for the brown CLAY and 250kN/m^2 to 300kN/m^2 for the deeper black CLAY.

If these values are too low then the remaining options for founding structures on site are raft or piled foundations. The raft foundations spread the loads over large areas and the soils are levelled and compacted at the formation level. This can help to identify any local soft spots that should be removed and replaced with engineered fill. Stone is then placed onto the founding soil in 200mm layers and compacted by a suitable roller and the process repeated until the level for the concrete is achieved. Further insitu testing in the form of CBR may be completed at this point to ensure that the gravel is compacted.

Alternatively, piled foundations may be considered and a specialist pile designer should be consulted to provide the most cost-effective method of founding the structures according to the proposed design.

The following assumptions were made as part of these analyses. If any of these assumptions are not in accordance with detailed design or observations made during construction these recommendations should be re-evaluated.

- The foundation is to be 1m wide.
- Foundations are to be constructed on a level formation of uniform material type (described above).
- All man-made or filled material is to be removed prior to construction.
- The bulk unit weight of the material in this stratum has a minimum density of 19kN/m^3.
- All bearing capacity calculations allow for a settlement of 25mm.
- Based on groundwater observations this analysis assumes the groundwater will not influence the construction or performance of these foundations.

The trial pit walls generally remained stable during excavation but due to the presence of deep man-made deposits, it would be recommended that all excavations should be checked immediately and battered back accordingly. Regular inspection of temporary excavations should be completed during construction to ensure that all slopes are stable. Temporary support should be used on any excavation that will be left open for an extended period.

6.2. Groundwater

The caveats below relating to interpretation of groundwater levels should be noted:

There is always considerable uncertainty as to the likely rates of water ingress into excavations in clayey soil sites due to the possibility of localised unforeseen sand and gravel lenses acting as permeable conduits for unknown volumes of water.

Furthermore, water levels noted on the borehole and trial pit logs do not generally give an accurate indication of the actual groundwater conditions as the borehole or trial pit is rarely left open for sufficient time for the water level to reach equilibrium.

Also, during boring procedures, a permeable stratum may have been sealed off by the borehole casing, or water may have been added to aid drilling. Therefore, an extended period of groundwater monitoring using any constructed standpipes is required to provide more accurate information regarding groundwater conditions. Finally, groundwater levels vary with time of year, rainfall or any nearby construction sites.

Pumping tests would be required to determine likely seepage rates and persistence into excavations taken below the groundwater level. Deep trial pits also aid estimation of seepage rates.

As discussed previously, groundwater was only recorded in BH02 at 3.50mbgl, at the boundary of the fill material and the natural soils. There is always considerable uncertainty as to the likely rates of water ingress into excavations in cohesive man-made and natural soil sites due to the possibility of localised unforeseen sand and gravel lenses acting as permeable conduits for unknown volumes of water. Based on this information at the exploratory hole locations to date, it is considered likely that any shallow ingress (less than 2.00mbgl) into excavations of the CLAY will be slow. If granular soils are encountered in shallow excavations, then the possibility of water ingressing into an excavation increase.

If groundwater is encountered during excavations then mechanical pumps will be required to remove the groundwater from sumps. Sumps should be carefully located and constructed to ensure that groundwater is efficiently removed from excavations and trenches.

6.3. Soakaway Test

The soakaway test at SA01 passed the specification with a permeability rate of **1.00 x 10^{-3}m/s.**

The remaining soakaway tests failed the specification as the water level did not fall sufficiently enough to complete the test. The BRE Digest stipulates that the pit should half empty within 24hrs, and extrapolation indicates this condition would not be satisfied. The tests were terminated at the end of the first (of a possible three) fill/empty cycle since further testing would give even slower fall rates due to increased soil saturation. The unsuitability of the soils for

soakaways is further suggested by the soil descriptions of the materials in this area of the site where the soakaway was completed, i.e., well compacted clay soils.

6.4. Pavement Design

The CBR test results in Appendix 4 indicate CBR values of 4.8% to 7.4%. The insitu CBR samples were recovered at 1.00mbgl and inspection of the formation strata should be completed prior to construction of the pavement. Once the exact formation levels are finalised then additional in-situ testing could be completed to assist with the detailed pavement design.

6.5. Aggressive Ground Conditions

The chemical test results in Appendix 8 indicate a general pH value between 8.16 and 8.73, which is close to neutral and below the level of 9, therefore no special precautions are required.

The maximum value obtained for water soluble sulphate was 36mg/l as SO_4. The BRE Special Digest 1:2005 – '*Concrete in Aggressive Ground'* guidelines shows Class 1 conditions and no special precautions are required.

6.6. Radon Gas

The Environmental Protection Agency (EPA) has recently updated the Radon gas exposure map and this is available to view on the EPA website. This shows the possible exposure to radon gas with the bedrock geology, subsoil geology, soil permeability and aquifer type analysed to produce the map. The map is based on residential homes and shows that the site falls within the lowest level of 1 in 20 homes have a possibility of high radon exposure. Measures should still be taken in the form of radon protection barriers from radon exposure in the new structure.

EPA map identifying possible Radon exposure.
https://gis.epa.ie/EPAMaps/Radon?&lid=EPA:RadonRiskMapofIreland

Appendix 1

Cable Percussive Borehole and Rotary Corehole Logs

Contract No: 6089	**Cable Percussion and Rotary Corehole Log**			Corehole No: **BH01**
Contract:	Mountgorry	Easting:	719248.308	Date Started: 24/02/2023
Location:	Swords, Co. Dublin	Northing:	746344.776	Date Completed: 11/05/2023
Client:	Bartra Property Capital Group	Elevation:	21.17	Drilled By: J. O'Toole
Engineer:	OCSC	Rig Type:	Dando 150	Status: FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples	Rock Indices TCR/%	SCR/%	RQD/%	FI/m	Backfill
0	0.20	TOPSOIL.		21.0	20.97						
0.5		MADE GROUND: brown slightly sandy gravelly silty clay with low cobble content and some concrete and red brick fragments.		20.5							
1.0						N=13 (1,2/2,3,4,4) B / 1.00					
	1.20	Firm light brown slightly sandy slightly gravelly silty CLAY.		20.0	19.97						
1.5				19.5							
	1.80	Stiff grey slightly sandy slightly gravelly silty CLAY.			19.37						
2.0				19.0		N=16 (2,2/3,4,5,4) B / 2.00					
2.5				18.5							
3.0						N=24 (2,3/5,6,6,7) B / 3.00					
3.5				18.0							
				17.5							
4.0	4.00	Very stiff grey slightly sandy slightly gravelly silty CLAY with low cobble content.			17.17	N=50 (3,7/50 for 255mm) B / 4.00					
4.5				17.0							
				16.5							
5.0				16.0		50 (25 for 125mm/50 for 40mm) B / 5.00					
5.5				15.5							
6.0						N=49 (2,4/11,11,13,14) B / 6.00					
	6.20	Very stiff grey sandy slightly gravelly silty CLAY.		15.0	14.97						
6.5				14.5							
	6.80	Very stiff brown slightly sandy slightly gravelly silty CLAY.			14.37						
7.0				14.0		N=36 (2,5/7,9,9,11) B / 7.00					
7.5				13.5							
	7.90	Obstruction - boulders.			13.27						
8.0	8.00	Open hole drilling: Driller reports returns of brown sandy gravelly silty CLAY with cobbles and boulders.		13.0	13.17	50 (25 for 5mm/50 for 5mm) B / 8.00					
8.5				12.5							
9.0				12.0		N=40 (4,5/8,10,10,12)					
9.5				11.5							
10.0				11.0							
10.5				10.5		50 (5,7/50 for 85mm)					
11.0				10.0							
11.5				9.5							
12.0				9.0		N=40 (3,5/7,9,11,13)					
12.5				8.5							
	13.00	End of Corehole at 13.00m			8.17						

Chiselling:

From:	To:	Time:
5.10	5.20	01:00
7.90	8.00	01:30

Water Strikes:

Strike:	Rose:	Sealed:

Water Details:

Date:	Hole Depth:	Water Depth:
24/02	8.00	Dry

Installations:

From:	To:	Pipe:
0.00	1.50	Solid
1.50	8.00	Slotted

Backfill:

From:	To:	Type:
0.00	1.00	Bentonite
1.00	8.00	Gravel
8.00	13.00	Bentonite

Remarks:

Cable percussion borehole terminated at 8.00mbgl due to obstruction. Rotary corehole completed.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water

Contract No: 6089	**Cable Percussion and Rotary Corehole Log**				Corehole No: **BH02**
Contract:	Mountgorry	Easting:	719249.696	Date Started:	27/02/2023
Location:	Swords, Co. Dublin	Northing:	746387.557	Date Completed:	10/05/2023
Client:	Bartra Property Capital Group	Elevation:	21.02	Drilled By:	J. O'Toole
Engineer:	OCSC	Rig Type:	Dando 150	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples	Rock Indices TCR/%	SCR/%	RQD/%	FI/m	Backfill
	0.20	TOPSOIL.			20.82						
0.5		MADE GROUND: grey sandy slightly gravelly silty clay with some concrete and red brick fragments.		20.5							
1.0				20.0		N=14 (2,2/3,3,4,4) B / 1.00					
1.5				19.5							
	1.80	MADE GROUND: black brown slightly sandy gravelly silty clay with some concrete and red brick fragments.			19.22						
2.0				19.0		N=11 (1,1/2,3,3,3) B / 2.00					
2.5				18.5							
3.0				18.0		N=12 (2,2/3,3,3,3) B / 3.00					
3.5	3.50	Medium dense brown silty sandy GRAVEL.		17.5	17.52						
		Firm becoming stiff brown slightly sandy gravelly silty CLAY with low cobble content.									
4.0				17.0		N=14 (2,2/3,3,4,4) B / 4.00					
	4.40	Medium dense brown silty gravelly SAND.			16.62						
4.5				16.5							
5.0				16.0		N=28 (3,4/5,7,7,9) B / 5.00					
5.5	5.50			15.5	15.52						
	5.50	Very stiff black grey slightly sandy slightly gravelly silty CLAY with medium cobble content.			15.52						
6.0				15.0		N=39 (3,5/7,9,11,12) B / 6.00					
6.5				14.5							
7.0				14.0		N=34 (3,5/7,7,9,11) B / 7.00					
7.5				13.5							
8.0	8.00			13.0	13.02						
	8.10	Obstruction - boulders.			12.92	50 (25 for 5mm/50 for 5mm) B / 8.00					
8.5		Open hole drilling: Driller reports returns of brown sandy gravelly silty CLAY with cobbles and boulders.		12.5							
9.0				12.0		N=46 (4,6/9,11,12,14)					
9.5				11.5							
10.0				11.0							
10.5				10.5		50 (5,9/50 for 50mm)					
11.0				10.0							
11.5				9.5							
12.0				9.0		50 (8,15/50 for 100mm)					
12.5				8.5							
	13.00	End of Corehole at 13.00m			8.02						

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Sealed:	Water Details: Date:	Hole Depth:	Water Depth:	Installations: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:
8.00	8.10	01:30	3.50	2.50	5.80	27/02	8.10	Dry				0.00	13.00	Arisings	Cable percussion borehole terminated at 8.10mbgl due to obstruction. Rotary corehole completed.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water

Contract No: 6089	**Cable Percussion and Rotary Corehole Log**				Corehole No: **BH03**
Contract:	Mountgorry	Easting:	719245.665	Date Started:	23/02/2023
Location:	Swords, Co. Dublin	Northing:	746408.914	Date Completed:	23/02/2023
Client:	Bartra Property Capital Group	Elevation:	20.82	Drilled By:	J. O'Toole
Engineer:	OCSC	Rig Type:	Dando 150	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples	Rock Indices TCR/%	SCR/%	RQD/%	FI/m	Backfill
	0.20	TOPSOIL.			20.62						
0.5		MADE GROUND: brown sandy slightly gravelly silty clay with some concrete and red brick fragments.		20.5							
1.0	1.10			20.0	19.72	N=9 (1,2/2,2,3,2) B / 1.00					
1.5		Firm brown slightly sandy slightly gravelly silty CLAY.		19.5							
2.0				19.0		N=11 (2,2/2,3,3,3) B / 2.00					
2.5				18.5							
3.0				18.0		N=9 (2,3/2,2,2,3) B / 3.00					
3.5				17.5							
4.0				17.0		N=13 (2,2/3,3,4,3) B / 4.00					
4.5				16.5							
5.0				16.0		N=14 (1,2/3,3,4,4) B / 5.00					
5.5	5.50			15.5	15.32						
		Stiff black slightly sandy slightly gravelly silty CLAY.									
6.0				15.0		N=23 (2,4/5,5,6,7) B / 6.00					
6.5	6.50	Very stiff black grey slightly sandy slightly gravelly silty CLAY.		14.5	14.32						
		Very stiff black grey slightly sandy slightly gravelly silty CLAY.		14.0		N=48 (5,7/9,11,14,14) B / 7.00					
7.0				13.5							
7.5	7.40				13.42						
	7.80			13.0	13.02						
8.0	8.00	Obstruction - boulders.			12.82	50 (25 for 5mm/50 for 5mm) B / 8.00					
		End of Corehole at 8.00m		12.5							
8.5				12.0							
9.0				11.5							
9.5				11.0							
10.0				10.5							
10.5				10.0							
11.0				9.5							
11.5				9.0							
12.0				8.5							
12.5				8.0							

Chiselling:

From:	To:	Time:
7.80	8.00	01:30

Water Strikes:

Strike:	Rose:	Sealed:

Water Details:

Date:	Hole Depth:	Water Depth:
23/02	8.00	Dry

Installations:

From:	To:	Pipe:
0.00	1.50	Solid
1.50	8.00	Slotted

Backfill:

From:	To:	Type:
0.00	1.00	Bentonite
1.00	8.00	Gravel

Remarks:

Cable percussion borehole terminated due to obstruction.
No rotary coring scheduled.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water

Appendix 2

Trial Pit Logs and Photographs

Contract No: 6089	**Trial Pit Log**				Trial Pit No: **TP01**
Contract:	Mountgorry	Easting:	719206.243	Date:	23/02/2023
Location:	Swords, Co. Dublin	Northing:	746372.954	Excavator:	5T Tracked Excavator
Client:	Bartra Property Capital Group	Elevation:	21.57	Logged By:	P. McGonagle
Engineer:	OCSC	Dimensions (LxWxD) (m):	3.30 x 0.50 x 3.00	Status:	FINAL

Level (mbgl) Scale:	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples / Field Tests Depth	Type	Result	Water Strike
		MADE GROUND: grey silty sandy gravel with some red brick and steel fragments.		21.5					
	0.40				21.17				
0.5		Firm becoming stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.		21.0		0.50 0.50	B ES	MK01 MK02	
1.0				20.5		1.00	B	MK03	
1.5				20.0					
2.0				19.5					
	2.10	Stiff grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.			19.47				
2.5				19.0		2.50	B	MK04	
	3.00	**Pit terminated at 3.00m**			18.57				

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 6089	**Trial Pit Log**				Trial Pit No: **TP02**
Contract:	Mountgorry	Easting:	719216.986	Date:	23/02/2023
Location:	Swords, Co. Dublin	Northing:	746401.627	Excavator:	5T Tracked Excavator
Client:	Bartra Property Capital Group	Elevation:	20.73	Logged By:	P. McGonagle
Engineer:	OCSC	Dimensions (LxWxD) (m):	3.40 x 0.50 x 3.00	Status:	FINAL

Level (mbgl) Scale:	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples / Field Tests Depth	Type	Result	Water Strike
		MADE GROUND: brown slightly sandy slightly gravelly silty clay with low cobble and boulder content and some red brick, concrete block, steel, plastic and timber fragments.		20.5					
0.5						0.50	ES	MK08	
	0.80			20.0	19.93				
		Firm becoming stiff brown slightly sandy gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.							
1.0						1.00	B	MK09	
				19.5					
1.5									
	1.60				19.13				
		Stiff grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.		19.0					
2.0						2.00	B	MK10	
				18.5					
2.5									
				18.0					
	3.00	**Pit terminated at 3.00m**			17.73				

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 6089	**Trial Pit Log**				Trial Pit No: **TP03**
Contract:	Mountgorry	Easting:	719260.362	Date:	23/02/2023
Location:	Swords, Co. Dublin	Northing:	746392.711	Excavator:	5T Tracked Excavator
Client:	Bartra Property Capital Group	Elevation:	20.94	Logged By:	P. McGonagle
Engineer:	OCSC	Dimensions (LxWxD) (m):	3.40 x 0.50 x 3.00	Status:	FINAL

Level (mbgl) Scale:	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples / Field Tests Depth	Type	Result	Water Strike
0.5		MADE GROUND: brown grey slightly sandy slightly gravelly silty clay with low cobble and boulder content and some red brick, concrete, steel and timber fragments.		20.5		0.50 0.50	B ES	MK05 MK06	
1.0				20.0					
1.5				19.5					
2.0				19.0					
2.5	2.50	Stiff brown grey sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.		18.5	18.44	2.60	B	MK07	
	3.00	**Pit terminated at 3.00m**		18.0	17.94				

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 6089	**Trial Pit Log**				Trial Pit No: **TP04**
Contract:	Mountgorry	Easting:	719231.775	Date:	23/02/2023
Location:	Swords, Co. Dublin	Northing:	746424.166	Excavator:	5T Tracked Excavator
Client:	Bartra Property Capital Group	Elevation:	20.20	Logged By:	P. McGonagle
Engineer:	OCSC	Dimensions (LxWxD) (m):	3.30 x 0.50 x 3.00	Status:	FINAL

Level (mbgl) Scale:	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples / Field Tests Depth	Type	Result	Water Strike
0.5		MADE GROUND: brown slightly sandy slightly gravelly silty clay with some red brick and steel fragments.		20.0		0.50	ES	MK11	
1.0				19.5					
1.5				19.0		1.50	B	MK12	
				18.5					
	1.90	Firm becoming stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.			18.30				
2.0				18.0					
2.5						2.50	B	MK13	
	2.60	Stiff grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.		17.5	17.60				
	3.00	**Pit terminated at 3.00m**			17.20				

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 6089	**Trial Pit Log**				Trial Pit No: **TP05**
Contract:	Mountgorry	Easting:	719255.623	Date:	23/02/2023
Location:	Swords, Co. Dublin	Northing:	746424.053	Excavator:	5T Tracked Excavator
Client:	Bartra Property Capital Group	Elevation:	20.40	Logged By:	P. McGonagle
Engineer:	OCSC	Dimensions (LxWxD) (m):	3.60 x 0.50 x 3.00	Status:	FINAL

Level (mbgl) Scale:	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples / Field Tests Depth	Type	Result	Water Strike
		MADE GROUND: brown slightly sandy slightly gravelly silty clay with some concrete and red brick fragments.		20.0					
0.5						0.50	ES	MK14	
				19.5					
1.0	1.00	MADE GROUND: grey silty sandy gravel.			19.40				
	1.10	MADE GROUND: black slightly sandy slightly gravelly silty clay with low cobble content and some plastic fragments.			19.30				
				19.0					
1.5						1.50	B	MK15	
				18.5					
2.0									
	2.20	Stiff grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.			18.20				
				18.0					
2.5						2.50	B	MK16	
				17.5					
	3.00	**Pit terminated at 3.00m**			17.40				

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

TP01 Sidewall

TP01 Spoil

TP02 Sidewall

TP02 Spoil

TP03 Sidewall

TP03 Spoil

TP04 Sidewall

TP04 Spoil

TP05 Sidewall

TP05 Spoil

Appendix 3

Soakaway Test Results and Photographs

SOAKAWAY TEST

Project Reference:	6089
Contract name:	Mountgorry
Location:	Swords, Co. Dublin
Test No:	SA01
Date:	23/02/2023

Ground Conditions

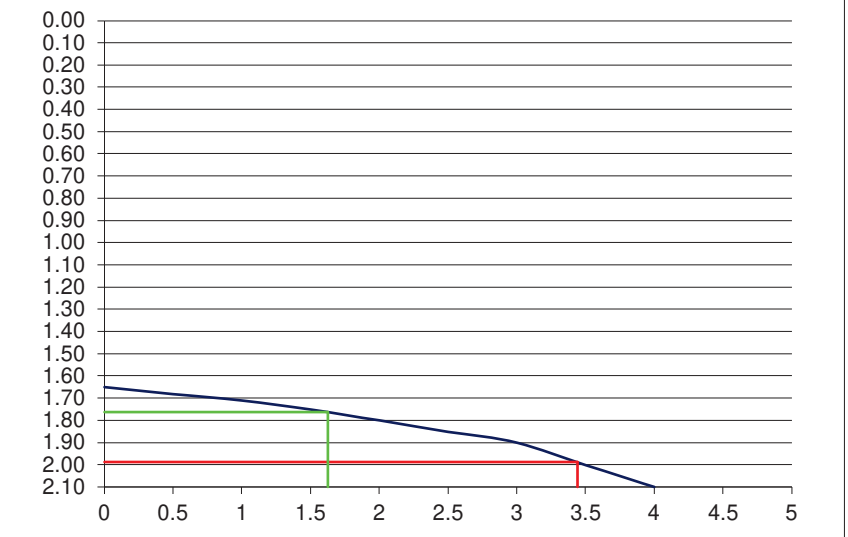
From	To	
0.00	1.30	MADE GROUND: brown slightly sandy slightly gravelly silty clay with some timber fragments.
1.30	2.10	MADE GROUND: grey silty sandy gravel with some concrete, red brick, plastic pipe fragments.

Remarks:

Added 1000l to pit - water level only to 1.65mbgl.

Elapsed Time (mins)	Fall of Water (m)
0	1.65
0.5	1.68
1	1.71
1.5	1.75
2	1.80
2.5	1.85
3	1.90
3.5	2.00
4	2.10

Pit Dimensions (m)		
Length (m)	2.80	m
Width (m)	0.50	m
Depth	2.10	m
Water		
Start Depth of Water	1.65	m
Depth of Water	0.45	m
75% Full	1.76	m
25% Full	1.99	m
75%-25%	0.23	m
Volume of water (75%-25%)	**0.32**	m3
Area of Drainage	**13.86**	m2
Area of Drainage (75%-25%)	**2.89**	m2
Time		
75% Full	1.63	min
25% Full	3.44	min
Time 75% to 25%	**1.81**	min
Time 75% to 25% (sec)	**108.8**	sec



f = 0.06024 m/min or **1.00E-03 m/s**

SOAKAWAY TEST

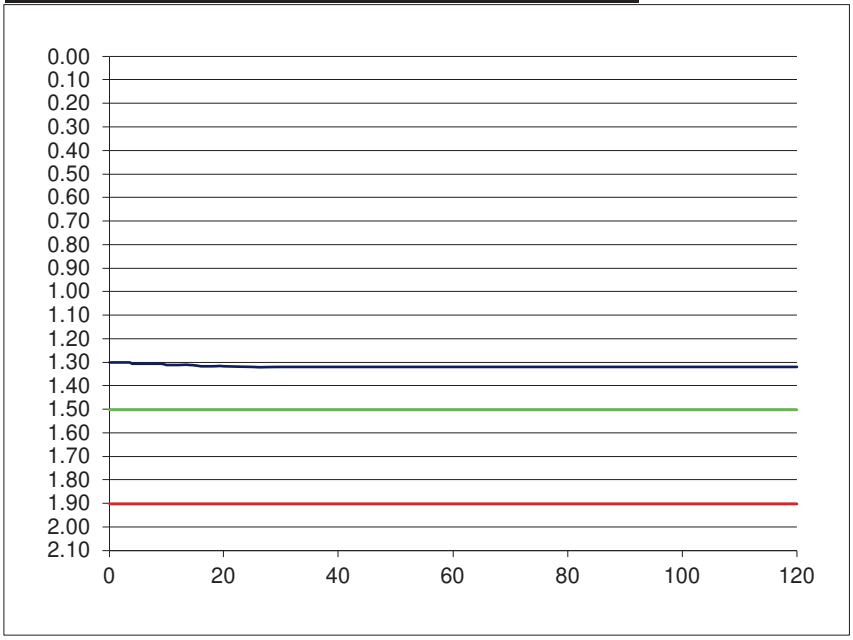
Project Reference:	6089
Contract name:	Mountgorry
Location:	Swords, Co. Dublin
Test No:	SA02
Date:	23/02/2023

Ground Conditions

From	To	
0.00	0.80	MADE GROUND: brown slightly sandy slightly gravelly silty clay with some plastic bag fragments.
0.80	0.90	MADE GROUND: light brown silty sandy gravel.
0.90	2.10	MADE GROUND: grey slightly sandy slightly gravelly silty clay with some red brick, concrete block, timber and plastic fragments.

Elapsed Time (mins)	Fall of Water (m)
0	1.30
0.5	1.30
1	1.30
1.5	1.30
2	1.30
2.5	1.30
3	1.30
3.5	1.30
4	1.31
4.5	1.31
5	1.31
6	1.31
7	1.31
8	1.31
9	1.31
10	1.31
12	1.31
14	1.31
16	1.32
18	1.32
20	1.32
25	1.32
30	1.32
40	1.32
50	1.32
60	1.32
75	1.32
90	1.32
120	1.32

Pit Dimensions (m)		
Length (m)	2.60	m
Width (m)	0.50	m
Depth	2.10	m
Water		
Start Depth of Water	1.30	m
Depth of Water	0.80	m
75% Full	1.50	m
25% Full	1.90	m
75%-25%	0.40	m
Volume of water (75%-25%)	**0.52**	m3
Area of Drainage	**13.02**	m2
Area of Drainage (75%-25%)	**3.78**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = **Fail** **m/min** or **Fail** **m/s**

SOAKAWAY TEST

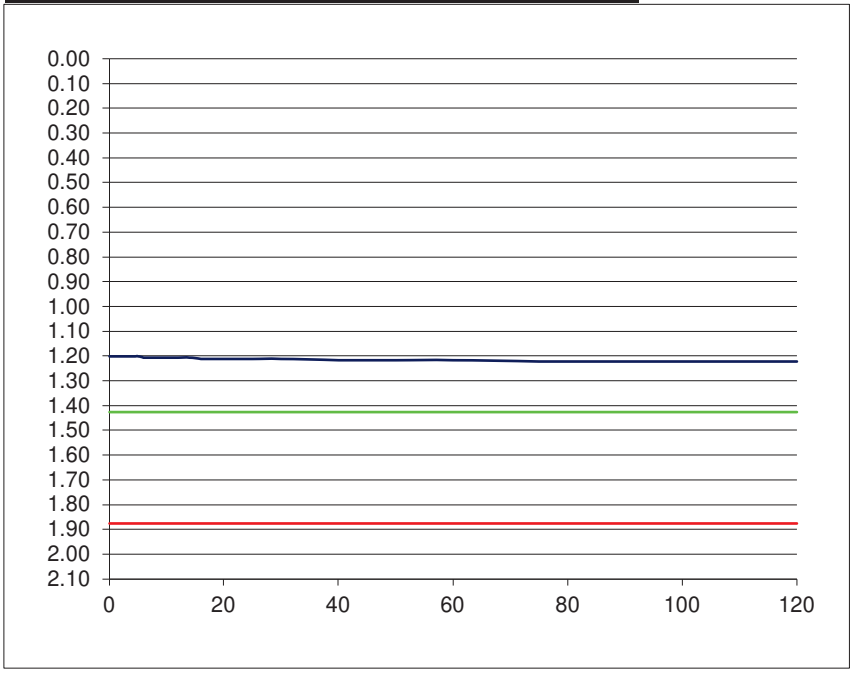
Project Reference:	6089
Contract name:	Mountgorry
Location:	Swords, Co. Dublin
Test No:	SA03
Date:	23/02/2023

Ground Conditions

From	To	
0.00	1.50	MADE GROUND: brown slightly sandy slightly gravelly silty clay with some red brick, concrete block, timber and steel fragments.
1.50	2.10	MADE GROUND: grey slightly sandy slightly gravelly silty clay with some red brick fragments.

Elapsed Time (mins)	Fall of Water (m)
0	1.20
0.5	1.20
1	1.20
1.5	1.20
2	1.20
2.5	1.20
3	1.20
3.5	1.20
4	1.20
4.5	1.20
5	1.20
6	1.21
7	1.21
8	1.21
9	1.21
10	1.21
12	1.21
14	1.21
16	1.21
18	1.21
20	1.21
25	1.21
30	1.21
40	1.22
50	1.22
60	1.22
75	1.22
90	1.22
120	1.22

Pit Dimensions (m)		
Length (m)	2.70	m
Width (m)	0.50	m
Depth	2.10	m
Water		
Start Depth of Water	1.20	m
Depth of Water	0.90	m
75% Full	1.43	m
25% Full	1.88	m
75%-25%	0.45	m
Volume of water (75%-25%)	**0.61**	m3
Area of Drainage	**13.44**	m2
Area of Drainage (75%-25%)	**4.23**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = **Fail** **m/min** or **Fail** **m/s**

SOAKAWAY TEST

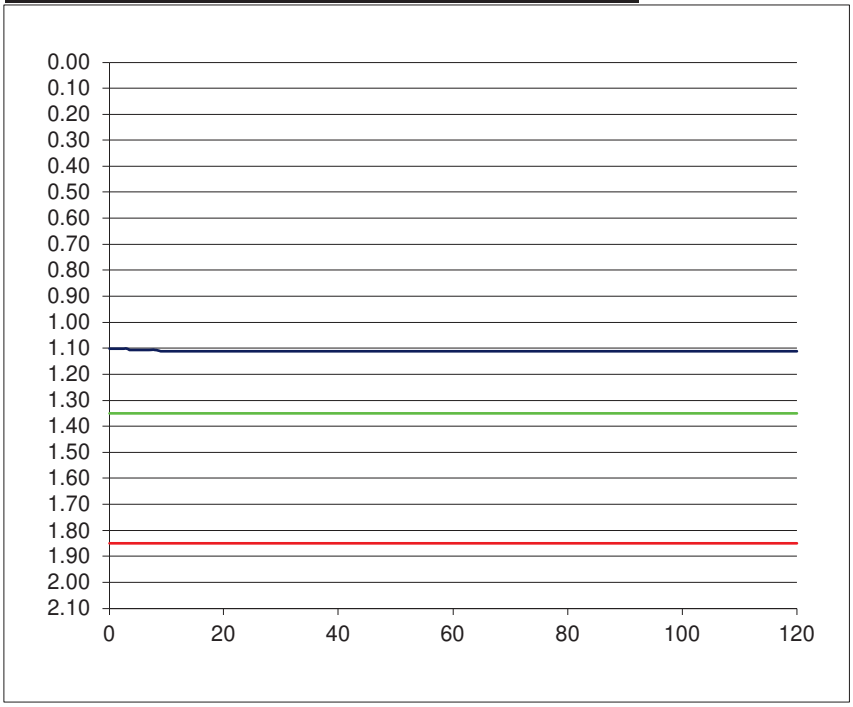
Project Reference:	6089
Contract name:	Mountgorry
Location:	Swords, Co. Dublin
Test No:	SA04
Date:	23/02/2023

Ground Conditions

From	To	
0.00	0.40	MADE GROUND: brown sandy slightly gravelly silty clay with some red brick, concrete block, timber and steel fragments.
0.40	2.10	Firm brown grey slightly sandy slightly gravelly silty CLAY with low cobble content.

Elapsed Time (mins)	Fall of Water (m)
0	1.10
0.5	1.10
1	1.10
1.5	1.10
2	1.10
2.5	1.10
3	1.10
3.5	1.11
4	1.11
4.5	1.11
5	1.11
6	1.11
7	1.11
8	1.11
9	1.11
10	1.11
12	1.11
14	1.11
16	1.11
18	1.11
20	1.11
25	1.11
30	1.11
40	1.11
50	1.11
60	1.11
75	1.11
90	1.11
120	1.11

Pit Dimensions (m)		
Length (m)	2.60	m
Width (m)	0.50	m
Depth	2.10	m
Water		
Start Depth of Water	1.10	m
Depth of Water	1.00	m
75% Full	1.35	m
25% Full	1.85	m
75%-25%	0.50	m
Volume of water (75%-25%)	**0.65**	m3
Area of Drainage	**13.02**	m2
Area of Drainage (75%-25%)	**4.40**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = **Fail** **m/min** or **Fail** **m/s**

SA01 Sidewall

SA01 Spoil

SA02 Sidewall

SA02 Spoil

SA03 Sidewall

SA03 Spoil

SA04 Sidewall

SA04 Spoil

Appendix 4

California Bearing Ratio Test Results

California Bearing Ratio (CBR) In accordance with BS1377: Part 4: Method 7

Client	Bartra Property Capital Group
Site	Mountgorry, Swords
S.I. File No	6089 / 23
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email info@siteinvestigations.ie
Report Date	28th March 2023

CBR No	Depth (mBGL)	Sample No	Sample Type	Lab Ref	Moisture Content (%)	CBR Value (%)	Location / Remarks
1	1.00	PM20	CBR	23/309	16.6	7.4	
2	1.00	PM21	CBR	23/310	18.5	4.8	
3	1.00	PM22	CBR	23/311	17.4	5.8	

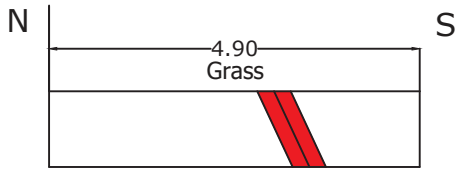
Printed 10/08/2023

_____Paddy McGonagle
Site Investigations Ltd

Appendix 5
Slit Trench Logs

ST01

Plan



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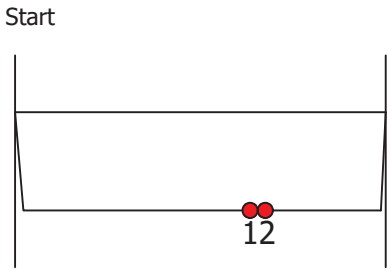


Services

No:	Diameter:	Colour:	Utility:	Distance:	Depth:	Alignment:
1	200mm	Red	ESB	3.10m	1.20m	65°
2	200mm	Red	ESB	3.30m	1.20m	65°

Photographs

Ground Conditions

From:	To:	Description:
0.00m	1.30m	MADE GROUND: brown slightly sandy slightly gravelly silty clay with some timber fragments.

Trench Dimensions

Point:	Easting:	Northing:	Level:
Start	719211.962	746348.560	21.53
Duct 1	719211.814	746345.468	20.33
Duct 2	719211.840	746345.237	20.33
End	719211.719	746343.692	21.49

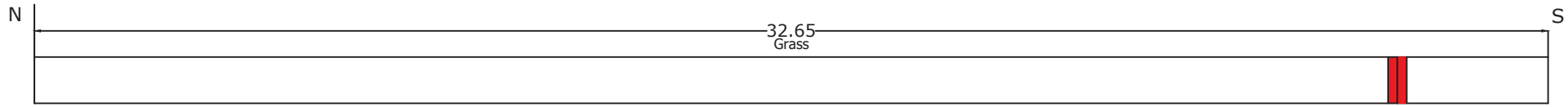
Length:	Width:	Depth:
4.90m	1.00m	1.30m

SITE INVESTIGATIONS LTD

Project:	Mountgorry	Logged by: D. Monaghan	Excavation Started: 11/05/2023	Excavation Finished: 11/05/2023	CONTRACT NUMBER
Client:	Bartra Property Capital Group	Scale: NOT TO SCALE, ALL DISTANCES IN m			6089
Consultant:	OCSC	DEPTH ARE TO THE TOP OF SERVICES			

ST02

Plan



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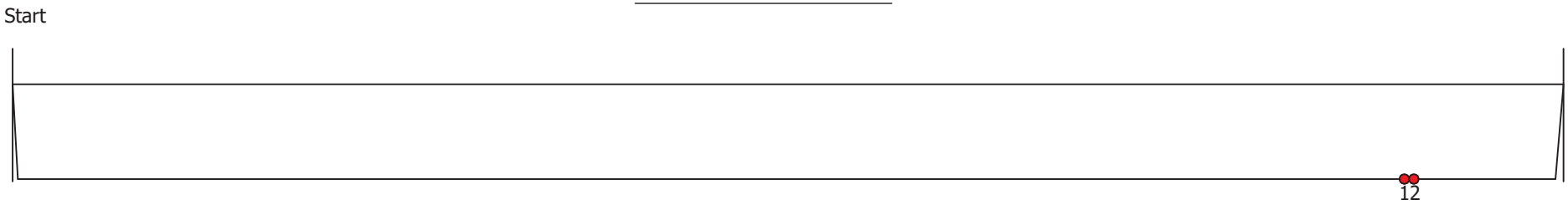


Services

No:	Diameter:	Colour:	Utility:	Distance:	Depth:	Alignment:
1	200mm	Red	ESB	29.30m	1.90m	90°
2	200mm	Red	ESB	29.50m	1.90m	90°

Photographs

Ground Conditions

From:	To:	Description:
0.00m	1.80m	MADE GROUND: brown grey slightly sandy slightly gravelly silty clay with low cobble and boulder content and some red brick, concrete, steel and timber fragments.

Trench Dimensions

Point:	Easting:	Northing:	Level:
Start	719258.332	746393.542	20.81
Duct 1	719265.241	746365.047	19.09
End	719266.758	746361.995	21.15

Length:	Width:	Depth:
32.65m	1.00m	1.80m

SITE INVESTIGATIONS LTD

Project:	Mountgorry
Client:	Bartra Property Capital Group
Consultant:	OCSC

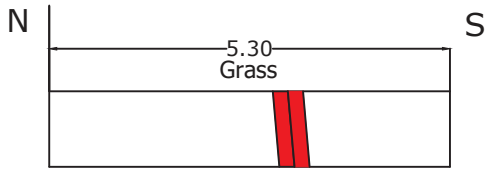
Logged by:	Excavation Started:	Excavation Finished:	CONTRACT NUMBER
D. Monaghan	11/05/2023	11/05/2023	6089

Scale: NOT TO SCALE, ALL DISTANCES IN m

DEPTH ARE TO THE TOP OF SERVICES

ST03

Plan



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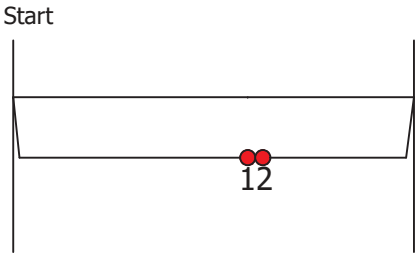


Services

No:	Diameter:	Colour:	Utility:	Distance:	Depth:	Alignment:
1	200mm	Red	ESB	3.10m	0.70m	85°
2	200mm	Red	ESB	3.30m	0.70m	85°

Photographs

Ground Conditions

From:	To:	Description:
0.00m	0.80m	MADE GROUND: brown slightly sandy gravelly silty clay with low cobble content and some concrete and red brick fragments.

Trench Dimensions

Point:	Easting:	Northing:	Level:
Start	719234.297	746358.677	21.38
Duct 1	719235.827	746355.891	20.70
End	719235.696	746353.537	21.39

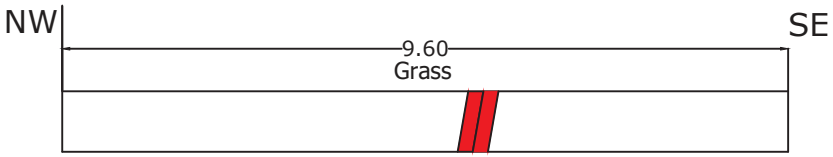
Length:	Width:	Depth:
5.30m	1.00m	0.80m

SITE INVESTIGATIONS LTD

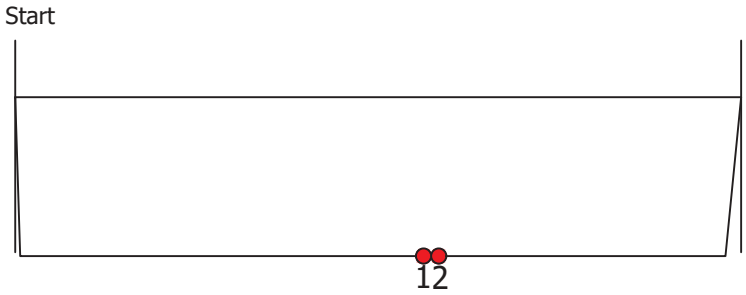
Project:	Mountgorry	Logged by: D. Monaghan	Excavation Started: 11/05/2023	Excavation Finished: 11/05/2023	CONTRACT NUMBER
Client:	Bartra Property Capital Group	Scale: NOT TO SCALE, ALL DISTANCES IN m			6089
Consultant:	OCSC	DEPTH ARE TO THE TOP OF SERVICES			

ST04

Plan



Cross Section



Services

No:	Diameter:	Colour:	Utility:	Distance:	Depth:	Alignment:
1	200mm	Red	ESB	5.40m	2.00m	100°
2	200mm	Red	ESB	5.60m	2.00m	100°

Photographs

Ground Conditions

From:	To:	Description:
0.00m	1.20m	MADE GROUND: brown slightly sandy gravelly silty clay with low cobble content and some concrete and red brick fragments.
1.20m	2.10m	Firm light brown slightly sandy slightly gravelly silty CLAY.

Trench Dimensions

Point:	Easting:	Northing:	Level:
Start	719246.742	746365.369	21.20
Duct 1	719248.754	746360.391	19.24
End	719250.799	746356.642	21.26

Length:	Width:	Depth:
9.60m	0.70m	2.10m

SITE INVESTIGATIONS LTD

Project:	Mountgorry	Logged by: D. Monaghan	Excavation Started: 12/05/2023	Excavation Finished: 12/05/2023	CONTRACT NUMBER
Client:	Bartra Property Capital Group	Scale: NOT TO SCALE, ALL DISTANCES IN m			6089
Consultant:	OCSC	DEPTH ARE TO THE TOP OF SERVICES			

Appendix 6

Groundwater Monitoring

Groundwater Readings

BH No:	Depth of standpipe	Depth to water - mbgl	Depth to water - mOD
10/05/2023			
BH01	7.28	2.29	18.88
BH03	6.81	2.17	18.65
22/05/2023			
BH01	7.25	2.35	18.88
BH03	6.81	2.19	18.65

Appendix 7

Geotechnical Laboratory Test Results

Classification Tests
In accordance with BS 1377: Part 2

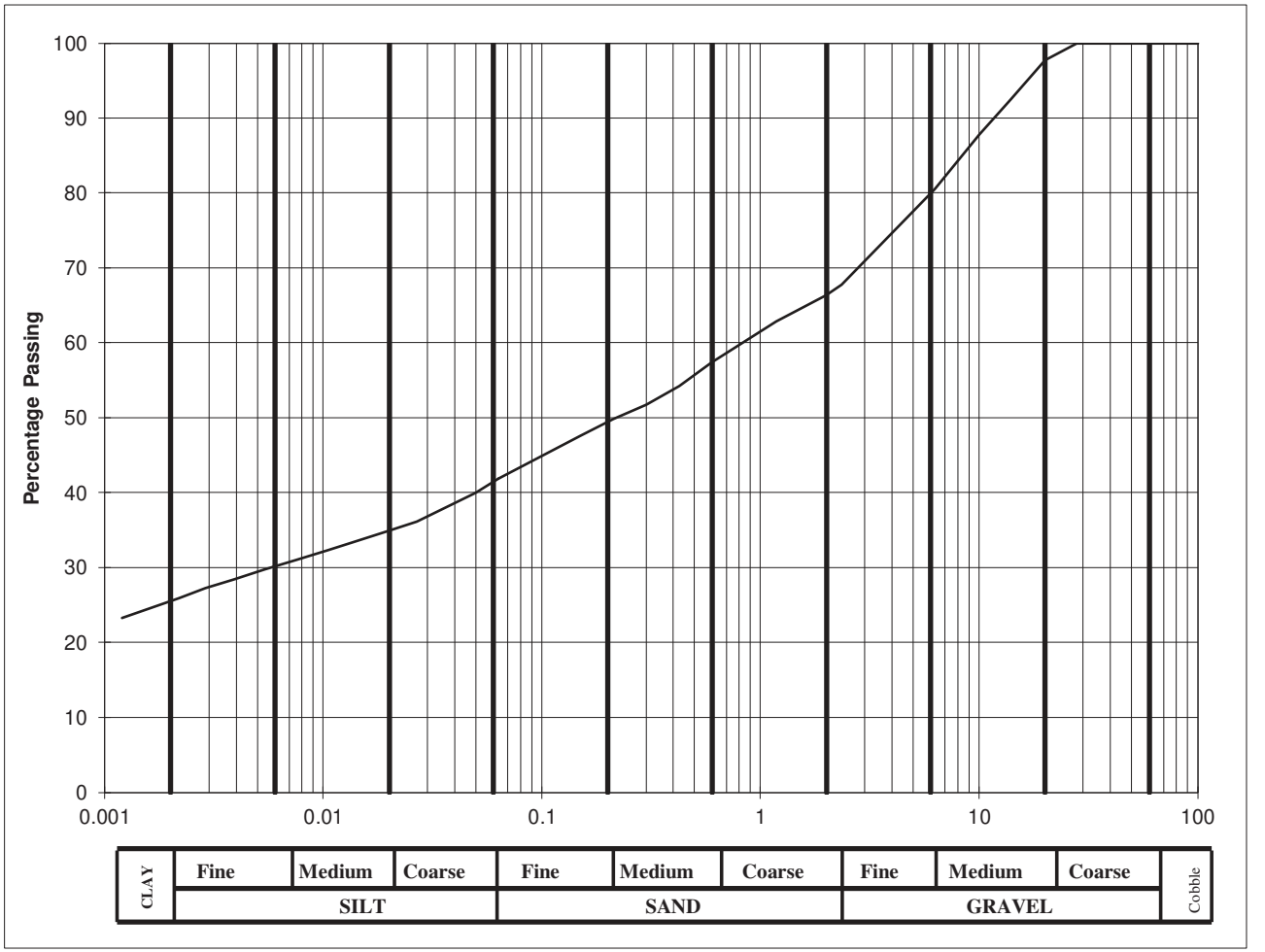
Client	Bartra Property Capital Group
Site	Mountgorry, Swords
S.I. File No	6089 / 23
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email:info@siteinvestigations.ie
Report Date	28th March 2023

Hole ID	Depth	Sample No	Lab Ref No.	Sample Type	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plastic Index %	Max. Density Mg/m^2	Bulk Density Mg/m^3	% passing 425um	Comments	**Remarks** **C**=Clay; **M**=Silt **Plasticity**: **L**=Low; **I**=Intermediate; **H**=High; **V**=Very High; **E**=Extremely High
BH01	2.00	JOT10	23/301	B	10.4	36	20	16			54.2		CI
BH02	2.00	JOT18	23/302	B	20.1	37	21	16			63.3		CI
BH02	4.00	JOT20	23/303	B	11.8	33	20	13			26.6		CL
BH03	2.00	JOT02	23/304	B	12.1	37	20	17			58.0		CI
TP01	1.00	PM03	23/305	B	19.6	38	21	17			74.4		CI
TP02	1.00	PM09	23/306	B	17.3	32	20	12			45.4		CL
TP03	2.60	PM07	23/307	B	16.4	36	20	16			70.2		CI
TP05	2.50	PM16	23/308	B	22.1	40	20	20			66.7		CI

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	42
90	100	**0.0200**	35
75	100	**0.0060**	31
63	100	**0.0020**	26
50	100		
37.5	100		
28	100		
20	97.7		
14	92.5		
10	87.7		
6.3	80.5		
5.0	77.5		
2.36	67.7		
2.00	66.3		
1.18	62.8		
0.600	57.4		
0.425	54.2		
0.300	51.7		
0.212	49.8		
0.150	47.6		
0.063	42		



Cobbles, %	0
Gravel, %	34
Sand, %	24
Silt, %	16
Clay, %	26

Client :	Bartra Property Capital Group
Project :	Mountgorry, Swords

Lab. No :	23/301
Sample No :	JOT10

Hole ID :	BH 01
Depth, m :	2.00

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

Printed 30/03/2023

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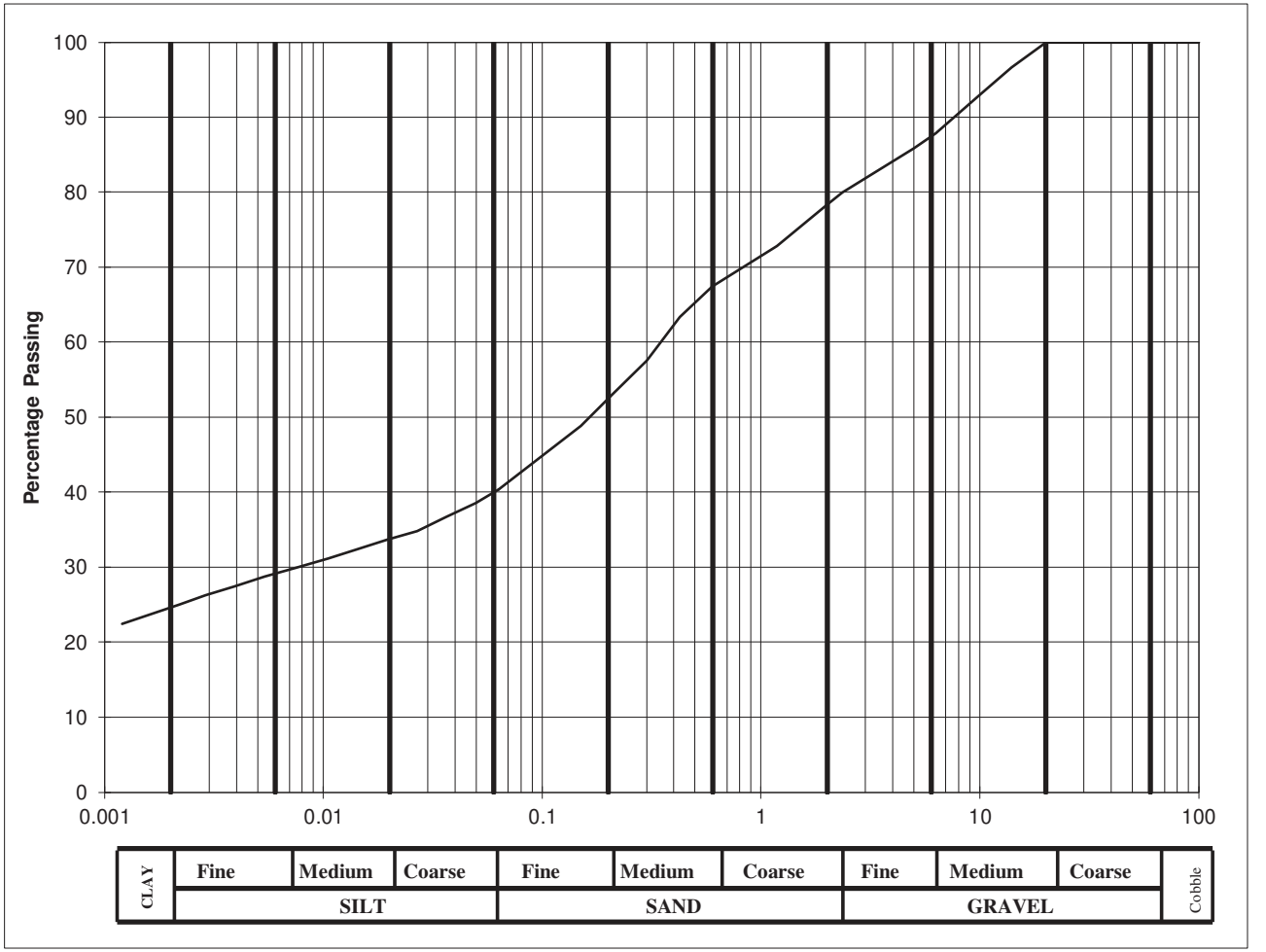
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	40
90	100	**0.0200**	34
75	100	**0.0060**	29
63	100	**0.0020**	25
50	100		
37.5	100		
28	100		
20	100		
14	96.6		
10	93		
6.3	87.8		
5.0	85.8		
2.36	79.9		
2.00	78.3		
1.18	72.8		
0.600	67.4		
0.425	63.3		
0.300	57.5		
0.212	53.2		
0.150	48.8		
0.063	40		



Cobbles, %	0
Gravel, %	22
Sand, %	38
Silt, %	15
Clay, %	25

Client :	Bartra Property Capital Group
Project :	Mountgorry, Swords

Lab. No :	23/302
Sample No :	JOT18

Hole ID :	BH 02
Depth, m :	2.00

Material description :	sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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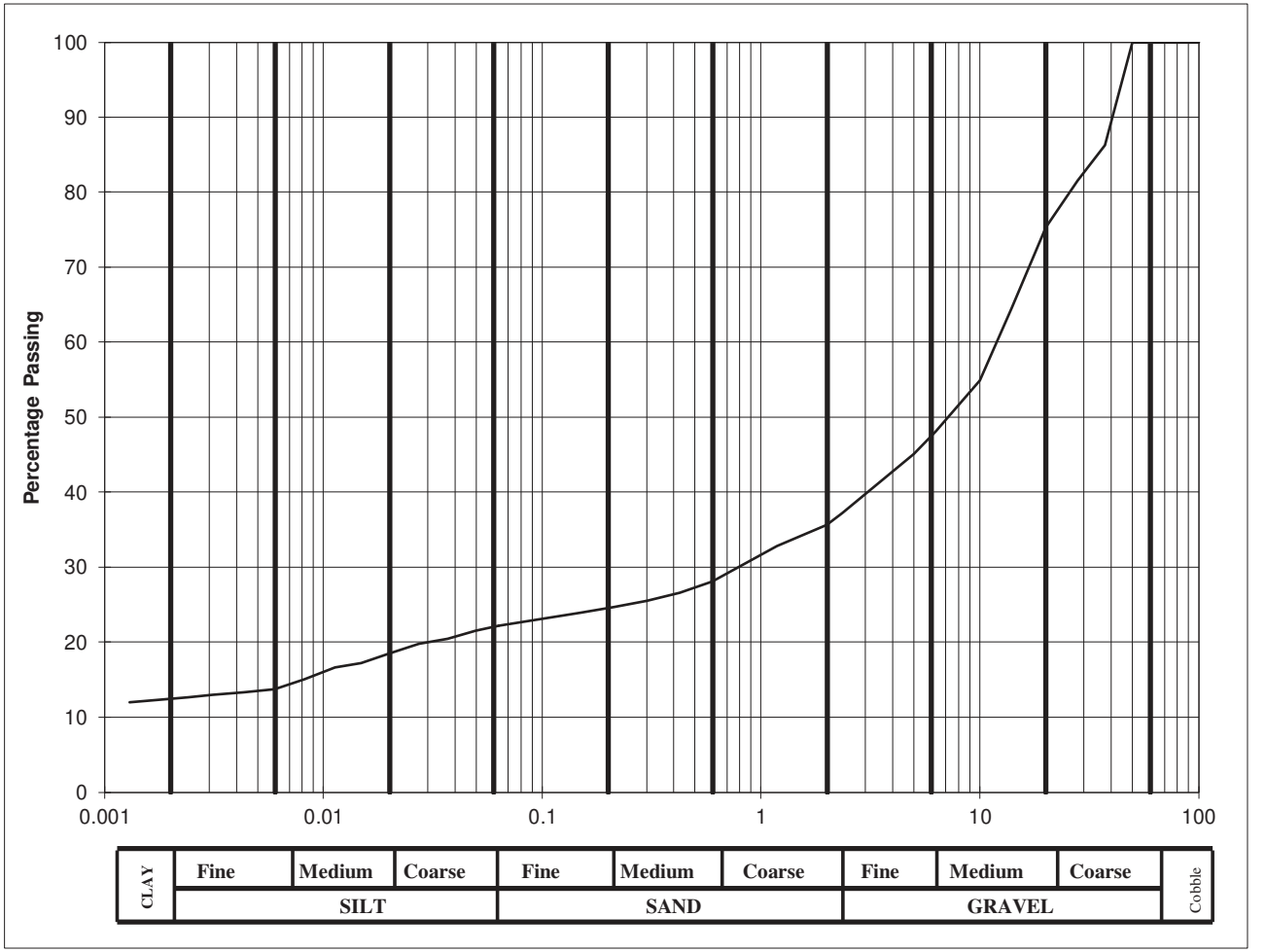
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	22
90	100	**0.0200**	19
75	100	**0.0060**	14
63	100	**0.0020**	12
50	100		
37.5	86.2		
28	81.5		
20	75.3		
14	64.5		
10	54.9		
6.3	48.1		
5.0	45.1		
2.36	37.2		
2.00	35.6		
1.18	32.8		
0.600	28.1		
0.425	26.6		
0.300	25.5		
0.212	24.7		
0.150	23.9		
0.063	22		



Cobbles, %	0
Gravel, %	64
Sand, %	14
Silt, %	10
Clay, %	12

Client :	Bartra Property Capital Group
Project :	Mountgorry, Swords

Lab. No :	23/303
Sample No :	JOT20

Hole ID :	BH 02
Depth, m :	4.00

Material description :	slightly sandy gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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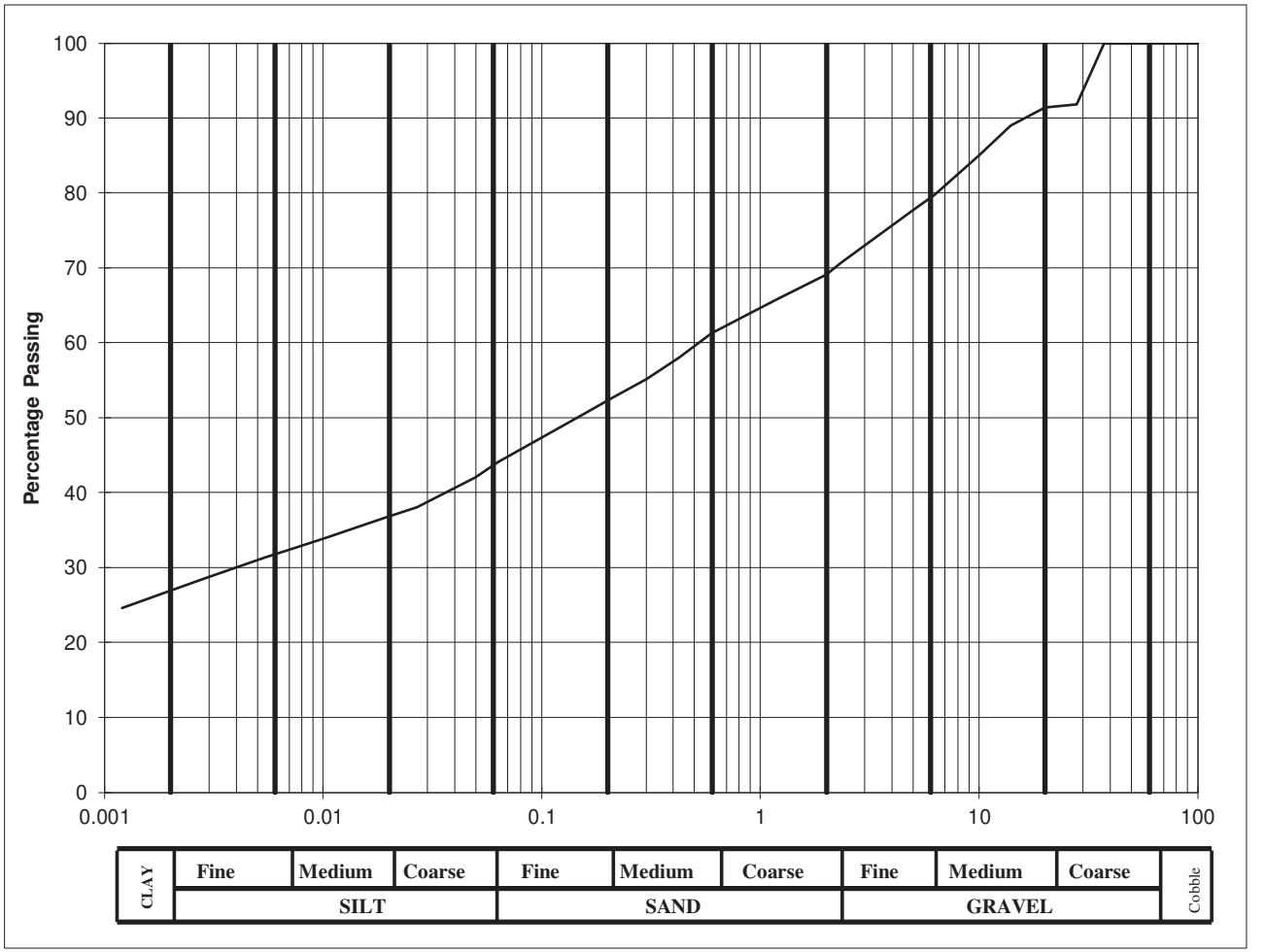
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	44
90	100	**0.0200**	37
75	100	**0.0060**	32
63	100	**0.0020**	27
50	100		
37.5	100		
28	91.8		
20	91.4		
14	89		
10	85		
6.3	79.8		
5.0	77.7		
2.36	70.7		
2.00	69.1		
1.18	65.7		
0.600	61.3		
0.425	58		
0.300	55.1		
0.212	52.7		
0.150	50.2		
0.063	44		



Cobbles, %	0
Gravel, %	31
Sand, %	25
Silt, %	17
Clay, %	27

Client :	Bartra Property Capital Group
Project :	Mountgorry, Swords

Lab. No :	23/304
Sample No :	JOT02

Hole ID :	BH 03
Depth, m :	2.00

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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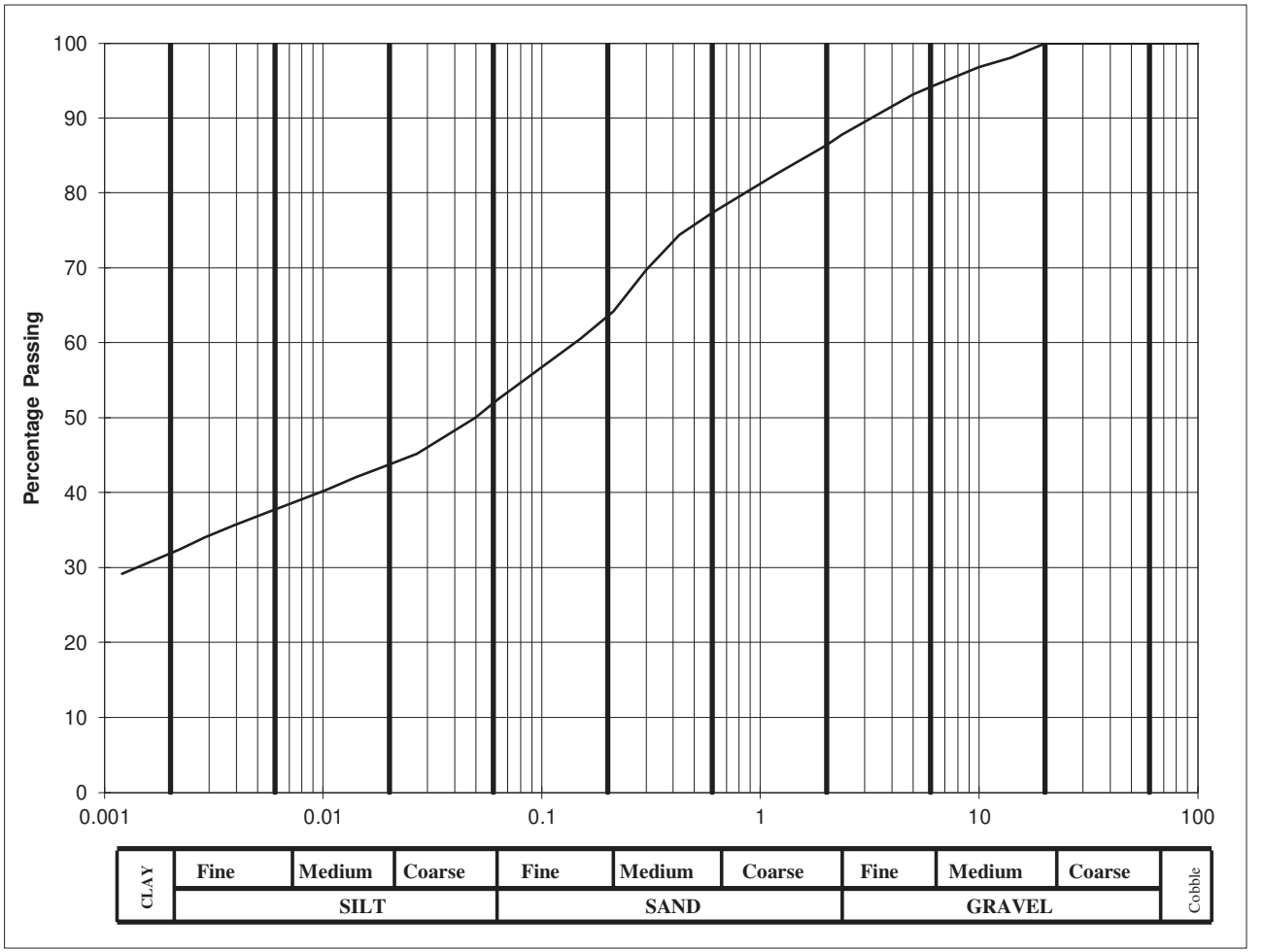
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	53
90	100	**0.0200**	44
75	100	**0.0060**	38
63	100	**0.0020**	32
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	96.8		
6.3	94.4		
5.0	93.1		
2.36	87.7		
2.00	86.3		
1.18	82.5		
0.600	77.3		
0.425	74.4		
0.300	69.7		
0.212	64.2		
0.150	60.5		
0.063	53		

Cobbles, %	0
Gravel, %	14
Sand, %	33
Silt, %	21
Clay, %	32



Client :	Bartra Property Capital Group
Project :	Mountgorry, Swords

Lab. No :	23/305
Sample No :	PM03

Hole ID :	TP 01
Depth, m :	1.00

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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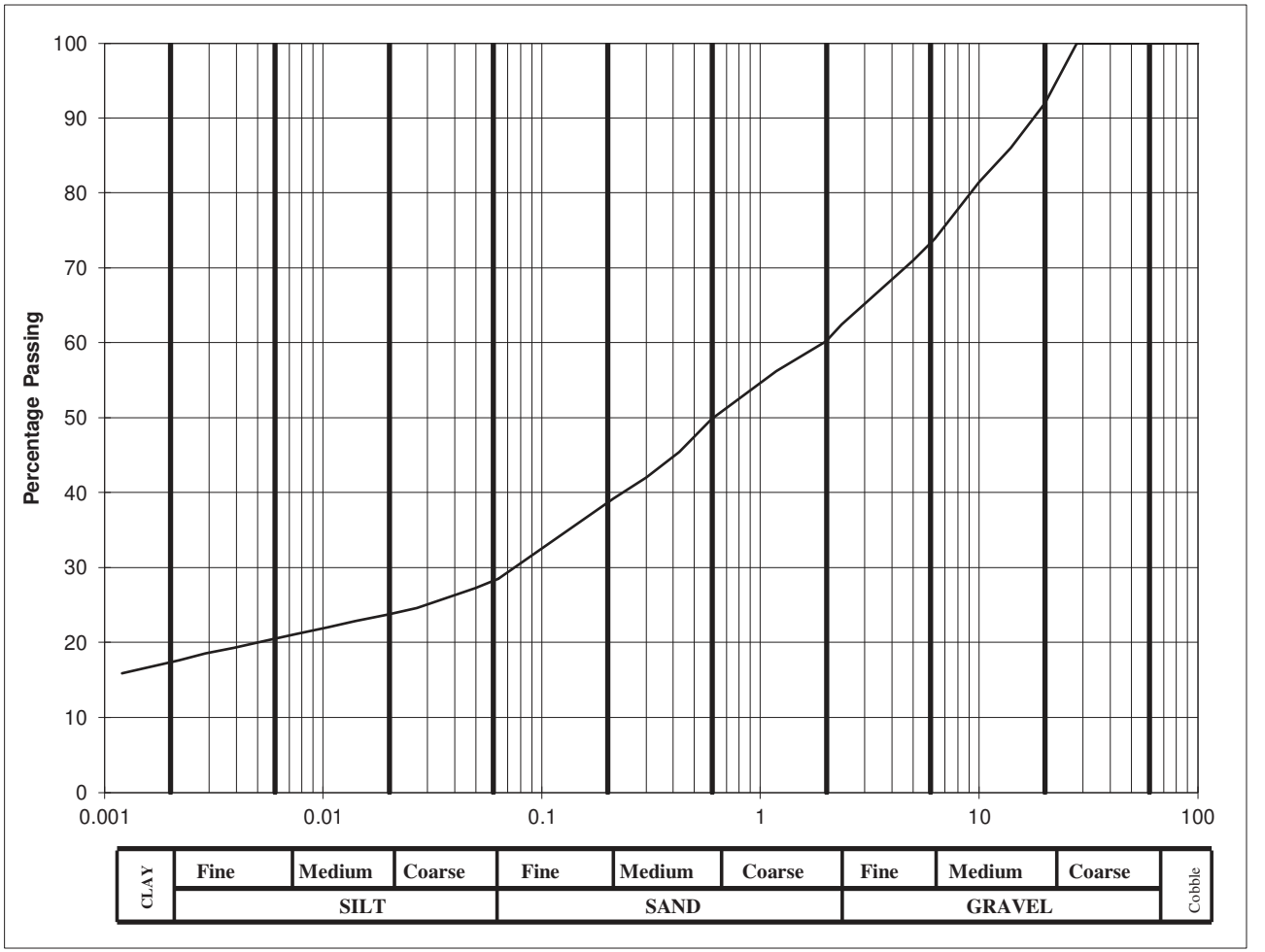
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	29
90	100	**0.0200**	23
75	100	**0.0060**	21
63	100	**0.0020**	17
50	100		
37.5	100		
28	100		
20	92		
14	86		
10	81.4		
6.3	73.9		
5.0	71		
2.36	62.4		
2.00	60.2		
1.18	56.2		
0.600	49.8		
0.425	45.4		
0.300	42		
0.212	39.2		
0.150	36.1		
0.063	29		



Cobbles, %	0
Gravel, %	40
Sand, %	31
Silt, %	12
Clay, %	17

Client :	Bartra Property Capital Group
Project :	Mountgorry, Swords

Lab. No :	23/306
Sample No :	PM09

Hole ID :	TP 02
Depth, m :	1.00

Material description :	slightly sandy gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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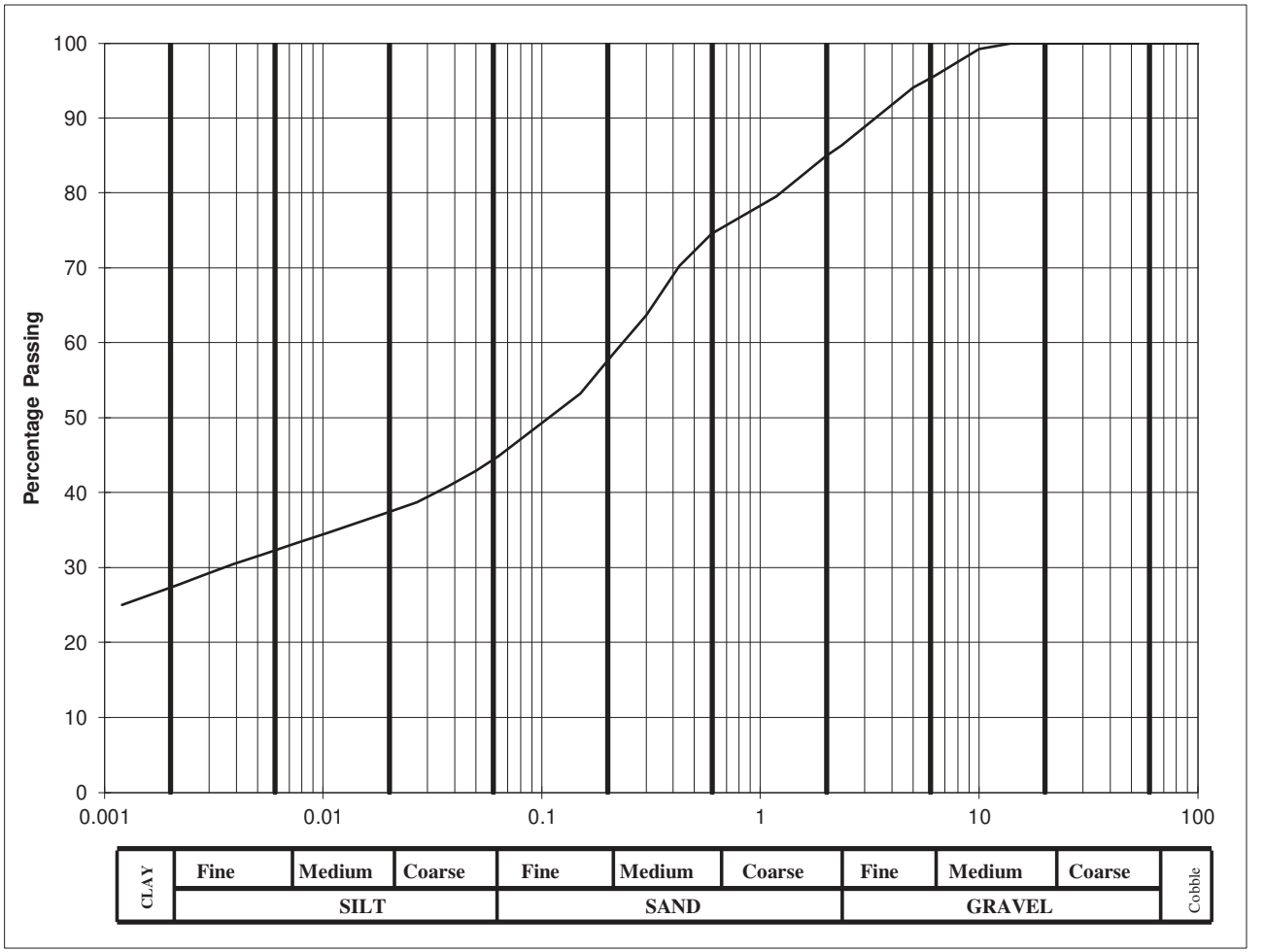
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	45
90	100	**0.0200**	37
75	100	**0.0060**	33
63	100	**0.0020**	27
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99.2		
6.3	95.6		
5.0	94		
2.36	86.3		
2.00	84.9		
1.18	79.5		
0.600	74.5		
0.425	70.2		
0.300	63.7		
0.212	58.5		
0.150	53.2		
0.063	45		

Cobbles, %	0
Gravel, %	15
Sand, %	40
Silt, %	18
Clay, %	27



Client :	Bartra Property Capital Group	Lab. No :	23/307	Hole ID :	TP 03
Project :	Mountgorry, Swords	Sample No :	PM07	Depth, m :	2.60

Material description :	sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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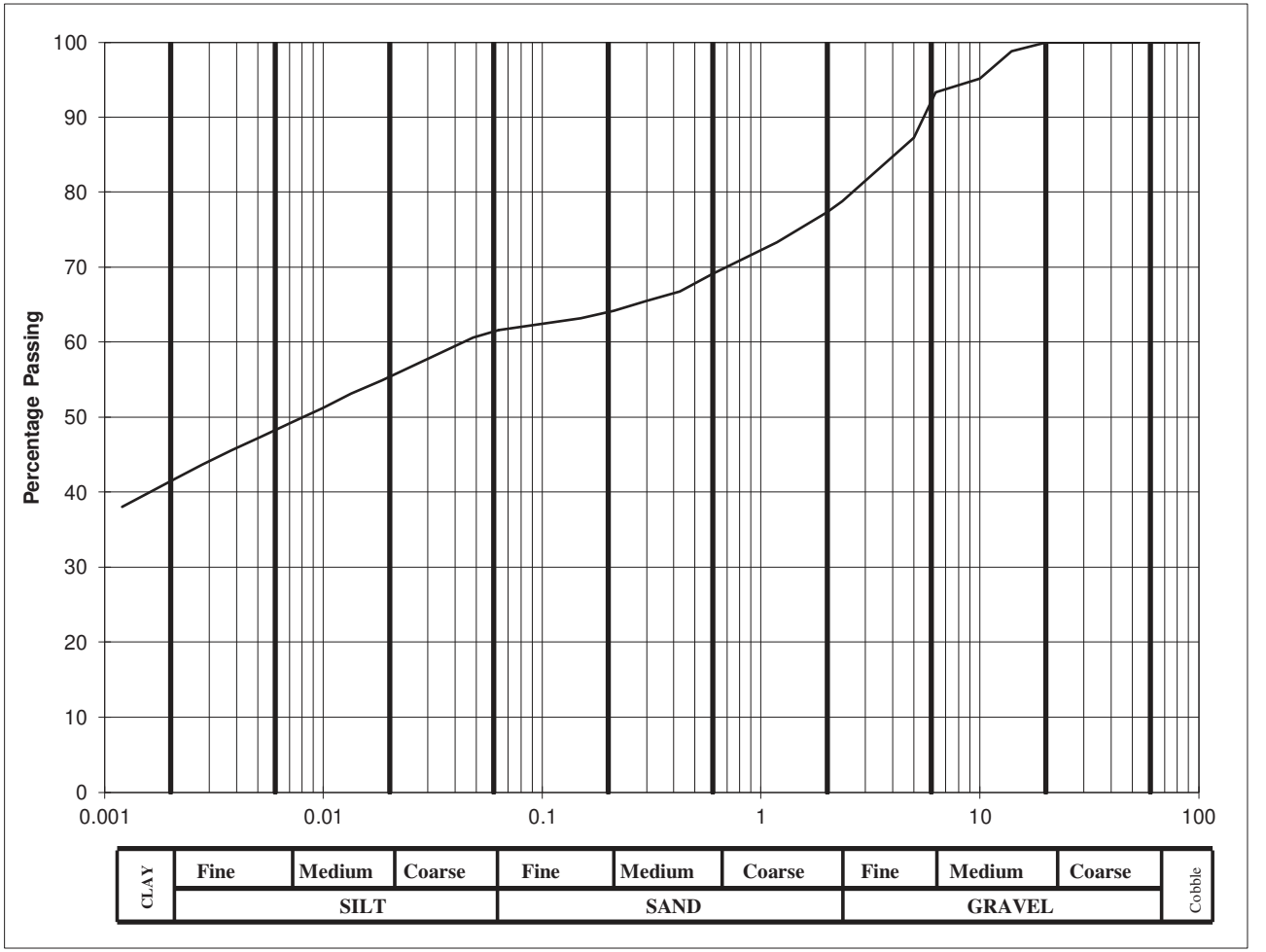
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	62
90	100	**0.0200**	55
75	100	**0.0060**	48
63	100	**0.0020**	42
50	100		
37.5	100		
28	100		
20	100		
14	98.8		
10	95.1		
6.3	93.3		
5.0	87.2		
2.36	78.8		
2.00	77.3		
1.18	73.3		
0.600	69.1		
0.425	66.7		
0.300	65.5		
0.212	64.2		
0.150	63.2		
0.063	62		



Cobbles, %	0
Gravel, %	23
Sand, %	15
Silt, %	20
Clay, %	42

Client :	Bartra Property Capital Group
Project :	Mountgorry, Swords

Lab. No :	23/308
Sample No :	PM16

Hole ID :	TP 05
Depth, m :	2.50

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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_____Paddy McGonagle
Site Investigations Ltd

Appendix 8

Environmental Laboratory Test Results

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528777
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Site Investigations Ltd
The Grange
Carhugar
12th Lock Road
Lucan
Co. Dublin

Attention: Stephen Letch

CERTIFICATE OF ANALYSIS

Date of report Generation:	12 March 2023
Customer:	Site Investigations Ltd
Sample Delivery Group (SDG):	230306-45
Your Reference:	6089
Location:	Mountgorry, Swords
Report No:	681809
Order Number:	13/A/23

We received 4 samples on Monday March 06, 2023 and 4 of these samples were scheduled for analysis which was completed on Sunday March 12, 2023. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.

Approved By:

Sonia McWhan
Operations Manager

ALS Laboratories (UK) Limited. Registered Office: Torrington Avenue, Coventry CV4 9GU. Registered in England and Wales No. 02391955.

CERTIFICATE OF ANALYSIS

SDG: 230306-45 **Report Number:** 681809 **Superseded Report:**
Client Ref.: 6089 **Location:** Mountgorry, Swords

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
27642961	TP1		0.50 - 0.50	01/03/2023
27642962	TP2		0.50 - 0.50	01/03/2023
27642963	TP3		0.50 - 0.50	01/03/2023
27642964	TP5		0.50 - 0.50	01/03/2023

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

CERTIFICATE OF ANALYSIS

SDG: 230306-45 **Report Number:** 681809 **Superseded Report:**
Client Ref.: 6089 **Location:** Mountgorry, Swords

Results Legend

X **Test**

N **No Determination Possible**

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

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container	Sample Type
			27642961	TP1		0.50 - 0.50	250g Amber Jar (ALE210)	S
			27642962	TP2		0.50 - 0.50	250g Amber Jar (ALE210)	S
			27642963	TP3		0.50 - 0.50	250g Amber Jar (ALE210)	S
			27642964	TP5		0.50 - 0.50	250g Amber Jar (ALE210)	S
Ammoniacal N as NH4 in 2:1 extract	All	NDPs: 0 Tests: 4	X	X	X	X		
Anions by Kone (soil)	All	NDPs: 0 Tests: 4	X	X	X	X		
Magnesium (BRE)	All	NDPs: 0 Tests: 4	X	X	X	X		
NO3, NO2 and TON by KONE (s)	All	NDPs: 0 Tests: 4	X	X	X	X		
pH	All	NDPs: 0 Tests: 4	X	X	X	X		
Sample description	All	NDPs: 0 Tests: 4	X	X	X	X		
Total Sulphate	All	NDPs: 0 Tests: 4	X	X	X	X		
Total Sulphur	All	NDPs: 0 Tests: 4	X	X	X	X		

CERTIFICATE OF ANALYSIS

SDG: 230306-45 **Report Number:** 681809 **Superseded Report:**
Client Ref.: 6089 **Location:** Mountgorry, Swords

Sample Descriptions

Grain Sizes

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

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
27642961	TP1	0.50 - 0.50	Dark Brown	Silty Clay Loam	Stones	Vegetation
27642962	TP2	0.50 - 0.50	Dark Brown	Sandy Silt Loam	Stones	Vegetation
27642963	TP3	0.50 - 0.50	Dark Brown	Sandy Loam	Stones	Vegetation
27642964	TP5	0.50 - 0.50	Dark Brown	Sandy Clay Loam	Stones	Vegetation

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

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

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

Validated

CERTIFICATE OF ANALYSIS

SDG: 230306-45 **Report Number:** 681809 **Superseded Report:**
Client Ref.: 6089 **Location:** Mountgorry, Swords

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

Component	LOD/Units	Method	Customer Sample Ref.	TP1	TP2	TP3	TP5		
			Depth (m)	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50		
			Sample Type	Unspecified Solid (UNS)	Unspecified Solid (UNS)	Unspecified Solid (UNS)	Unspecified Solid (UNS)		
			Date Sampled	01/03/2023	01/03/2023	01/03/2023	01/03/2023		
			Sample Time	-	-	-	-		
			Date Received	06/03/2023	06/03/2023	06/03/2023	06/03/2023		
			SDG Ref	230306-45	230306-45	230306-45	230306-45		
			Lab Sample No.(s)	27642961	27642962	27642963	27642964		
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		12	15	11	14		
Sulphur, Total	<0.02 %	TM132		<0.02	0.0275	0.111	0.0357		
pH	1 pH Units	TM133		8.44	8.41	8.73	8.16		
Sulphate, acid soluble (total)	<0.0048 %	TM221		0.0179	0.019	0.0455	0.0425		
Soluble Sulphate 2:1 extract as SO4 BRE	<0.004 g/l	TM243		0.024	0.017	0.0362	0.0086		
Chloride 2:1 water/soil extract BRE	<0.0025 g/l	TM243		0.0035	0.0046	0.0047	0.0045		
Nitrate as NO3, 2:1 water soluble (BRE)	<0.0003 g/l	TM243		0.00354	0.00151	0.00637	0.00928		
Ammoniacal N as NH4 in 2:1 extract BRE	<0.0003 g/l	TM248		0.00161	0.0017	0.00195	0.00193		
Magnesium (BRE)	<0.008 g/l	TM282		<0.008	<0.008	<0.008	<0.008		

Table of Results - Appendix

Method No	Description
PM024	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM132	ELTRA CS800 Operators Guide
TM133	Determination of pH in Soil and Water using the GLpH pH Meter
TM221	Determination of Acid Extractable Sulphate in Soils by ICP OES
TM243	Mixed Anions In Soils By Kone
TM248	Determination of Ammonium BRE (2:1 Extract) on solids
TM282	Extraction of Magnesium by BRE Method

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).

CERTIFICATE OF ANALYSIS

SDG: 230306-45 **Report Number:** 681809 **Superseded Report:**
Client Ref.: 6089 **Location:** Mountgorry, Swords

Test Completion Dates

Lab Sample No(s)	27642961	27642962	27642963	27642964
Customer Sample Ref.	TP1	TP2	TP3	TP5
AGS Ref.				
Depth	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50
Type	Unspecified So	Unspecified So	Unspecified So	Unspecified So
Ammoniacal N as NH4 in 2:1 extract	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023
Anions by Kone (soil)	09-Mar-2023	09-Mar-2023	09-Mar-2023	09-Mar-2023
Magnesium (BRE)	09-Mar-2023	09-Mar-2023	09-Mar-2023	09-Mar-2023
NO3, NO2 and TON by KONE (s)	09-Mar-2023	09-Mar-2023	09-Mar-2023	09-Mar-2023
pH	12-Mar-2023	12-Mar-2023	12-Mar-2023	12-Mar-2023
Sample description	07-Mar-2023	07-Mar-2023	07-Mar-2023	07-Mar-2023
Total Sulphate	10-Mar-2023	10-Mar-2023	10-Mar-2023	10-Mar-2023
Total Sulphur	09-Mar-2023	09-Mar-2023	09-Mar-2023	09-Mar-2023

SDG:	230306-45	**Report Number:**	681809	**Superseded Report:**	
Client Ref:	6089	**Location:**	Mountgorry, Swords		

Appendix

General

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

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

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

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

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

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

7. Results relate only to the items tested.

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

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

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

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

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury.

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

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

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

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

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

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

19. **Sample Deviations**

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

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

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials andd soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

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

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

Visual Estimation Of Fibre Content

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

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

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

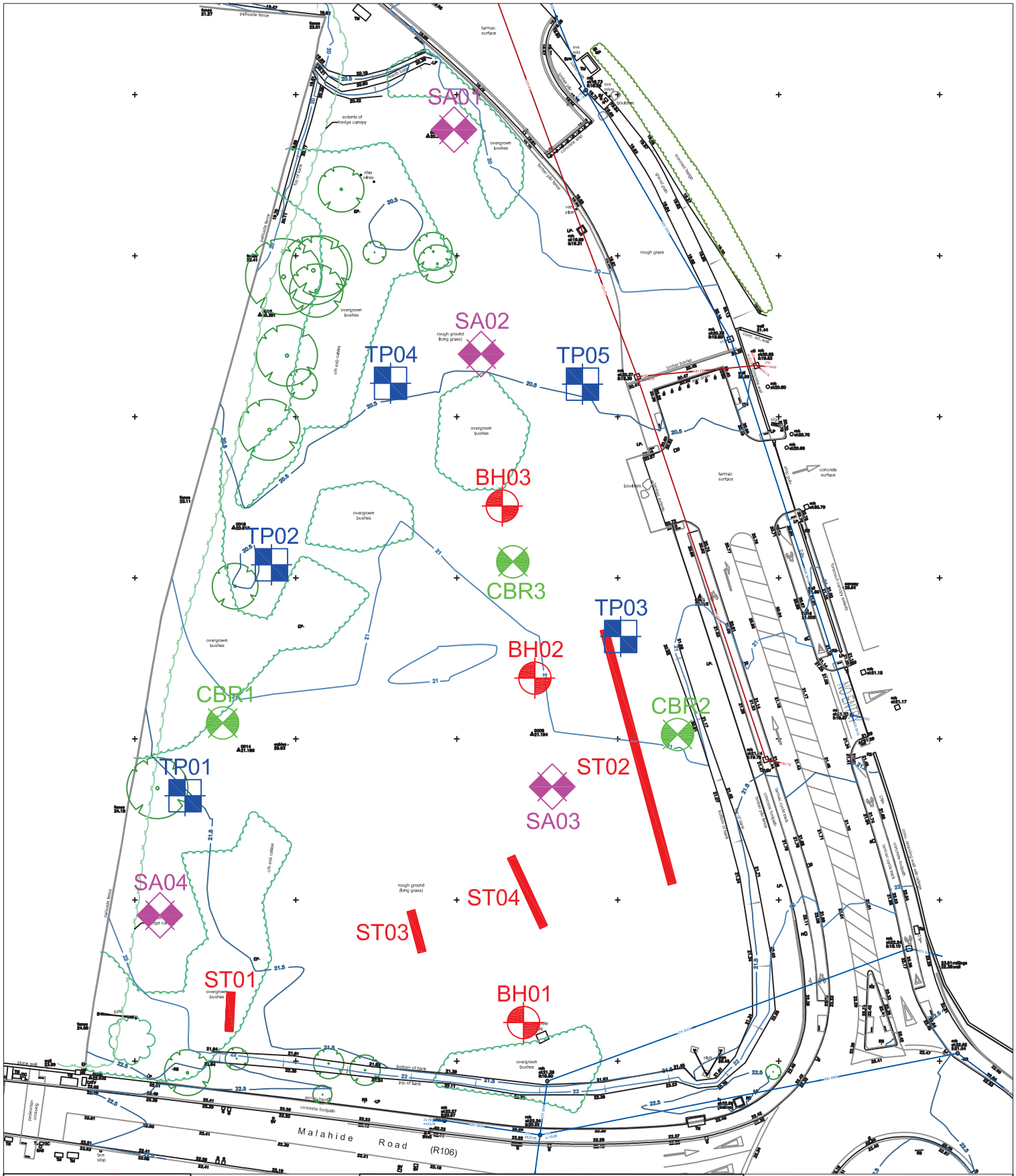
The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix 9

Survey Data

Survey Data

Location	Irish Transverse Mercator		Elevation	Irish National Grid	
	Easting	Northing		Easting	Northing
Cable Percussive Boreholes					
BH01	719248.308	746344.776	21.17	319323.295	246321.167
BH02	719249.696	746387.557	21.02	319324.683	246363.958
BH03	719245.665	746408.914	20.82	319320.651	246385.319
Trial Pits					
TP01	719206.243	746372.954	21.57	319281.221	246349.351
TP02	719216.986	746401.627	20.73	319291.966	246378.031
TP03	719260.362	746392.711	20.94	319335.351	246369.113
TP04	719231.775	746424.166	20.20	319306.758	246400.574
TP05	719255.623	746424.053	20.40	319330.611	246400.462
Soakaway Tests					
SA01	719239.655	746455.660	20.25	319314.639	246432.075
SA02	719243.032	746427.795	20.39	319318.017	246404.204
SA03	719251.854	746374.069	21.15	319326.842	246350.467
SA04	719203.123	746358.110	21.78	319278.100	246334.504
California Bearing Ratio Tests					
CBR1	719210.909	746381.978	21.12	319285.888	246358.377
CBR2	719267.431	746380.549	20.93	319342.422	246356.948
CBR3	719246.972	746402.001	20.84	319321.958	246378.405
Slit Trenches					
ST01 Start	719211.962	746348.560	21.53	319286.941	246324.952
ESB Duct1	719211.814	746345.468	20.33	319286.793	246321.859
ESB Duct2	719211.840	746345.237	20.33	319286.819	246321.628
ST01 End	719211.719	746343.692	21.49	319286.698	246320.083
ST02 Start	719258.332	746393.542	20.81	319333.321	246369.944
ESB Duct1	719265.241	746365.047	19.09	319340.232	246341.443
ST02 End	719266.758	746361.995	21.15	319341.749	246338.390
ST03 Start	719234.297	746358.677	21.38	319309.281	246335.071
ESB Duct1	719235.827	746355.891	20.70	319310.811	246332.285
ST03 End	719235.696	746353.537	21.39	319310.680	246329.930
ST04 Start	719246.742	746365.369	21.20	319321.729	246341.765
ESB Duct1	719248.754	746360.391	19.24	319323.741	246336.786
ST04 End	719250.799	746356.642	21.26	319325.787	246333.036



Site Investigations Ltd
The Grange
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Lucan
Co. Dublin

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Client :	Bartra Property Capital Group		
Engineer :	OCSC		
Project :	Mountgorry		
Date :	23-05-2023	**Scale :**	Not to Scale
Description :	Site Investigation	**Rev :**	1
Drawing No:	6089:01/01	**Drawn by :**	SL

Legend:

- Cable Percussion Borehole
- Trial Pit
- Soakaway Test
- California Bearing Ratio Test
- Slit Trench

APPENDIX H SITE SPECIFIC UTILITY & TOPOGRAPHICAL SURVEY

ITM grid north

719200mE 719220mE 719240mE 719260mE 719280mE 719300mE 719320mE

746480mN 746460mN 746440mN 746420mN 746400mN 746380mN 746360mN 746340mN 746320mN 746300mN 746280mN

Notes:

1. Survey coordinates are to ITM projection and levels relate to Ordnance Datum Malin Head. These have been established via multiple RTK GPS observations.

2. Manhole pipe sizes, type and connections where shown are estimated from surface level. It may not be possible to open some manholes located on public roads for safety reasons.

3. 3D information on contours and surveyed points (& lines where applicable) is contained on CAD layers prefixed by [BPM-3D].

Malahide Road (R106)

NO ENTRY

0 10 20 40 Metres

REV	DESCRIPTION	DATE	PLOT	BY
B	expanded to full topo site survey	01.12.22	2505-1B	DM
A	initial issue (boundary verification)	21.11.22	2505-1A	DM

BPM SURVEYS LTD. - SYMBOLS KEY 01

AV	AIR VALVE	IC CL:0.00	INSPECTION COVER
AJ	ARMSTRONG JUNCTION	LP	LAMP POST
B	BOLLARD	MH CL:0.00	MANHOLE
BB	BELISHA BEACON	PM	PARKING METER
BIN	BIN	PB	POST BOX
BUS	BUS STOP	RS	ROAD SIGN
CATV	CATV IC	RWP	RAIN WATER PIPE
DP	DOWN PIPE	SP	SOIL PIPE
ER	EARTH ROD	SV	SLUICE VALVE
ESB	ELECTRICITY BOX	SC	STOPCOCK
EP	ELECTRICITY POLE	0001 0.000	SURVEY STATION
H	FIRE HYDRANT	TM	TELECOM MANHOLE
FS	FLAG STAFF	TP	TELEGRAPH POLE
GAS	GAS VALVE	TIC	TRAFFIC IC
GATE	GATE	TL	TRAFFIC LIGHT
G	GULLY	WM	WATER METER

The Irish Institution of Surveyors
Affiliated Company
Membership No.136

BPM SURVEYS LTD
CASTLE GATES,
MAYNOOTH ROAD,
CELBRIDGE,
Co. KILDARE.
Phone: 01 627 9000
Mobile: 087 638 4340
Email: info@bpms.ie

Project:	SITE AT MOUNTGORRY SWORDS - Co. DUBLIN
Title:	TOPOGRAPHICAL SITE SURVEY (full topo survey - revision B issue)
Client:	BARTRA CAPITAL PROPERTY
Job ID:	2505
Surveyor:	BN / DM / RN
CAD:	D. MEAGHER
Date:	01.12.22
Scale:	1:200 @ A0 (portrait)
AutoCAD title:	BPM2505-1.DWG
Rev:	B
Grid:	ITM PROJECTION
Level Datum:	O.D. MALIN HEAD (RTK GPS)
Plot No.:	2505-1B

APPENDIX I STATEMENT OF DESIGN ACCEPTANCE

Ciaran O'Reilly
OCSC
9 Prussia Street
Stoneybatter
Dublin
D07 KT57

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

25 September 2024

Re: Design Submission for Greenfield Site Mountgorry, Malahide Road, Swords, Dublin (the "Development")
(the "Design Submission") / Connection Reference No: CDS24000501

Dear Ciaran O'Reilly,

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, Uisce Éireann has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before you can connect to our network you must sign a connection agreement with Uisce Éireann. This can be applied for by completing the connection application form at www.water.ie/connections. Uisce Éireann'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 Uisce Éireann's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Uisce Éireann does not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Uisce Éireann representative:
Name: Antonio Garzón Mielgo
Email: antonio.garzonmielgo@water.ie

Yours sincerely,

Dermot Phelan
Connections Delivery Manager

Appendix A

Document Title & Revision

- B1054-OCSC-XX-XX-DR-C-0500-S4-P05
- B1054-OCSC-XX-XX-DR-C-0510-S4-P03
- B1054-OCSC-XX-XX-DR-C-0550-S4-P07

Additional Comments

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

Uisce Éireann cannot guarantee that its Network in any location will have the capacity to deliver a particular flow rate and associated residual pressure to meet the requirements of the relevant Fire Authority, see Section 1.17 of Water Code of Practice.

*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 Uisce Éireann will not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

GENERAL NOTES:

1. ALL NOTED LEVELS ARE TO ORDNANCE DATUM, MALIN HEAD.
2. REFER TO ARCHITECT'S LAYOUT FOR ALL SET-OUT INFORMATION.
3. REFER TO ARCHITECT / LANDSCAPE ARCHITECT'S DESIGN DRAWINGS FOR DETAILS OF PROPOSED SURFACE FINISHES AND LANDSCAPING.
4. REFER TO ARCHITECT DRAWINGS FOR DETAILS OF PRIVATE DRAINAGE.
5. ALL SURFACE WATER DRAINAGE IS TO BE INSTALLED IN ACCORDANCE WITH THE GREATER DUBLIN REGION CODE OF PRACTICE FOR DRAINAGE WORKS, THE BUILDING REGULATIONS PART H AND THE SITE DEVELOPMENT SPECIFICATION.
6. ALL CAR PARK DRAINAGE IS TO BE INSTALLED IN ACCORDANCE WITH THE GREATER DUBLIN REGION CODE OF PRACTICE FOR DRAINAGE WORKS, THE BUILDING REGULATIONS PART H AND THE SITE DEVELOPMENT SPECIFICATION.
7. ALL WASTEWATER DRAINAGE IS TO BE INSTALLED IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE (REVISION 2 - JULY 2020), THE BUILDING REGULATIONS PART H AND THE SITE DEVELOPMENT SPECIFICATION.
8. ALL DRAINAGE COVER LEVELS ARE TO BE COORDINATED WITH PROPOSED ROAD DESIGN LEVELS AND ARCHITECT/LANDSCAPE ARCHITECT'S PROPOSED FINISH LEVELS.
9. ALL BASEMENT CHAMBER COVERS TO BE DOUBLE SEALED, AND CLASSIFICATION D400 LOADING WHERE LOCATED IN VEHICULAR AREAS.
10. ALL CONNECTIONS TO NEW DRAINAGE NETWORKS ARE TO BE MADE AT AN ANGLE OF 90° OR IN THE DIRECTION OF FLOW.
11. REFER TO ARCHITECT AND M&E ENGINEERING DESIGN DRAWINGS FOR CONFIRMATION OF LOCATION AND SPECIFICATION OF FLOOR GULLIES.
12. REFER TO M&E ENGINEERING DESIGN FOR CONFIRMATION OF WASTE AND SANITARY POP-UP/OUTLET LOCATIONS.
13. THE CONTRACTOR IS TO VERIFY INVERT LEVEL AT PROPOSED CONNECTION TO EXISTING SEWERS, PRIOR TO ANY OTHER WORKS BEING CARRIED OUT, AND MAKE ANY DISCREPANCIES KNOWN TO THE ENGINEER.
14. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMATION OF PRESENCE ALL EXISTING UTILITIES, IF ANY, ALONG ROUTE OF PROPOSED DRAINAGE NETWORKS - BY INTRUSIVE INVESTIGATION OR EQUAL.
15. EXISTING PUBLIC SEWER TO BE JET CLEANED AND CCTV SURVEYED PRIOR TO, AND AFTER PROPOSED CONNECTIONS FROM NEW NETWORK.
16. ALL NEW DRAINAGE INFRASTRUCTURE TO BE JET CLEANED AND CCTV SURVEYED, WITH ANY NOTED DEFECTS REMEDIATED, ON COMPLETION OF WORKS, TO THE SATISFACTION OF THE LOCAL AUTHORITY.

SURFACE WATER NETWORK DESIGN TABLE

NAME	US NODE	USCL (m)	DS NODE	DSCL (m)	LENGTH (m)	USIL (m)	DSIL (m)	SLOPE (1:X)	DIA. (mm)
SW/1.000	SW/1	22.000	SW/2	21.950	58.271	21.500	20.917	100.0	150
SW/1.001	SW/2	21.950	SADDLE	21.950	11.600	20.917	20.801	100.0	150
SW/2.000	SW/3	21.950	SW/4	21.950	52.646	20.483	20.173	170.0	225
SW/2.001	SW/4	21.950	SADDLE	21.950	3.830	20.173	20.150	170.0	225
SW/1.002	SADDLE	21.950	SW/5	21.450	21.650	20.150	19.789	60.0	225
SW/1.003	SW/5	21.450	SW/7	21.450	30.578	19.789	19.279	60.0	225
SW/3.000	SW/6	20.950	SW/7	21.450	19.955	19.396	19.279	170.0	225
SW/1.004	SW/7	21.450	SW/8	21.450	19.429	19.204	19.125	245.0	300
SW/1.005	SW/8	21.450	SW/12	21.150	16.710	19.125	19.057	245.0	300
SW/4.000	SW/9	21.950	SW/10	21.000	34.601	20.408	19.975	80.0	225
SW/4.001a	SW/10	21.000	SADDLE1	21.000	4.399	19.975	19.949	170.0	225
SW/5.000	PERF. PIPE1	21.450	SW/AJ1	21.000	35.541	20.411	20.056	100.0	150
SW5.001	SW/AJ1	21.000	SADDLE1	21.000	3.214	20.056	20.024	100.0	150
SW/4.001b	SADDLE1	21.000	SW/11	21.000	5.047	19.949	19.919	170.0	225
SW/4.002a	SW/11	21.000	SADDLE2	21.150	3.239	19.919	19.900	170.0	225
SW/6.000	PERF. PIPE2	21.150	SW/AJ2	21.000	28.779	20.284	19.996	100.0	150
SW6.001	SW/AJ2	21.000	SADDLE2	21.150	2.117	19.996	19.975	100.0	150
SW/4.002b	SADDLE2	21.150	SW/12	21.150	34.623	19.825	19.621	170.0	300
SW/1.006	SW/12	21.150	SW/13	21.150	5.251	18.982	18.966	324.0	375
SW/1.007	SW/13	21.150	SW/14	20.700	12.482	18.966	18.927	324.0	375
SW/1.008	SW/14	20.700	SW/16	20.700	14.192	18.927	18.839	160.6	375
SW/7.000	PERF. PIPE3	21.450	PERF. PIPE4	21.150	24.922	20.300	20.051	100.0	150
SW/7.001	PERF. PIPE4	21.150	PERF. PIPE5	21.150	3.050	20.051	20.020	100.0	150
SW/7.002	PERF. PIPE5	21.150	SW/AJ3	21.150	7.515	20.020	19.895	60.0	150
SW/8.000	PERF. PIPE6	21.000	PERF. PIPE7	21.000	17.734	20.254	19.958	60.0	150
SW/8.001	PERF. PIPE7	21.000	SW/AJ3	21.150	3.695	19.958	19.895	58.7	150
SW/7.003	SW/AJ3	21.150	SW/15	20.700	8.847	19.820	19.491	26.9	225
SW/7.004	SW/15	20.700	SW/16	20.700	14.537	19.001	18.915	170.0	225
SW/1.009	SW/16	20.700	SW/17	21.100	11.674	18.757	18.688	170.0	375
SW/1.010	SW/17	21.100	SW/18	20.900	10.218	18.688	18.628	170.0	225
SW/1.011	SW/18	20.900	SW/OUTFALL	20.330	11.907	18.628	18.558	170.0	225

WASTEWATER NETWORK DESIGN TABLE

NAME	US NODE	USCL (m)	DS NODE	DSCL (m)	LENGTH (m)	USIL (m)	DSIL (m)	SLOPE (1:X)	DIA. (mm)
WW/1.000	WW/1	21.950	WW/2	21.950	16.243	20.825	20.554	60.0	225
WW/1.001	WW/2	21.950	WW/3	21.950	44.822	20.554	20.255	150.0	225
WW/1.002	WW/3	21.950	WW/4	21.450	19.596	20.255	20.124	150.0	225
WW/1.003	WW/4	21.450	WW/5	21.450	52.855	20.124	19.772	150.0	225
WW/1.004	WW/5	21.450	WW/6	21.150	13.650	19.772	19.704	200.0	225
WW/1.005	WW/6	21.150	WW/7	20.900	35.826	19.704	19.525	200.0	225
WW/1.006	WW/7	20.900	WW/9	20.900	4.033	19.525	19.505	200.0	225
WW/2.000	WW/8	21.950	WW/9	20.900	59.322	20.494	19.505	60.0	225
WW/1.007	WW/9	20.900	WW/OUTFALL	20.370	7.035	19.505	19.470	200.0	225

ATTENUATION SYSTEM

PERFORATED PIPE RUNNING THROUGH CLAUSE 505 STONE WRAPPED IN GEO-TEXTILE MEMBRANE.
[350m² x 0.680m, IL: + 18.757m]

LINED ATTENUATION BASIN TO BE CONSTRUCTED 300mm OVER STONE.
[CL: +20.700m, IL: +19.736m. BANKS @ 1:5]
[AREA @ BASE = 140m², AREA @ TOP = 425m²]

TOP WATER LEVEL WITHIN SYSTEM DURING 100 YEAR +20% CRITICAL STORM DURATION = +20.515m

ORIFACE FITTED TO OUTLET.
DESIGN DEPTH: +1.500m
DESIGN FLOW: 3.0 l/s

PROPOSED CLASS 1 BYPASS SEPARATOR. KLARGESTER FUEL INTERCEPTOR NSBE015 OR SIMILAR APPROVED TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.

600mm DEEP SILT TRAP MANHOLE.

MANHOLE COVERS TO BE GRATED.

PROPOSED FLOW CONTROL CHAMBER WITH PENSTOCK AT INLET. HYDROBRAKE OR SIMILAR APPROVED INSTALLED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.

DESIGN HEAD: +1.800m
DESIGN FLOW: 2.6 l/s

WASTEWATER NETWORK DISCHARGE LOCATION.
EXISTING COVER LEVEL: +20.370m
EXISTING INVERT LEVEL: +19.390m

SURFACE WATER NETWORK DISCHARGE LOCATION.
EXISTING COVER LEVEL: +20.330m
EXISTING INVERT LEVEL: +18.500m

BLUE ROOF LIMITING FLOW TO 1.5 l/s.

BLUE ROOF LIMITING FLOW TO 1.5 l/s.

BLUE ROOF LIMITING FLOW TO 1.5 l/s.

ORIFACE FITTED TO OUTLET.
DESIGN DEPTH: +1.500m
DESIGN FLOW: 3.0 l/s

EXISTING CUL DE SAC

EXISTING ROAD

EXISTING ROAD

AHIDE

LEGEND:

- uPVC TWINWALL SURFACE WATER DRAINAGE OR SIMILAR APPROVED
- uPVC TWINWALL PERFORATED SURFACE WATER DRAINAGE OR SIMILAR APPROVED
- 100mmØ PRIVATE CONNECTION uPVC PIPE
- uPVC SN8 WASTEWATER DRAINAGE OR SIMILAR APPROVED
- 1200mmØ WASTEWATER DRAINAGE PRECAST CONCRETE MANHOLE
- SURFACE WATER DRAINAGE PRECAST CONCRETE MANHOLE
- TRAPPED ROAD GULLY
- 450mm x 450mm SURFACE WATER INSPECTION CHAMBER
- KLARGESTER CLASS I BYPASS NSB FUEL SEPARATOR
- SURFACE WATER ACO, WITH D400 GRATED CHANNEL [IN ACCORDANCE WITH MANUFACTURE'S GUIDELINES & RECOMMENDATIONS]
- BLUE ROOF EXTENT
- FILTER DRAIN
- INTEGRATED CONSTRUCTED TREE PIT / TRENCH
- PERVIOUS PAVING
- EXISTING SURFACE WATER DRAINAGE
- EXISTING SURFACE WATER DRAINAGE MANHOLE
- EXISTING WASTEWATER DRAINAGE
- EXISTING WASTEWATER DRAINAGE MANHOLE

- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DESIGN TEAM DRAWINGS AND SPECIFICATIONS.
- FOR SETTING OUT REFER TO ARCHITECT'S DRAWINGS. DO NOT SCALE THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
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P02	29.02.24	SUITABLE FOR INFORMATION	MF	PR
P03	19.03.24	DRAFT PLANNING - ARCH LAYOUT UPDATED	RM	PR
P04	13.08.24	SUITABLE FOR PLANNING	COR	COM
P05	23.09.24	FOR PLANNING - ARCH LAYOUT UPDATED	RM	COM

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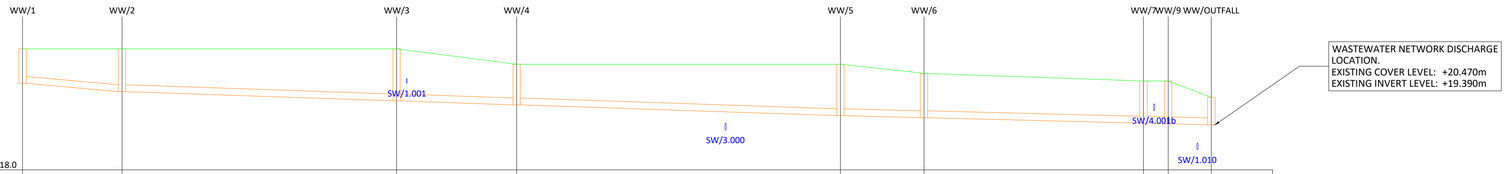
Client: BARTRA PROPCO 23 LIMITED
Project: MOUNTGORRY LRD
SWORDS
Title: PROPOSED DRAINAGE LAYOUT

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
B1054	OCSC	XX	XX	DR	C	0500	S4	P05

Date: JAN'24 Scale @ A1: 1:250 Drn by: COR Chkd by: PR Aprvd by: PR

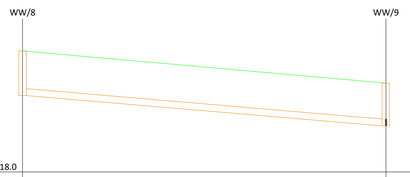


Vert exaggeration = 5.0

Datum = 18.0

Link Name		WW/1.000	WW/1.001	WW/1.002	WW/1.003	WW/1.004	WW/1.005	WW/1.006	WW/1.007	
Section Type		225mm	225mm	225mm	225mm	225mm	225mm	225mm	225mm	
Slope (1:X)		1:60.0	1:150.0	1:150.0	1:150.0	1:200.0	1:200.0	1:200.0	1:200.0	
Cover Level (m)		21.950	21.950	21.950	21.450	21.450	21.150	20.900	20.900	20.370
Invert Level (m)		20.825	20.554 20.554	20.255 20.255	20.124 20.124	19.772 19.772	19.704 19.704	19.525 19.525	19.505 19.505	19.470
Length (m)		16.243	44.822	19.596	52.855	13.650	35.826	4.033	7.035	

WASTEWATER NETWORK WW/1.000 - WW/1.007



Vert exaggeration = 5.0

Datum = 18.0

Link Name		WW/2.000	
Section Type		225mm	
Slope (1:X)		1:60.0	
Cover Level (m)	21.950		20.900
Invert Level (m)	20.494		19.505
Length (m)		59.322	

WASTEWATER NETWORK WW/2.000

NOTES

1. ALL WASTEWATER INFRASTRUCTURE TO BE INSTALLED IN ACCORDANCE WITH IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE AND STANDARD DETAILS
2. ALL SURFACE WATER INFRASTRUCTURE TO BE INSTALLED IN ACCORDANCE WITH THE GDSDS AND THE GREATER DUBLIN REGION CODE OF FOR DRAINAGE WORKS.

REFERENCE NOTE

REFER TO DWG. NO. B1054-OCSC-XX-XX-DR-C-0500 FOR DRAINAGE LAYOUT

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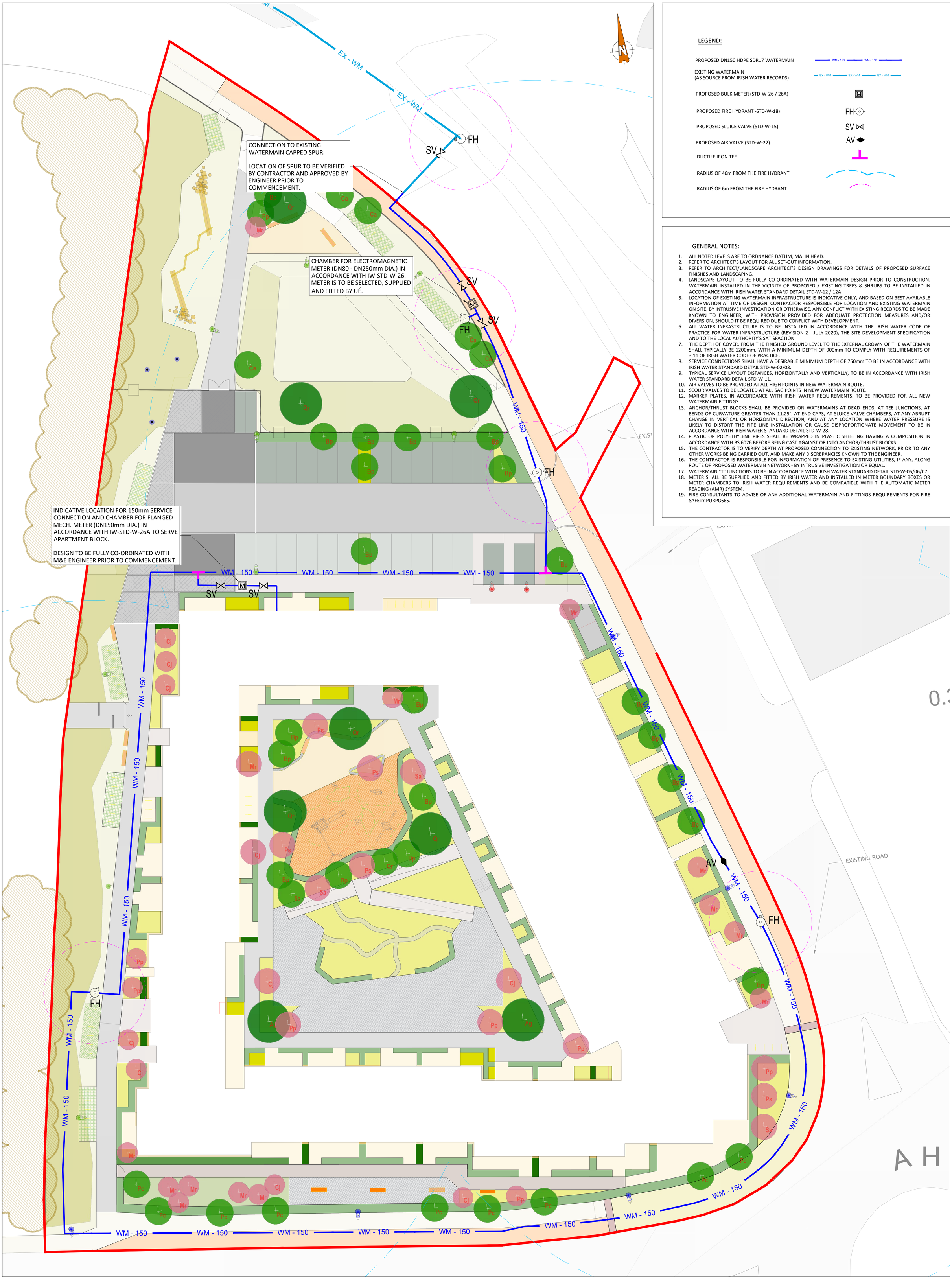
Client: BARTRA PROPCO 23 LIMITED
Project: MOUNTGORRY LRD
SWORDS
Title: PROPOSED WASTEWATER LONG SECTIONS

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
B1054	OCSC	XX	XX	DR	C	0510	S4	P03

Date: FEB' 24 Scale @ A1: 1:500 Drn by: MF Chkd by: COR Aprvd by: PR



LEGEND:

PROPOSED DN150 HDPE SDR17 WATERMAIN	WM - 150
EXISTING WATERMAIN (AS SOURCE FROM IRISH WATER RECORDS)	EX - WM
PROPOSED BULK METER (STD-W-26 / 26A)	M
PROPOSED FIRE HYDRANT -STD-W-18)	FH
PROPOSED SLUICE VALVE (STD-W-15)	SV
PROPOSED AIR VALVE (STD-W-22)	AV
DUCTILE IRON TEE	
RADIUS OF 46m FROM THE FIRE HYDRANT	
RADIUS OF 6m FROM THE FIRE HYDRANT	

GENERAL NOTES:

1. ALL NOTED LEVELS ARE TO ORDNANCE DATUM, MALIN HEAD.
2. REFER TO ARCHITECT'S LAYOUT FOR ALL SET-OUT INFORMATION.
3. REFER TO ARCHITECT/LANDSCAPE ARCHITECT'S DESIGN DRAWINGS FOR DETAILS OF PROPOSED SURFACE FINISHES AND LANDSCAPING.
4. LANDSCAPE LAYOUT TO BE FULLY CO-ORDINATED WITH WATERMAIN DESIGN PRIOR TO CONSTRUCTION. WATERMAIN INSTALLED IN THE VICINITY OF PROPOSED / EXISTING TREES & SHRUBS TO BE INSTALLED IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-W-12 / 12A.
5. LOCATION OF EXISTING WATERMAIN INFRASTRUCTURE IS INDICATIVE ONLY, AND BASED ON BEST AVAILABLE INFORMATION AT TIME OF DESIGN. CONTRACTOR RESPONSIBLE FOR LOCATION AND EXISTING WATERMAIN ON SITE, BY INTRUSIVE INVESTIGATION OR OTHERWISE. ANY CONFLICT WITH EXISTING RECORDS TO BE MADE KNOWN TO ENGINEER, WITH PROVISION PROVIDED FOR ADEQUATE PROTECTION MEASURES AND/OR DIVERSION, SHOULD IT BE REQUIRED DUE TO CONFLICT WITH DEVELOPMENT.
6. ALL WATER INFRASTRUCTURE IS TO BE INSTALLED IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE FOR WATER INFRASTRUCTURE (REVISION 2 - JULY 2020), THE SITE DEVELOPMENT SPECIFICATION AND TO THE LOCAL AUTHORITY'S SATISFACTION.
7. THE DEPTH OF COVER, FROM THE FINISHED GROUND LEVEL TO THE EXTERNAL CROWN OF THE WATERMAIN SHALL TYPICALLY BE 1200mm, WITH A MINIMUM DEPTH OF 900mm TO COMPLY WITH REQUIREMENTS OF 3.11 OF IRISH WATER CODE OF PRACTICE.
8. SERVICE CONNECTIONS SHALL HAVE A DESIRABLE MINIMUM DEPTH OF 750mm TO BE IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-W-02/03.
9. TYPICAL SERVICE LAYOUT DISTANCES, HORIZONTALLY AND VERTICALLY, TO BE IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-W-11.
10. AIR VALVES TO BE PROVIDED AT ALL HIGH POINTS IN NEW WATERMAIN ROUTE.
11. SCOUR VALVES TO BE LOCATED AT ALL SAG POINTS IN NEW WATERMAIN ROUTE.
12. MARKER PLATES, IN ACCORDANCE WITH IRISH WATER REQUIREMENTS, TO BE PROVIDED FOR ALL NEW WATERMAIN FITTINGS.
13. ANCHOR/THRUST BLOCKS SHALL BE PROVIDED ON WATERMAINS AT DEAD ENDS, AT TEE JUNCTIONS, AT BENDS OF CURVATURE GREATER THAN 11.25°, AT END CAPS, AT SLUICE VALVE CHAMBERS, AT ANY ABRUPT CHANGE IN VERTICAL OR HORIZONTAL DIRECTION, AND AT ANY LOCATION WHERE WATER PRESSURE IS LIKELY TO DISTORT THE PIPE LINE INSTALLATION OR CAUSE DISPROPORTIONATE MOVEMENT TO BE IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-W-28.
14. PLASTIC OR POLYETHYLENE PIPES SHALL BE WRAPPED IN PLASTIC SHEETING HAVING A COMPOSITION IN ACCORDANCE WITH BS 6076 BEFORE BEING CAST AGAINST OR INTO ANCHOR/THRUST BLOCKS.
15. THE CONTRACTOR IS TO VERIFY DEPTH AT PROPOSED CONNECTION TO EXISTING NETWORK, PRIOR TO ANY OTHER WORKS BEING CARRIED OUT, AND MAKE ANY DISCREPANCIES KNOWN TO THE ENGINEER.
16. THE CONTRACTOR IS RESPONSIBLE FOR INFORMATION OF PRESENCE TO EXISTING UTILITIES, IF ANY, ALONG ROUTE OF PROPOSED WATERMAIN NETWORK - BY INTRUSIVE INVESTIGATION OR EQUAL.
17. WATERMAIN "T" JUNCTIONS TO BE IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-W-05/06/07.
18. METER SHALL BE SUPPLIED AND FITTED BY IRISH WATER AND INSTALLED IN METER BOUNDARY BOXES OR METER CHAMBERS TO IRISH WATER REQUIREMENTS AND BE COMPATIBLE WITH THE AUTOMATIC METER READING (AMR) SYSTEM.
19. FIRE CONSULTANTS TO ADVISE OF ANY ADDITIONAL WATERMAIN AND FITTINGS REQUIREMENTS FOR FIRE SAFETY PURPOSES.

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P04	13.08.24	SUITABLE FOR PLANNING	COR	CO'M
P05	16.09.24	ADDITIONAL NOTES INCLUDED	COR	COR
P06	18.09.24	SERVICE CONNECTION ADDED AS PER UÉ COMMENTS	COR	COR
P07	23.09.24	FOR PLANNING - ARCH LAYOUT UPDATED	RM	COM

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Client: BARTRA PROPCO 23 LIMITED
Project: MOUNTGORRY LRD
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Title: PROPOSED WATERMAIN LAYOUT

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
B1054	OCSC	XX	XX	DR	C	0550	S4	P07

Date:JAN'24 Scale @ A1: 1:200 Drn by:COR Chkd by:PR Aprvd by:PR

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