APPENDIX 4-9

ENGINEERING SERVICES REPORT

Engineering Services Report

Strategic Employment Zone (Biotechnology & Life Sciences Campus) Development For Sky Castle Ltd

PROJECT NO. S665

26 August 2022

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

Engineering Services Report

Strategic Employment Zone (Biotechnology & Life Sciences Campus) Development

For Sky Castle Ltd

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26 August 2022

Engineering Services Report

for

Strategic Employment Zone,

at Moygaddy, Co. Meath.

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Engineering Services Report

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1. INTRODUCTION

1.1 Appointment

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by *Sky Castle Ltd* to carry out the design of the civil engineering services associated with the development of a the proposed, 3nr. Unit, phase 1 of a Strategic Employment Zone office campus at Moygaddy, Co. Meath.

1.2 Administrative Jurisdiction

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

- Meath County Development Plan (2021 – 2027);
- Maynooth Environs Local Area Plan;
- Kildare County Council Development Plan (2017 – 2023);
- Regional Spatial and Economic Strategy;
- Greater Dublin Strategic Drainage Study (GDSDS);
- The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government and the Office of Public Works).

1.3 Site Location

The subject site is located on the southernmost extent of County Meath, aligning with the county boundary to Co. Kildare, and is approximately 2km north from the town of Maynooth, Co. Kildare, which form part of a larger strategic landbank on zoned lands, known as the Maynooth Environs, as shown in

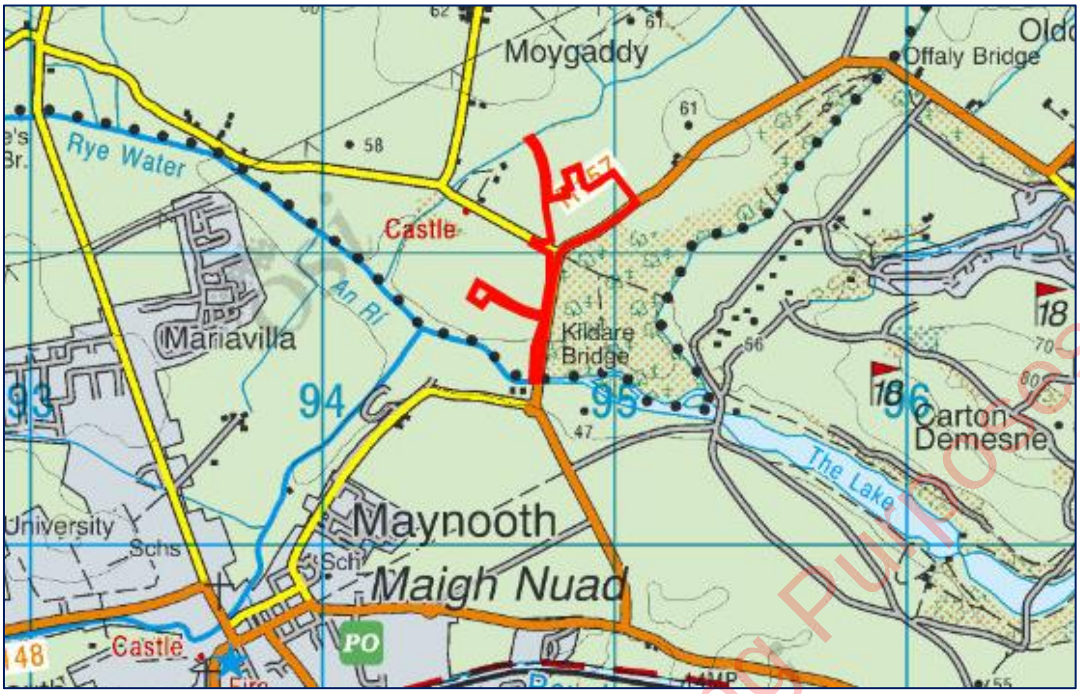


Figure 1.1, and is immediately bound by:

- R157 Maynooth – Dunboyne Road, to the south-east; and
- Agricultural Fields on all other sides.

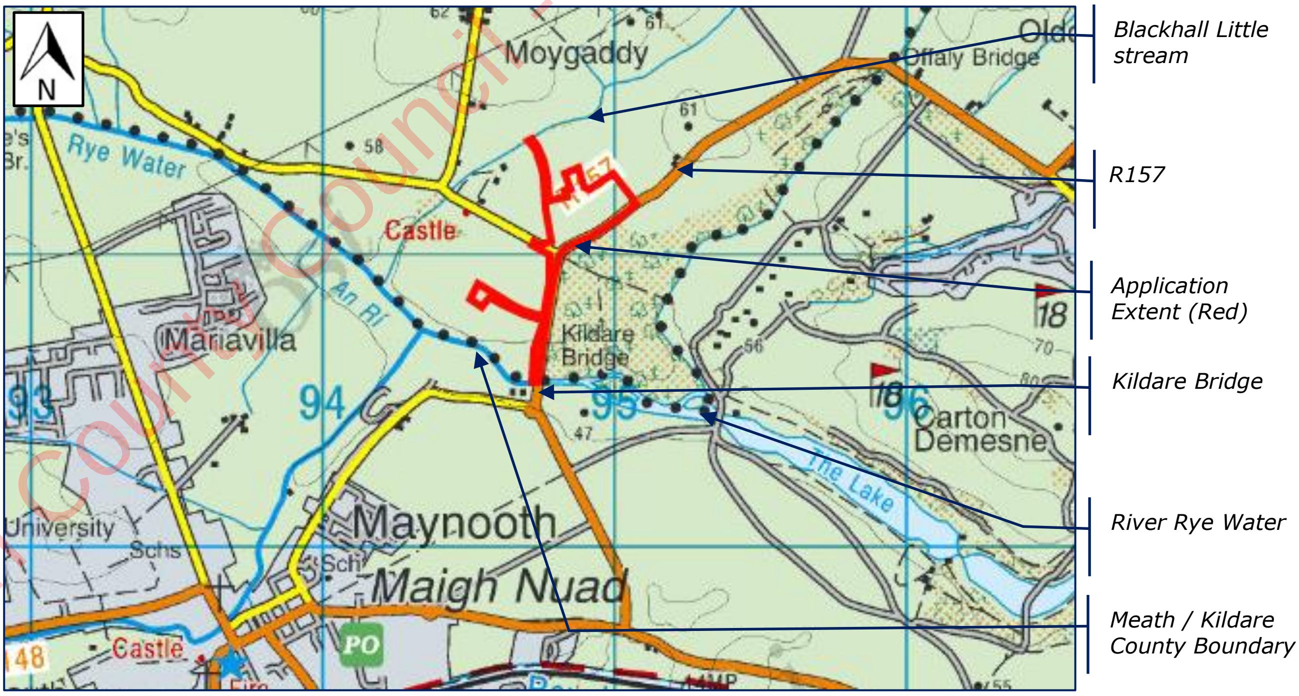


Figure 1.1 - Site Location (www.myplan.ie)

1.4 Existing Site Overview

The overall total application site area is **c. 6.9-hectares**, with approximately 4-hectares of this being zoned by Meath County Council for Enterprise and Employment in the Draft Meath County Development Plan 2021 – 2027. The total area also includes areas outside of the proposed office park, where further works are to be carried out e.g., realignment and upgrading of existing road; installation of new infrastructure, including new wastewater, surface water and watermain services, along existing road; new wastewater pumping station; and the provision of new pedestrian and cycle bridge structure adjacent to the Kildare Bridge, to its west.

The site is currently greenfield and used for agricultural purposes, and can be accessed from the R157, Maynooth to Dunboyne Road, which aligns the southern boundary of the subject site.

There is a localised high-point of 60.18mAOD near the centre of the site, with levels gently graded, from here, towards the Dunboyne Road (R157) at the southern boundary of the site with levels of 56.22mAOD.

1.5 Proposed Development Context

The Applicant– Sky Castle Limited – is applying for planning permission for Phase 1 of a proposed Strategic Employment Zone Office Campus Development at Moygaddy, Co. Meath.

The proposed development comprises 3 no. office blocks and all associated site development works (GFA: 20,633.26 sq.m) as follows:

- Block A: 5 storey office building providing offices, stair and lift cores and plant rooms (GFA: 10,260.42 sq.m)
- Block B: 3 storey office building providing offices, stair and lift cores and plant rooms (GFA: 5,186.54 sq.m)
- Block C: 3 storey office building providing offices, stair and lift cores and plant rooms (GFA: 5,186.30 sq.m)
- The development includes a surface car park which includes 323 no. car parking spaces and 320 no. bicycle car parking spaces (including 16 no. accessible car parking spaces and 12 no. EV charging spaces)
- Undertaking of road upgrade works including the provision of a signalised junction on the R157 Dunboyne Road and the construction of a section of the Maynooth Outer Orbital Route and provision of associated pedestrian and cycle infrastructure, as well as a realignment of a section of the R157. The works to the R157 adjoin the Carton Demense Wall which is a Protected Structure (RPS Ref 91556).
- Vehicular access to the site will be provided via the R157 Dunboyne Road and provision is made for a secondary vehicular access via the proposed section of the Maynooth Outer Orbital Route.
- Provision of water, foul and surface water drainage infrastructure including pumping station.
- Provision of a new pedestrian & cycle bridge structure at the River Rye Water adjacent to the existing Kildare Bridge.
- Provision of roof mounted solar PV panels on Office Blocks A, B & C.
- Provision of 3 no. ESB Kiosks.

- Provision of bin stores, bike stands, landscaping, boundary treatments and public lighting and all other site development works and services ancillary to the proposed development.

The proposed site layout is shown in **Figure 1.2**.

Figure 1.2 - Proposed Development Layout

1.6 Further Development Context

The developer has also committed to submitting a separate planning application to Meath County Council for the development of the Maynooth Outer Orbital Road (MOOR), which is to be routed from Moyglare Hall residential estate, on the north western extent of Maynooth, through the Applicant owned Moygaddy Environs lands and around to meet the R157 road, north from the Bridge. This is to align with the southwestern boundary of the subject application site.

Additional planning applications will be simultaneously submitted to Kildare County Council for the following two infrastructural works, which complement both the proposed development and the delivery of the MOOR:

1. Moyglare Bridge i.e., new bridge structure at southwestern extent of MOOR, including associated water services for extension and connection to public infrastructure;
2. Kildare Bridge upgrade, and associated infrastructure connections i.e., addition of pedestrian and cycle link.

The subject site is part of a larger land-holding, held by Sky Castle Ltd, which is zoned for Strategic Employment, Tourism, and Community Infrastructure. The applicant – Sky Castle Ltd – intends to submit separate planning applications for a Nursing Home and Primary Care Centre, and a new residential development, with associated infrastructure. These projects are subject to separate, independent planning applications, which will be accompanied by site-specific Engineering Services reports, and associated design drawings.

2. SCOPE OF ENGINEERING SERVICES REPORT

The Engineering Services Report was prepared by reviewing the available data from the Local Authority sources and national bodies *i.e.,* Meath County Council, Kildare County Council, Irish Water, The OPW, and the wider multi-disciplinary Design Team. The following services are addressed within this report, with respect to the proposed development:

- Surface Water Drainage;
- Wastewater Drainage;
- Potable Water Supply;
- Roads Infrastructure.

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

- Meath County Council Development Plan (2021 – 2027);
- Greater Dublin Strategic Drainage Study (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works (GDRCOP);
- Irish Water Code of Practice for Wastewater, IW-CDS-5030-03;
- Irish Water Code of Practice for Water Supply, IW-CDS-5020-03;
- The Building Regulations – Technical Guidance Document Part H;
- BE EN 752 – Drainage Outside Buildings;
- BS 7533-13 – Guide for Design of Permeable Pavements;
- CIRIA C753 – The SuDS Manual;
- The Office of Public Works, the Planning System and Flood Risk Management;
- Irish Water Drainage & Watermain Records;
- Design Manual for Urban Roads and Streets.

3. SURFACE WATER DRAINAGE

3.1 Surface Water Design Overview

3.1.1 Design Guidelines Overview

Any planning permission sought on the subject lands are required to adhere to the Local Authority requirements i.e., the Meath County Council Development Plan, the Maynooth Environs Local Area Plan, and as such, the Greater Dublin Strategic Drainage Study (2005).

New development must ensure that a comprehensive Sustainable Drainage System (SuDS), is incorporated into the development. SuDS requires that post development run-off rates be maintained at equivalent, or lower, levels than pre-development levels. Thus, the development must be able to retain, within its boundaries, surface water volumes from extreme rainfall events up to a 1 in 100-year rainfall event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability), while also allowing for an additional climate change factor of 20% increase in rainfall intensity. Any new development must also have the physical capacity to retain surface water volumes as directed under the Greater Dublin Strategic Drainage Strategy (GDSDS) and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate, not greater than the greenfield runoff equivalent.

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

The surface water strategy for the proposed development is to include a number of Sustainable Drainage Systems, prior to discharging an attenuated and treated flow to the existing watercourses that align to the southern and eastern boundaries of the main development site. Development discharge rates are to be restricted to less than the calculated greenfield runoff equivalent.

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

3.2 Surface Water Management Strategy Overview

The proposed surface water network is to be into individual sub-catchment areas, in order to best integrate Sustainable Drainage Systems across the site and manage the surface water runoff. Each sub-catchment area will look to provide treatment to the rainfall runoff, either at source or through site design. Infiltration systems are provided as part of the integrated SuDS network, however, as a results of the failed soakaway tests during site investigation, no infiltration is considered as part of the design of attenuation systems. This will still allow for interception to be provided for the first rainfall events, and slow recharge of groundwater. Therefore, the main functions of the SuDS provided will be for interception and treatment of the rainfall runoff, in order to reduce the runoff volume and increase the runoff quality, prior to discharge from the new development.

The surface water drainage network has been designed as part of the overall office park masterplan, in order to allow for connection of infrastructure from future phases of development.

The proposed surface water networks are to typically comprise a gravity pipe network, with significant Sustainable Drainage Systems (primarily pervious paving) implemented, where practicable.

Attenuation systems are to be strategically located under the development's car parking zones, and the design intent is to reduce the rainfall runoff from the proposed development to less than the greenfield runoff equivalent; thus, resulting in no adverse impact on the receiving watercourse.

3.3 Consultation

The proposed strategy has been discussed in detail with Meath County Council's (MCC) Drainage Department prior to submission, with all item discussion points addressed as part of the design submission.

3.4 Existing Site Drainage

3.4.1 Existing Surface Water Drainage Infrastructure

There is currently no existing public surface water drainage infrastructure in the immediate vicinity of the site that can serve the proposed development.

However, it is clear from the detailed topography of the site, and surrounding extents, that the local area drains naturally towards the river Ryewater, via a series of land drains and ditches, one of which is aligned to the edge of the northbound carriageway of the R157.

Refer to **Figure 3.1** for overview of existing natural watercourses in the vicinity of the proposed development.

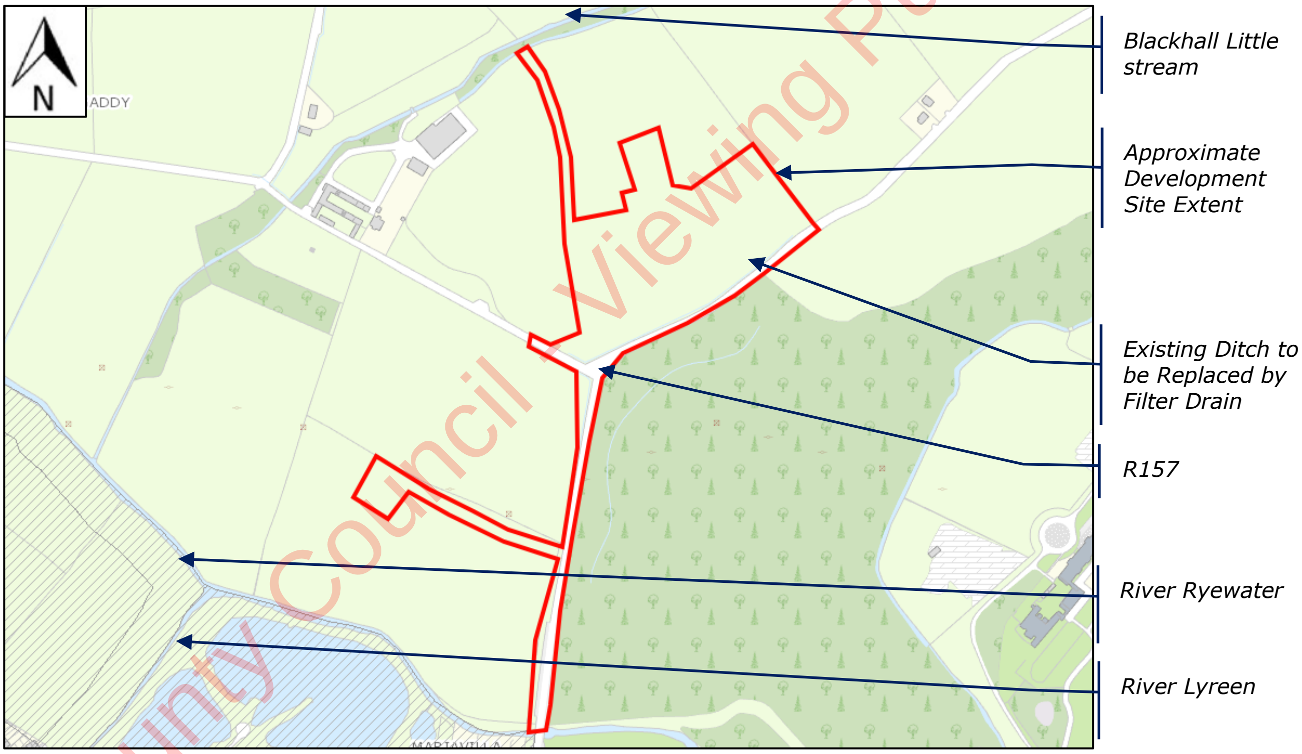


Figure 3.1 - Local Watercourses

3.4.2 Existing Site Catchment Areas

The gross catchment area for the surface water network that is to serve this phase of development is c.4.05-hectares, with the development site aligning with the R157 on its south-eastern boundary. The Blackhall Little stream located due north of the subject site, and agricultural fields to both the northeast and southwest.

There is a localised high-point of 60.18mAOD in the northern vicinity of the site, with levels gently graded, from here, towards the Dunboyne Road (R157) at the south eastern boundary of the site with levels of 56.22mAOD. This acts as a natural catchment boundary, along the southeast boundary. Refer to **Figure 3.2** for overview of site contours – not including areas of new roads and associated infrastructure external to development area – indicated at 0.5m interval.

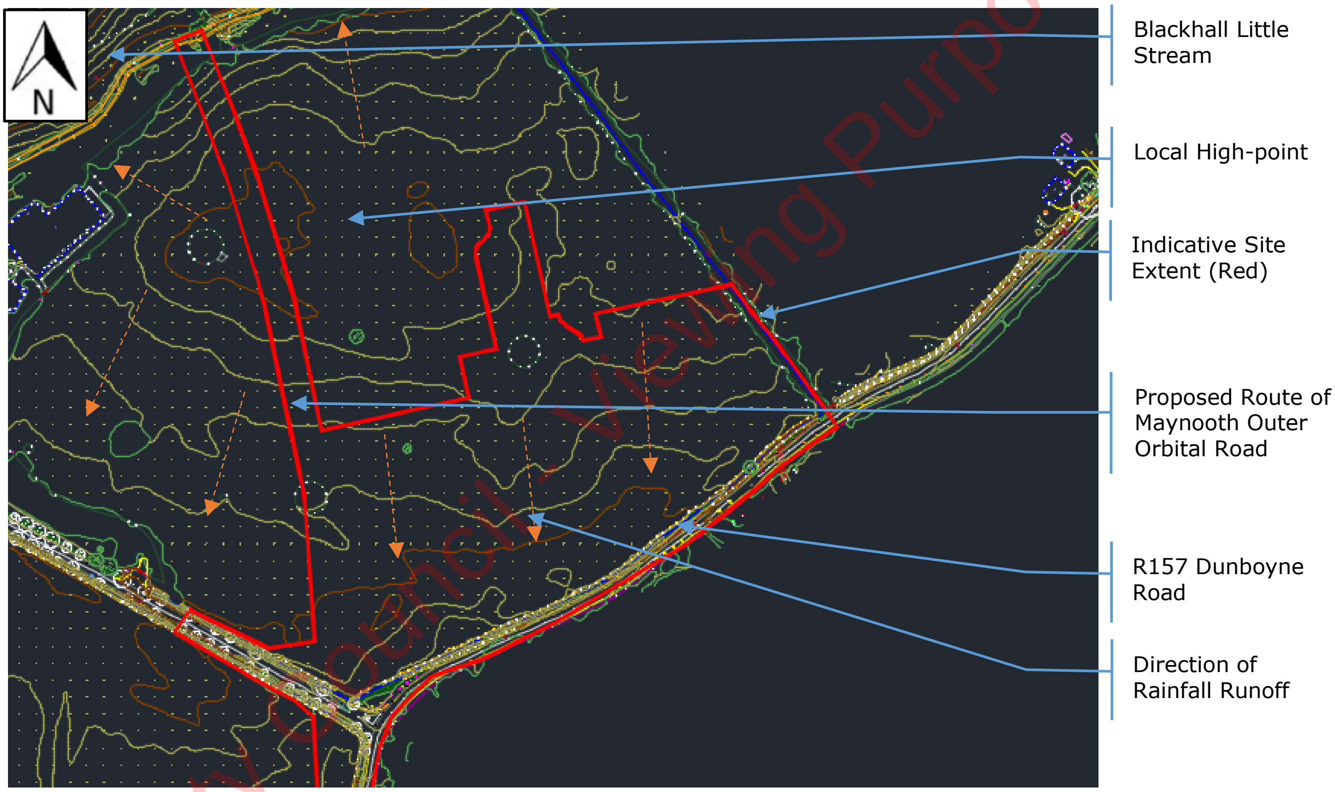


Figure 3.2 – Site Levels and Contour Overview

It is noted that the existing R157, Dunboyne Road appears to drain to the existing ditch alongside its northbound carriageway. This ditch conveys the runoff in a southerly direction, as far as the river Ryewater.

3.4.3 Existing Site Rainfall Runoff

All surface water runoff, on the existing site, currently infiltrates to the ground or discharges excess runoff to the Blackhall Little stream or River Ryewater, which align the eastern and southern boundaries respectively. Refer to *Section 3.4.2* for further details of existing site catchment area context.

A Site investigation was carried out on site in July 2021, with 3nr. soakaway tests performed to BRE Digest 365 requirements, at locations in the vicinity of open space in the new development. All 3nr. tests failed, with little to no infiltration observed. The existing subsoil was determined to be of stiff clayey substance, consistently across the site. It is noted that groundwater was not observed at the location of SuDS structures, including attenuation systems.

A copy of the site investigation has been submitted as part of this planning application.

Therefore, as a result of the above, **Soil Type 4** has been assigned for rainfall runoff calculations, as discussed and agreed with Meath County Council.

The Standard Average Annual Rainfall (SAAR) value for the development site, as sourced from Met Éireann, is **799mm**.

Using the ICPSuDS Input, (Flood Studies Report, FSR) Method, the rainfall runoff discharging from the total greenfield site area that is to be developed has been estimated at $QBAR_{RURAL}$ **5.6 l/s/ha,** in its existing condition.

Refer to **Figure 3.3** for an excerpt of the results from the MicroDrainage Runoff Calculator, which provides the calculated QBAR (*per hectare*) runoff rate, along with the discharge rate (*per hectare*) for varying Annual Recurrence Intervals (ARI).

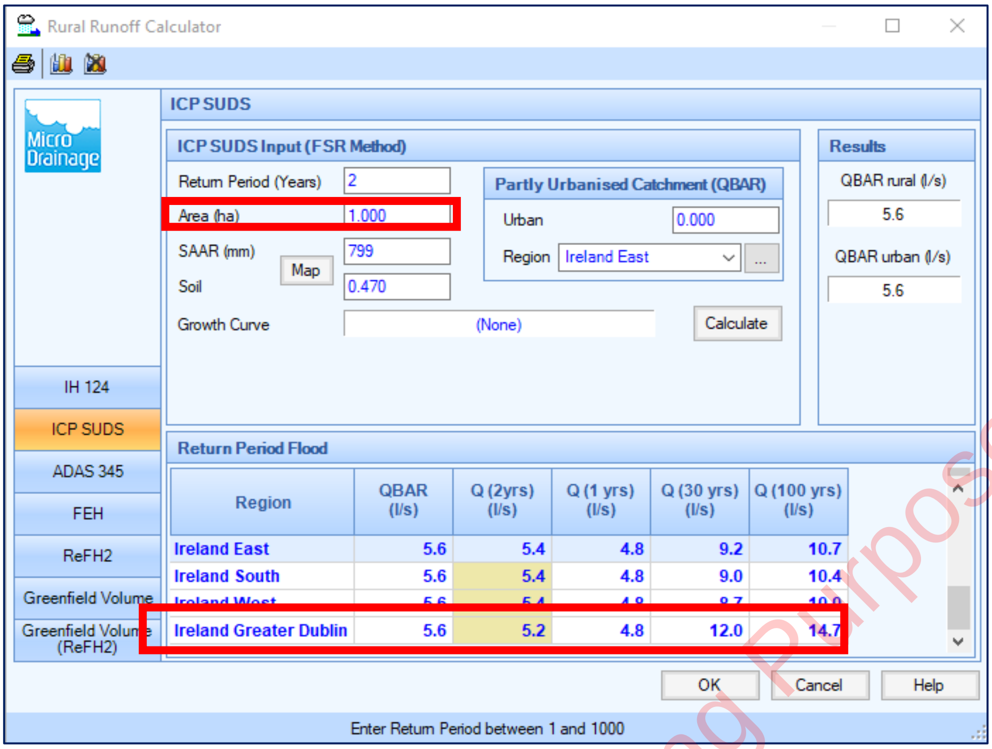


Figure 3.3 - Existing Site Runoff Calculator Results (MicroDrainage Excerpt)

3.5 Proposed Surface Water Drainage Design Strategy

3.5.1 Proposed Surface Water Strategy Overview

It is proposed to separate the surface water and wastewater drainage networks, which will serve the proposed development, and provide independent connections to the adjacent watercourse for surface water only with all wastewater to be connected to the local wastewater sewer network respectively. Refer to *Section 5* for details of the proposed wastewater drainage design.

3.5.2 Climate Change Allowance

As indicated in **Figure 3.11**, the proposed network is to be designed to allow for an additional 20% increase in rainfall intensity, to allow for Climate Change projections, in accordance with the Meath County Council Development Plan and the GDSDS.

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

3.5.3 Proposed Surface Water Network Strategy

The proposed surface water network is to be into individual sub-catchment areas, in order to best integrate Sustainable Drainage Systems across the site and manage the surface water runoff. Each sub-catchment area will look to provide treatment to the rainfall runoff, either at source or through site design. Infiltration systems are provided as part of the integrated SuDS network, however, as a results of the failed soakaway tests during site investigation, no infiltration is considered as part of the design of attenuation systems. This will still allow for interception to be provided for the first rainfall events, and slow recharge of groundwater. Therefore, the main functions of the SuDS provided will be for interception and treatment of the rainfall runoff, in order to reduce the runoff volume and increase the runoff quality, prior to discharge from the new development.

The surface water drainage network has been designed as part of the overall office park masterplan, in order to allow for connection of infrastructure from future phases of development.

The proposed surface water networks are to typically comprise a gravity pipe network, with significant Sustainable Drainage Systems implemented, where practicable.

Attenuation systems are to be strategically located under the development's car parking zones, and the design intent is to reduce the rainfall runoff from the proposed development to ***less than*** the greenfield runoff equivalent; thus, resulting in no adverse impact on the receiving watercourse.

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

3.5.3.1 Rainwater Harvesting

Rainwater harvesting options to be considered at each of the proposed office facilities, which can re-use the collected rainwater for welfare facilities, or landscaping purposes. Rainwater Harvesting helps to reduce the overall volume of rainfall runoff entering the surface water network.

Figure 3.4 - Example of Rainwater Harvesting System

3.5.3.2 Pervious Paving

Pervious surfaces 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. It is proposed to provide a *loose gravel surface finish* (or similar approved) to all car parking spaces within the new office development.

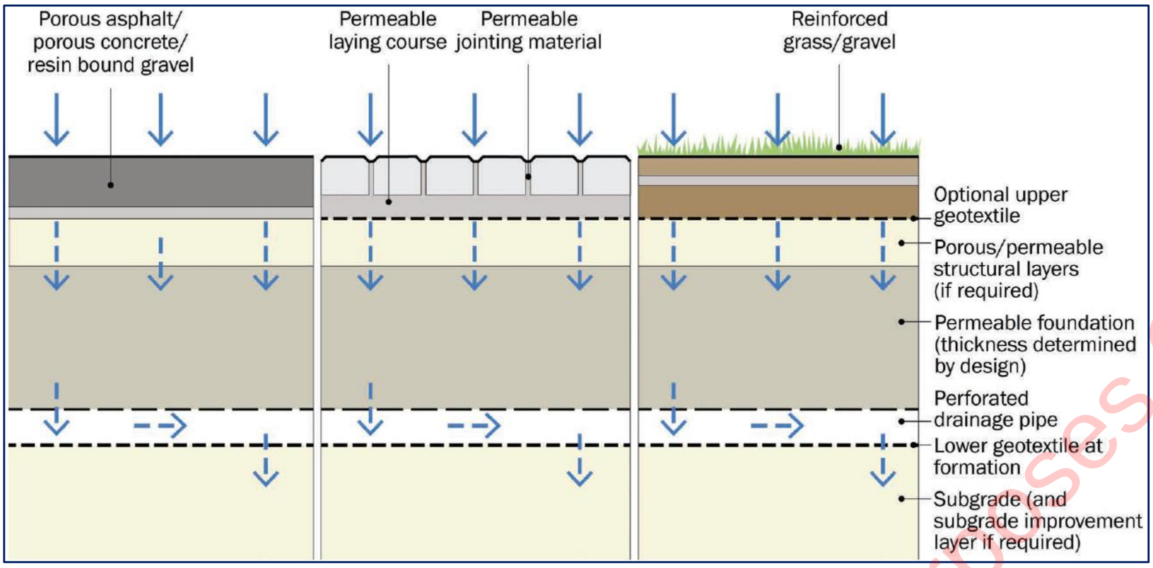


Figure 3.5 - Detail of Type B Pervious Paving (CIRIA C753)

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

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

3.5.3.3 Trapped Road Gullies

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

The grated covers are to have a minimum load classification of D400, for frequent vehicular traffic, and shall be lockable, as required by MCC.

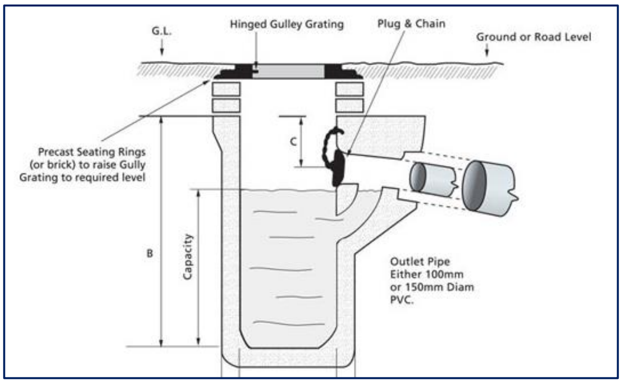


Figure 3.6 - Trapped Road Gully (Typical Detail)

3.5.3.4 Underground Pipe Network

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

3.5.3.5 Silt Traps

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

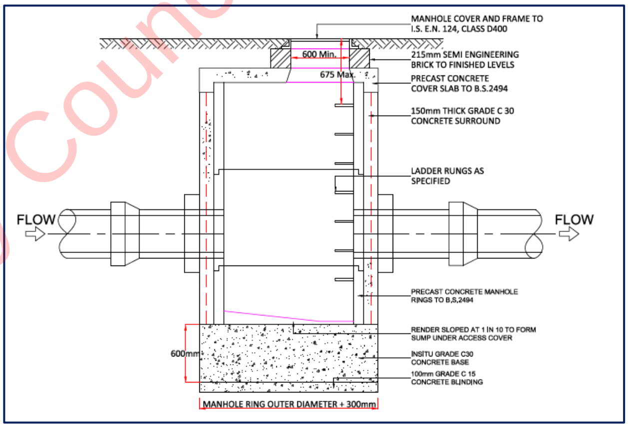


Figure 3.7 - Typical Detail of Silt Trap Manhole

3.5.3.6 Attenuation Storage Systems

Unlined proprietary poly-tunnel storage units (or similar approved) are to be provided, underground at car parking zones, for the attenuation of rainfall runoff prior to discharge to the existing natural watercourses.

These systems are to provide sufficient temporary storage volume for rainfall events up to, and including, the design 1% AEP rainfall event (including climate change). Typical poly-tunnel storage systems comprise plastic arch-units with open-graded crushed rock bedding and surround. These units are arranged in rows, with an isolator row for efficient operation and maintenance.

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

A minimum total attenuation storage volume of **1,556m^3** is required as part of the proposed development.

The attenuation systems are to be installed in the parking areas and was calculated to support the natural greenfield run off rate. Each system is to have an isolator row, and a high level 225mm ø overflow distributor pipe.

Interception storage for the first 10mm of rainfall is to be provided. Total hardstanding impermeable area is 1.67ha therefore an interception storage of 165m^3 is required.

Figure 3.8 –Typical Poly-Tunnel Installation Arrangement

3.5.3.7 Flow Control Device

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

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

Further, it is noted that the required aperture of the proposed Hydro-Brake outlets has been designed to be greater than 150mm diameter, to mitigate the risk of blockage.

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

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

3.5.3.8 Oil Separator

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

The proposed surface water network already provides sufficient mitigation measures, through the provisions listed previously (principally the pervious paving, filter drains, trapped road gullies and silt traps, and the attenuation interception layer). However, a Class 1 bypass fuel separator is to be provided as an additional and final mitigation measure, upstream of the attenuation system, prior to surface water discharge to both the network and watercourse.

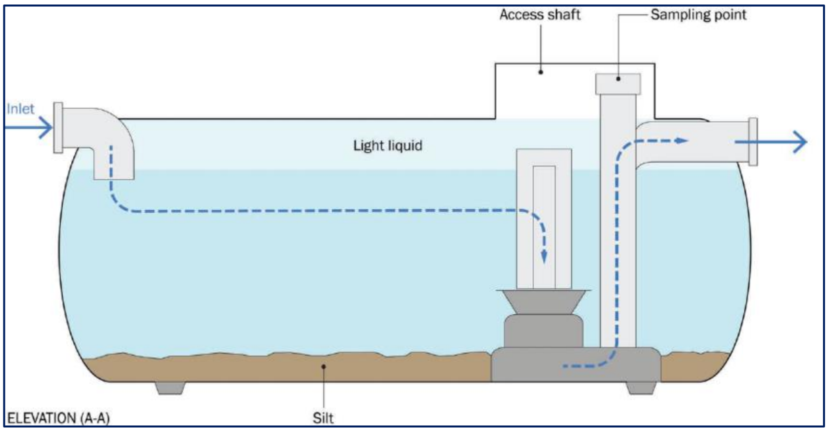


Figure 3.10 - Typical Section Detail of Fuel Separator (CIRIA C753)

3.6 Proposed Surface Water Network Detailed Design

3.6.1 Software Design Criteria

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

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

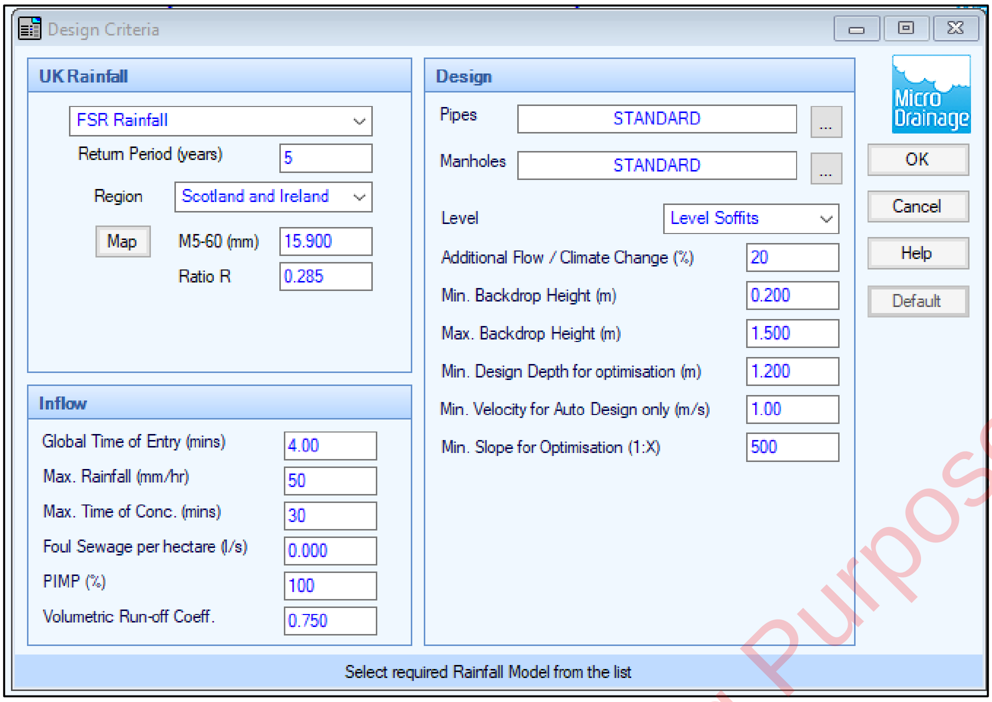


Figure 3.11 - Surface Water Network Design Criteria (MicroDrainage Excerpt)

3.6.2 Proposed Surface Water Catchment Areas

The proposed application is Phase 1 of a larger office campus development, with the larger masterplan area being divided into 2nr. catchments, the larger of which includes this current phase of development and directs rainfall runoff to the river Ryewater via a series of local ditch / open drains. The smaller catchment – located to the north of this application – directs rainfall runoff to the Blackhall Little stream.

The proposed development shall be served by a sub-catchment, on the downstream extent of the main overall catchment, with network connections provided, which are to account for future development that will form their own sub catchment, in order to best integrate and optimise sustainable drainage systems.

Each sub-catchment area will look to provide treatment to the rainfall runoff, either at source or through site design, with all treated rainfall runoff being directed towards the river Ryewater, as is its natural course, at a maximum flow rate of 5.5 l/s/ha, which is less than the calculated current greenfield runoff rate, noted in *Section 3.4.3*.

3.6.3 Proposed Development Rainfall Runoff

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

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

Refer to **Figure 3.3**, in *Section 3.4.3*, for an excerpt from the results MicroDrainage Runoff Calculator for the development catchment area, which indicates the greenfield equivalent, $QBAR_{RURAL}$, value of 5.61 l/s/ha along with the calculated runoff for varying Average Recurrence Intervals (ARI).

It is proposed to reduce all rainfall runoff from the new development to a maximum flow rate of **5.5 l/s/ha**, which is less than the calculated greenfield runoff rate equivalent, as discussed and agreed with MCC Drainage Department.

For the purpose of the surface water network design simulation, we have considered all external (roads, pavement, and roofs) areas as being 100% impermeable; giving a *winter* global runoff coefficient, C_v, of 0.84, in accordance with the HR Wallingford and Modified Rational Method for runoff.

3.6.4 Proposed Surface Water Pipe Network Design

The overall surface water drainage system, serving the catchment in the proposed development, is to consist of a gravity surface water sewer network that will convey runoff from the roofs and paved areas to the outfall manhole.

The proposed piped-network has been designed in accordance with BS EN 752 and all new infrastructure is to be compliant with the requirements of the

GDSDS and the GDRCOP for Drainage Works, with minimum full-bore velocities of 1.0 m/s achieved throughout.

All main surface water carrier pipes have been sized to ensure no surcharging of the proposed drainage network for rainfall events up to, and including, the 1 in 5-year ARI event, with a projected climate change allowance of 20% increase in rainfall intensity, under normal flow conditions.

3.7 Proposed Surface Water Attenuation Storage

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

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

The main development attenuation systems will be provided, comprising underground poly-tunnel systems. These have been designed for provision within the development's car parking zones, which also comprise a pervious paving finish. The polytunnel systems shall have an isolator row and high level 225mm ø overflow / distributor pipe.

The attenuation systems have been designed to temporarily store the surface water runoff for design rainfall events up to, and including, the 1% AEP return period underground. A minimum total attenuation storage volume of **1,556m^3** is required as part of the proposed development.

Interception storage for the first 10mm of rainfall is to be provided. Total impermeable hardstanding area is 1.67ha therefore an interception storage of **164m^3** is required.

3.8 Surface Water Outfall Locations

The development is to discharge the treated and attenuated rainfall runoff to an existing ditch, which is to be replaced by a new filter trench as part of the upgraded and re-aligned R157. This filter trench is to broadly follow the route of the existing ditch drain, which discharges to the river Ryewater.

The discharge rates are to be restricted to a maximum flow rate of **5.5 l/s/ha**, which is less than the calculated greenfield equivalent runoff rate, as discussed in *Section 3.6.3*,

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

All outfalls are to be fitted with non-return valves.

3.9 Water Quality

The quality of the surface water discharging from site is to be improved through the following provisions, which are being considered as part of an integrated drainage network, and each of which is discussed in greater detail in *Section* 3.5.3:

- Rainwater Harvesting at each building;
- Pervious Paving (gravel, or similar approved) for all car parking spaces;
- Intensive landscaping, where practical;
- Filter Trenches, where allowable around the buildings, and outfall route to river;
- Trapped road gullies on all road carriageways, to trap silt and gross pollutants;
- Silt traps to be provided on manholes immediately upstream of attenuation systems, as a further preventative measure to trap silt and other gross pollutants;
- Interception provisions at attenuation systems;
- Class 1 bypass fuel separator to be provided upstream of attenuation.

3.10 Maintenance

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

- Pervious paving (gravel, or similar approved);
- Trapped road gullies;
- Silt trap manholes;
- Interception at attenuation systems;
- Flow controls greater than 150mm diameter.

Road gullies, silt traps, flow control devices and attenuation systems, should be inspected regularly and maintained, as appropriate and in accordance with manufacturer's recommendations and guidelines.

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

3.11 Surface Water Impact Assessment

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

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

3.11.1 Criterion 1 – River Water Quality Protection

It is proposed that the overall drainage system, serving this development, will contain a range of surface water treatment methods, as outlined previously in *Section 3.5.3,* which will improve the quality of surface water being discharged from the proposed development.

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

a) Intensive landscaping, where practicable;
b) Pervious paving for car parking zones;
c) Interception storage at attenuation systems;
d) All road gullies and linear channel drains are to be trapped;
e) Silt-trap prior to attenuation storage area.

3.11.2 Criterion 2 – River Regime Protection

Surface water discharge from the overall development will be restricted to a maximum flow rate of **5.5 l/s/ha**, which is less than the greenfield runoff equivalent. Refer to *Section 3.6.3* for further details of the proposed development rainfall runoff calculations, as discussed and agreed with MCC Drainage Department.

This will be achieved with the provision of a flow control devices (Hydro-Brake Optimum, by Hydro-International, or similar approved) upstream of the outfall manhole.

3.11.3 Criterion 3 – Level of Service (Flooding) Site

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

- No flooding on site except where planned (30-year high intensity rainfall event);
- No internal property flooding (100-year high intensity rainfall event);
- No internal property flooding (100-year river event and critical duration for site) and;
- No flood routing off site except where specifically planned. (100-year high intensity rainfall event).

3.11.3.9 Sub-Criterion 3.1

The surface water drainage systems, serving the proposed development, are yet to be designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding. Therefore, the system has capacity for the 30-year return period rainfall event without flooding.

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

3.11.3.10 Sub-Criterion 3.2

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

The performance of the proposed drainage system in 100-year return period storm events (including 20% climate change allowance) is yet to be analysed – Refer **Appendix C** of this ESR for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

3.11.3.11 Sub-Criterion 3.3

Details of the flood risk assessment associated with the proposed development is outlined in the Site-Specific Flood Risk Assessment (Document Nr. **S665-OCSC-1A-XX-RP-C-0003**), which is to be submitted under separate cover, as part of this application. Furthermore, a detailed Flood Risk Assessment report of the river Ryewater has been prepared by JBA Consulting, and submitted under separate cover, which assesses potential impact from development across the Applicant's wider land-holding, which makes up the masterplan area of Maynooth Environs.

These documents confirm that there is no adverse flood risk impact on the subject development, and no adverse flood risk as a result of the subject development.

3.11.3.12 Sub-Criterion 3.4

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

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

Details of the flood risk assessment associated with the proposed development is outlined in the Site-Specific Flood Risk Assessment (Document Nr. **S665-OCSC-1A-XX-RP-C-0003**), which is submitted under separate cover, as part of this application.

3.11.4 Criterion 4 – River Flood Protection

As outlined in *Section 3.11.2* (Criterion 2), the surface water runoff from the development's catchment will be limited to a maximum of **5.5 l/s/ha**, which is less than the calculated greenfield equivalent.

Refer to *Section 3.6.3* of this report for further details on the limiting discharge rates. The *GDSDS Volume 2, Appendix E* states that this practice ensures *"that sufficient stormwater runoff retention is achieved to protect the river during extreme events"*.

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

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

4. NEW PEDESTRIAN / CYCLE BRIDGE STRUCTURE

There will be a new pedestrian / cycle bridge structure provided at the Kildare Bridge, in order to improve connectivity between the proposed development and Maynooth.

The new pedestrian/cycle bridge, which is to be located adjacent, and west of, to the existing Kildare Bridge will be formed of precast concrete beams sitting on an integral abutment bank seat. The clear span of the bridge is 17m between abutments, uninterrupted across the existing Kildare Bridge's arches. A 1m bearing length is provided at each end, resulting in a 19m long precast MY7 beam. A concrete infill is to be placed in between and over the top of the beams to complete the full depth of the deck, measuring 725mm.

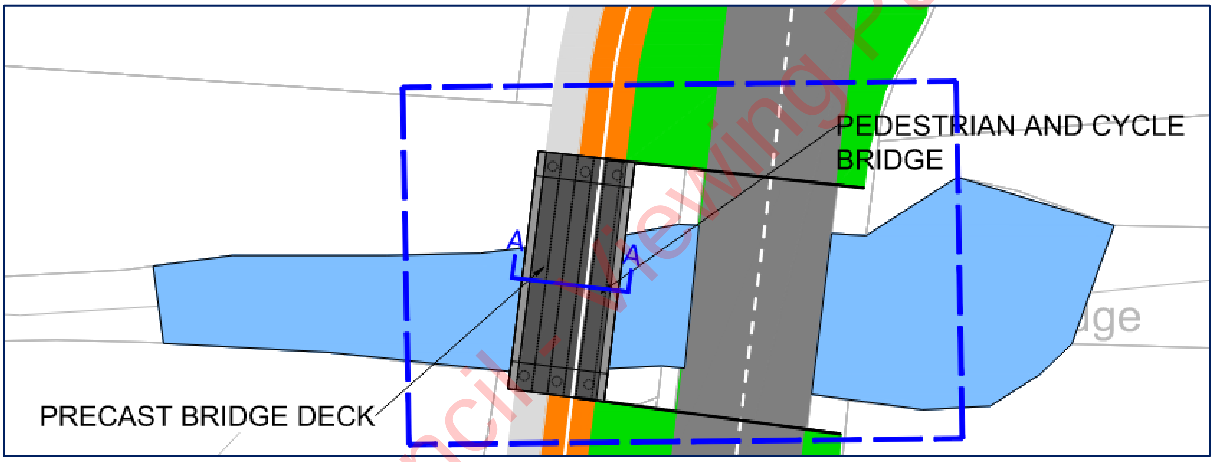


Figure 4.1 - Schematic Plan of new Pedestrian and Cycle Bridge Structure

The soffit of the precast beams matches the crown of the intrados of the adjacent masonry arch road bridge. The abutments are built-up on the existing embankments and sit outside the existing walled banks of the watercourse so as not to affect the current flood model. There is no skew on the bridge deck.

A pedestrian parapet forms the edge of the bridge deck.

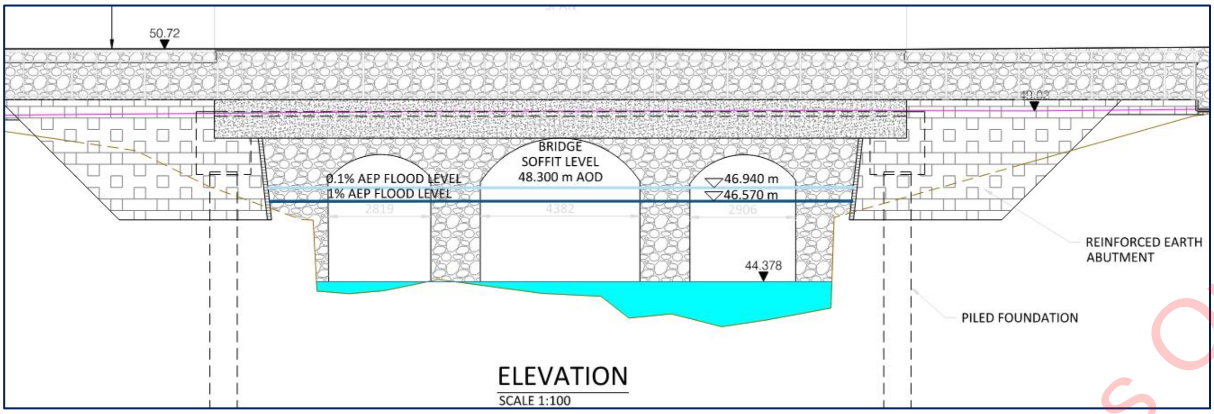


Figure 4.2 - Proposed Pedestrian / Cycle Bridge (Elevation)

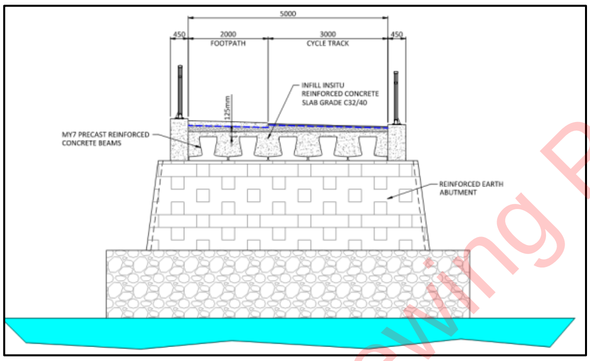


Figure 4.3 - Proposed Pedestrian / Cycle Bridge (Section)

The abutment bank seats are supported off a single row of 750mm diameter CFA piles. The connection between the precast bridge beams and the abutment is integral. To minimise maintenance, no bearings or expansion joints are required. The abutment will be finished with earthwork retaining panels on all sides.

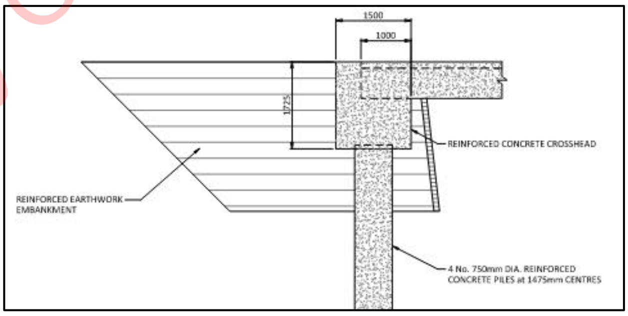


Figure 4.4 - Proposed Pedestrian / Cycle Bridge (Integral Abutments)

The surfacing material consists of a mortar build-up to drainage falls, a waterproofing course and an anti-slip wearing course, Eliminator and Safetrack SC or similar approved.

There are no proposed services in the bridge deck. However, further to our discussions with Irish Water, we understand that they are to tunnel underneath the river Ryewater's bed, in order to install a new high pressure wastewater transmission line under the river Ryewater, to the west of the existing bridge. This is located approximately 20m away from the existing bridge structure, and the new pedestrian / cycle structure has been sited in a location that is sufficiently far away from Irish Water's proposed work zone, so as not to cause any impact. An additional wastewater rising main is to be provided, serving new development in the Moygaddy area, and routed alongside the new bridge infrastructure, in order to facilitate routed connection to the existing Maynooth Municipal Wastewater Pumping Station. Refer to Section 6 for further information.

Durability to the bridge structure is provided by the concrete cover and the concrete mix design in accordance with IS EN 1992 and DN-STR-03012-03. All steel elements including fixings are to be fully galvanised. Refer to engineering design drawings S665-OCSC-XX-XX-DR-S-1707 & 1708 for design information. Refer to OCSC Bridge Options Report, S665-OCSC-XX-XX-RP-C-0010, submitted separately to this ESR, for detailed discussion on the proposed bridges.

Furthermore, due to the single span nature of construction, there will be no increased risk of blockage to the Kildare Bridge once the cycleway / pedestrian bridge has been installed.

As a precautionary design measure, the potential impact of the proposed pedestrian / cycle bridge structure was further assessed by JBA Consulting, as part of a wider flood study of the Moygaddy Environs, with the conclusions from JBA indicating that the proposed bridge structure has '*no impact on flood following its construction*'. Refer to JBA Consulting's Masterplan Flood Risk Assessment for further details.

5. WASTEWATER DRAINAGE

5.1 Overview

All proposed wastewater sewer design is to be carried out in accordance with Irish Water's Code of Practice for Wastewater Infrastructure. The existing site is currently greenfield, with no existing wastewater infrastructure in the immediate vicinity, however appropriate connection points have been identified at Maynooth municipal wastewater pumping station, in county Kildare, south of the river Ryewater/Kildare Bridge.

5.2 Consultation

A Pre-Connection Enquiry Form has been submitted to Irish Water for review, for both the proposed development, as well as for the Applicant's wider land holding, which forms part of the masterplan development for the Maynooth Environs lands. Irish Water (IW) issued a Confirmation of Feasibility Letter (Refer Appendix D) for the proposed development, subject to upgrade works being carried out.

OCSC and the applicant have had continued correspondence and meetings with Irish Water with respect to required upgrade works, and have committed to working with Irish Water in order to provide a strategic Wastewater Pumping Station (WWPS) within the applicant owned lands, at Moygaddy. The provision of strategic WWPS, centralised on the Maynooth Environs lands, will allow for new development in this area to be served by wastewater infrastructure, and subsequently allow expansion in order to serve the entire Maynooth Environs lands, as future phasing of development is brought on board.

The strategy of providing a WWPS, as noted, includes provision of rising main infrastructure to specifically serve the subject development, and the pipe will be routed along the Dunboyne Road, and routed across (under) the river Ryewater, adjacent to the Kildare Bridge, so that a connection to the gravity infrastructure upstream of the Maynooth municipal WWPS can be achieved.

Further consultation between the Applicant and Irish Water has been had in relation to Irish Water's Capital Project, which is for the provision of new high pressure rising main infrastructure to serve Maynooth Town from the Maynooth municipal WWPS, as far as Leixlip wastewater treatment plant. These ongoing works are to greatly improve the performance and capacity of the municipal WWPS, with a section of the new pipeline infrastructure to be provided in Applicant-owned lands. This is discussed further in *Section 5.4*.

5.3 Existing Wastewater Drainage

There is currently no existing wastewater infrastructure in the immediate vicinity of the site. The nearest public wastewater infrastructure is Maynooth's public Wastewater Pumping Station (WWPS).

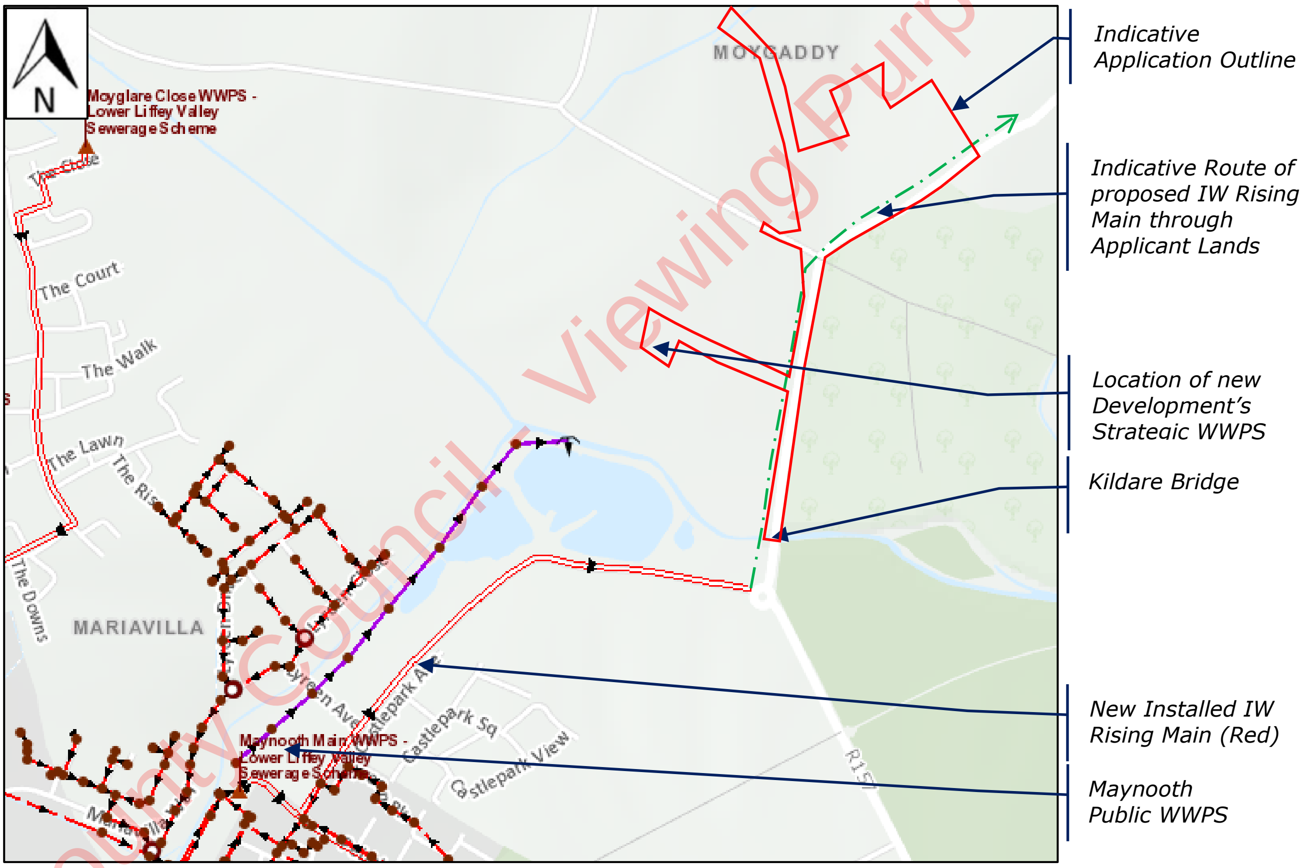


Figure 5.1 –Existing Wastewater Network and Pumping Station

It is noted that Irish Water have separate designs in place to install a high pressure rising main from the existing public WWPS at Maynooth, to the Leixlip Wastewater Treatment Plant, in order to significantly increase the capacity and performance of the Maynooth WWPS.

The route of this new Irish Water infrastructure is to align with the eastern boundary of the subject site, and discussions are ongoing between the applicant, Irish Water and the Local Authorities to ensure that this new strategic infrastructure can be delivered by Irish Water in conjunction with the wider masterplan for Maynooth Environs.

Maynooth Town is served by a municipal WWPS, at its eastern extent, which discharges wastewater effluent to Leixlip Wastewater Treatment Plant. There is a gravity wastewater network on the Dunboyne Road, adjacent to the Maynooth WWPS.

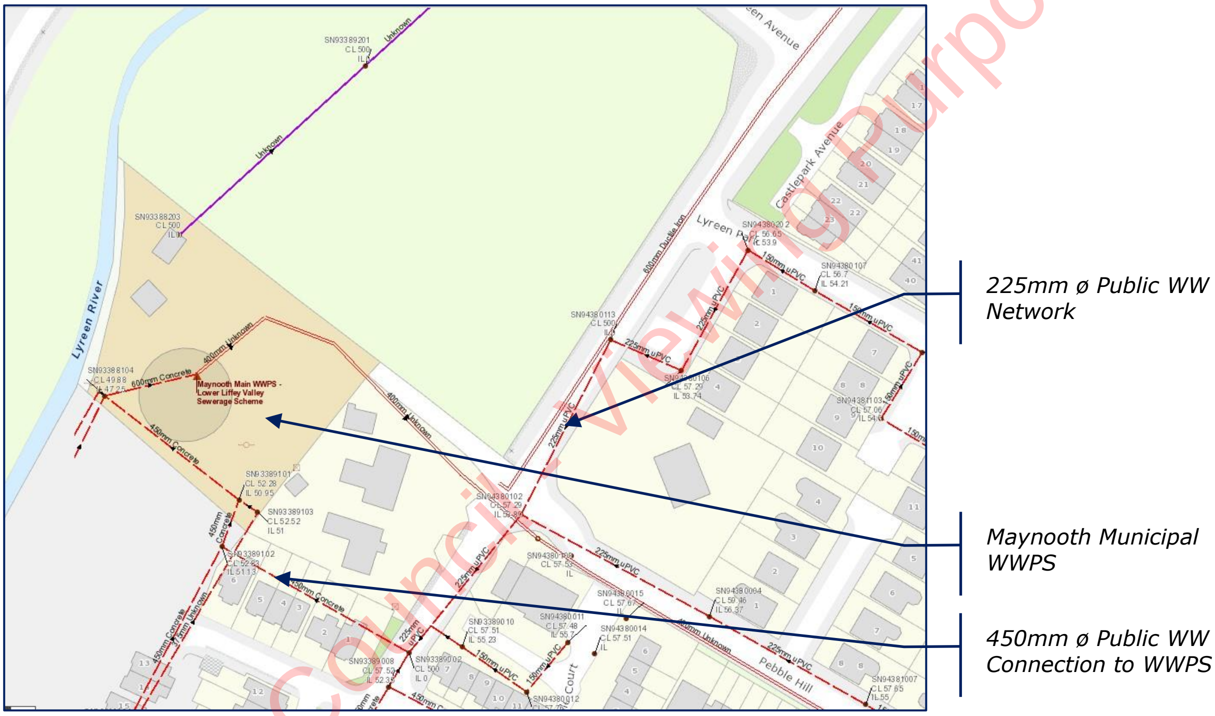


Figure 5.2 –Existing Wastewater Network and Pumping Station

5.4 New Irish Water Infrastructure

As part of Irish Water's Strategic Capital Investment Programme, Irish Water are currently undergoing design and construction of a new wastewater rising main that will improve the capacity and performance of the nearby Maynooth public Wastewater Pumping Station, and the associated capacity improvements will also serve the proposed development.

The proposed rising main is to be routed north and east, towards the public Wastewater Treatment Plant at Leixlip, with a section of the route located within the eastern part of the Moygaddy Environ's LAP lands, including this subject development site, which are owned by the Applicant as part of their wider land-holding.

A section of the new wastewater rising main is to be accommodated just inside the eastern boundary of the site, as indicated in **Figure 5.3**.

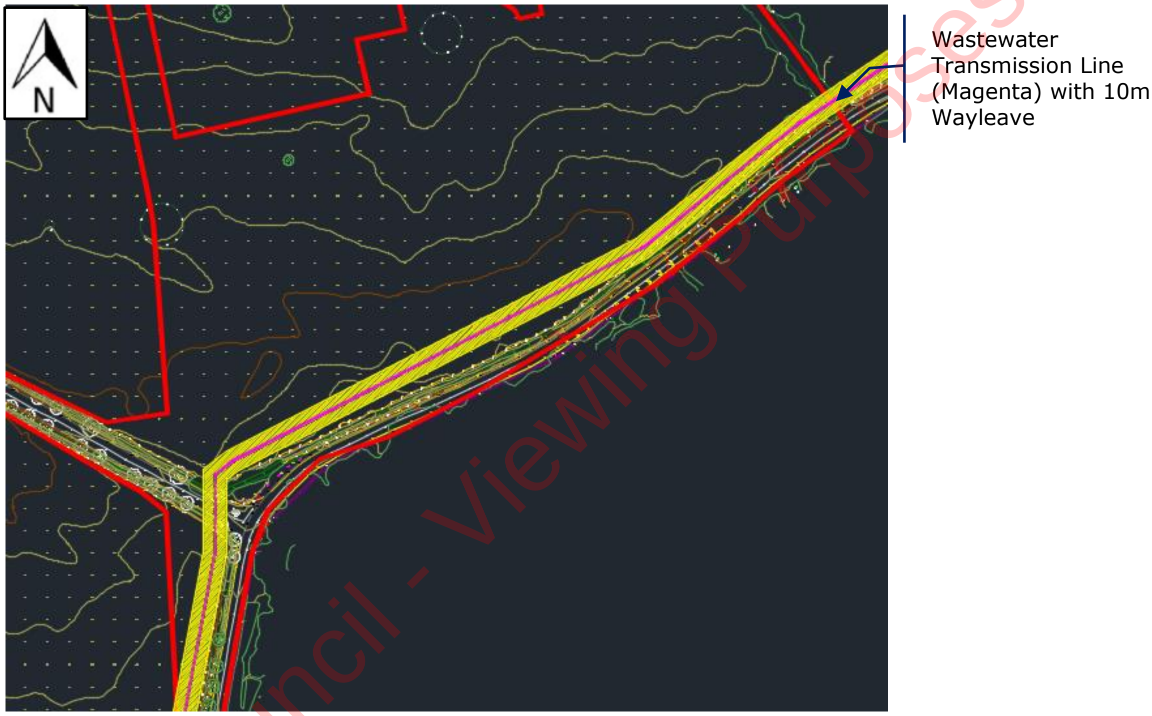


Figure 5.3 - Route of High-Pressure Wastewater Transmission Line

The Developer has been in detailed consultation with Irish Water, for design development of the section of new wastewater rising main, in order to help accommodate the new strategic infrastructure within their lands, and the subject development has been sufficiently set back from the centreline of the rising main route, at a distance greater than the required 5m, so as not to impact on its route and future operation.

It is understood that the section of infrastructure from the Maynooth WWPS as far as the river Ryewater has already been installed, as indicated on **Figure 5.1**.

From discussions with Irish Water, it is expected that the new infrastructure will be commissioned in 2025.

5.5 Proposed Wastewater Drainage Strategy

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

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

The wastewater discharge from the Office Innovation Campus is to discharge by gravity to a new wastewater pumping station, strategically located within adjoining client owned lands to serve wider parts of the masterplan area, which is to discharge by pumped rising main to Maynooth's public wastewater pumping station.

The new underground WWPS shall discharge pumped effluent via rising main – with additional rising main laid alongside to accommodate for greater loadings in future phases – as far as the gravity public infrastructure upstream of the Maynooth municipal WWPS. In order to achieve this, the rising main will need to cross the river Ryewater, adjacent to the new pedestrian / cycle bridge structure that is to be constructed adjacent to the Kildare Bridge. It is proposed that this rising main is to be routed under the river Ryewater, alongside the aforementioned new strategic high pressure rising mains that are to be installed by Irish Water to upgrade the Maynooth WWPS.

Refer to **Figure 5.4** for typical detail of a rising main crossing to the west of the Kildare Bridge structure, as per Irish Water Standard Detail Drawing Nr. STD-WW-24, details of which are to be agreed with Irish Water at connection offer stage. The construction methodology proposed is aligned with Irish Water's proposals for the separate Strategic Capital Programme rising main.

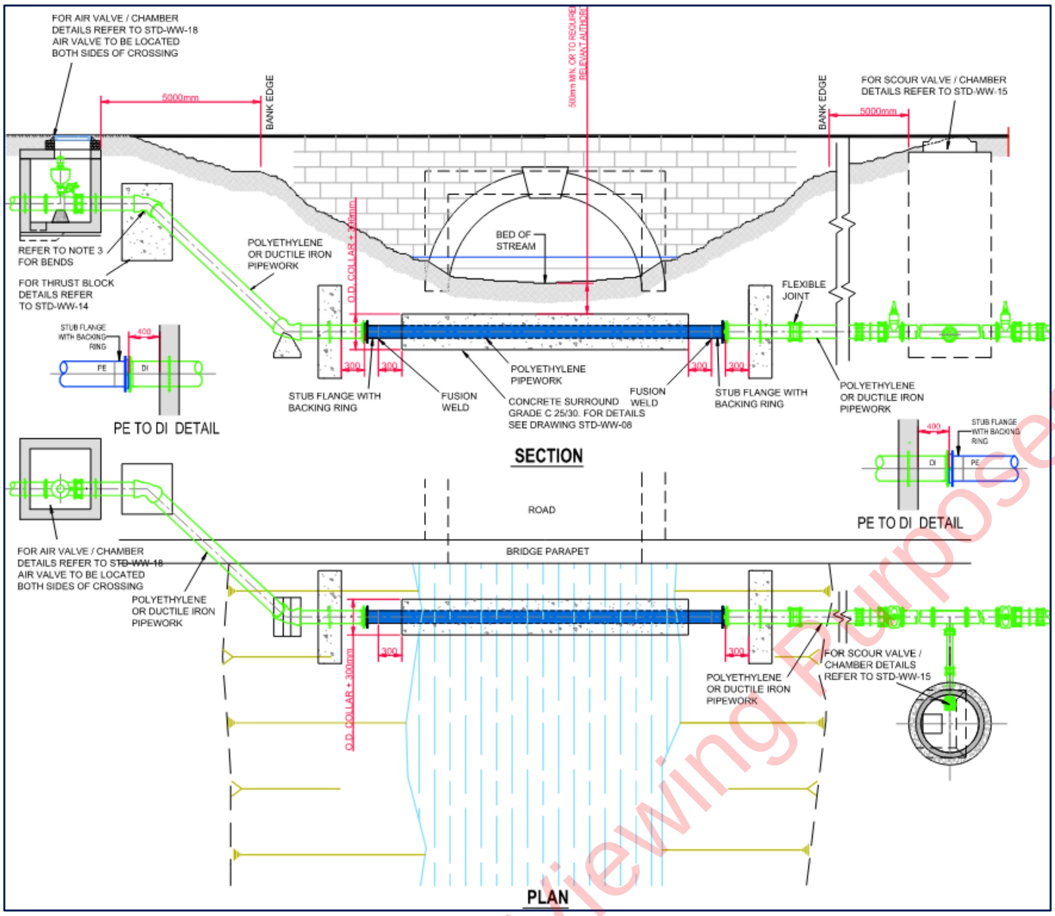


Figure 5.4 - Typical Detail of Rising Main Crossing at Bridge

All infrastructure is to be designed in accordance with the Irish Water Code of Practice for Wastewater Infrastructure, and shall be agreed at New Connection Application stage, prior to construction.

Refer to OCSC Bridge Options Report, S665-OCSC-XX-XX-RP-C-0010, submitted separately to this ESR, for detailed discussion on the proposed bridges.

5.6 Wastewater Pumping Station

A new underground strategic wastewater pumping station (WWPS) is to be constructed on Applicant-owned lands, to the southwest of the proposed office development site. Following discussions with Irish Water, the new WWPS has been sited at a location that is optimised for serving the wider Maynooth Environs lands, and is to be designed to allow for future expansion as additional development phases are brought through for planning and construction.

Details of the new underground wastewater pumping station shall be agreed with Irish Water at new connection application stage, as required.

5.7 Taking In Charge

All new wastewater drainage infrastructure, installed to serve the proposed development **is** to be offered to Irish Water for to be taken-in-charge.

6. POTABLE WATER SUPPLY

6.1 Overview

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

6.2 Consultation

A Pre-Connection Enquiry Form has been submitted to Irish Water for review, for both the proposed development, as well as the wider land holding, which forms part of the Maynooth Environs. Irish Water issued a Confirmation of Feasibility Letter (Refer Appendix D of this ESR) for the proposed development, subject to upgrade works being carried out.

OCSC and the applicant have continued correspondence with Irish Water with respect to proposed upgrade works, and have committed to working with Irish Water to resolve all infrastructure works in order to facilitate the proposed development.

6.3 Connection to the Existing Network

There is a 200mm watermain just south from the Kildare Bridge, south of the proposed development. An extension from the existing 200mm watermain to be provided along the MOOR Road, to the connection point at the site boundary. It is anticipated that a metered 150mm HDPE connection will be required to serve the Office Innovation Centre Campus, with a matching internal distribution and fire main.

The proposed development will be subject to a New Connection Agreement with Irish Water, with all details in accordance with the Irish Water Code of Practice and Standard Details

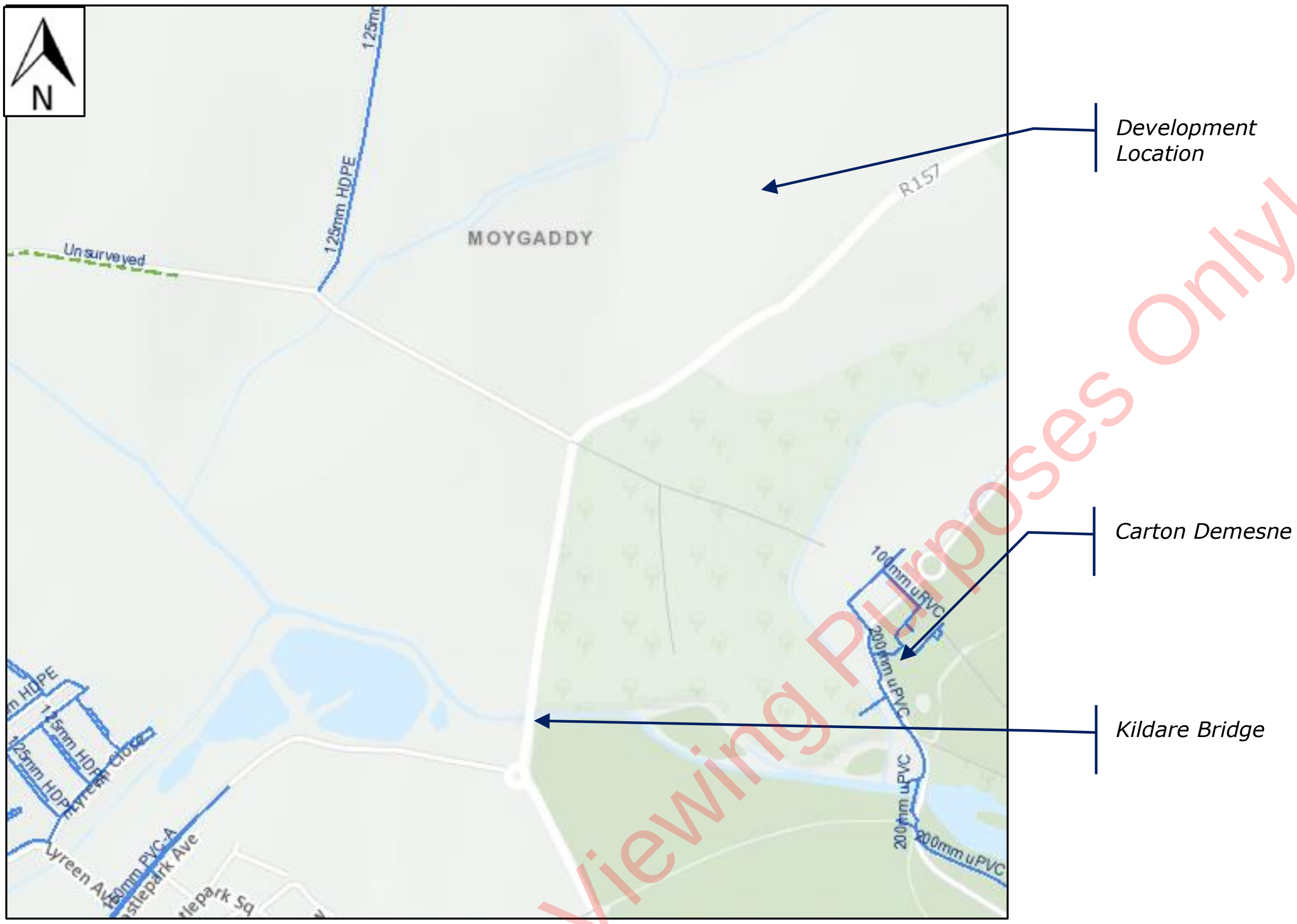


Figure 6.1 - Existing Public Water Infrastructure

6.4 Water Saving Devices

Water saving devices, along with rainwater harvesting systems, are to be considered for use within the proposed development office units, in order to conserve the use of water, as part of the internal fit-out.

6.5 Water Meters

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

7. ROADS AND TRAFFIC

7.6 Design Standards

The proposed development will incorporate a series of design measures, which will be detailed hereinafter, to promote more sustainable modes of transport and support vulnerable road users in line with the core principles of the Design Manual for Urban Roads and Streets (DMURS).

While DMURS is the principle design guideline for the roads elements of this project, the extended list of the main standard documents relied on is:

- National Cycle Manual;
- Traffic Signs Manual 2019;
- DN-PAV-03021: Pavement & Foundation Design;
- GE-STY-01024: Road Safety Audit;
- DN-GEO-03060: Geometric Design of Junctions;
- Traffic Management Guidelines
- NRA IAN 02/11 Interim Requirements for the Use of Eurocodes for the Design of Road Structures Amendment No. 1.

7.7 Proposed Road Network

The proposed development provides for the upgrade of the R157 from the junction with the L22143 north to the edge of the development boundary and then south connecting to the bridge crossing the River Rye into Kildare Co. The proposals also include internal access roads and parking associated with the development.

A separate application will be made to Kildare County Council for the upgrade of the R157 south of the Kildare bridge. This overlap of applications will ensure unimpeded access to the proposed development lands along the R157 for pedestrian and cyclists.

The upgrade of the proposed section of the R157 will take cognisance of the existing approved Part VIII design by Meath County Council Reference P8/10011, and the strategic plan for the Maynooth Outer Relief Road (MOOR). The design of the MOOR will take cognisance of the already constructed section adjacent to Moyglare Hall and also ensure consistency with the recently granted Maynooth Eastern Ring Road planning reference P82019-08. The design will implement latest design standards in agreement with Meath County Council Transportation Section.

The internal road layout and carpark access route will consist of a 6.0m wide carriageway that allows for access to perpendicular parking in line with section 4.4.9 of DMURS.

The development will access via a new priority type junction to the R157. The proposed development entrance will take the form of a simple priority T-Junction.

All junctions are assessed in detail within the final Traffic Impact Assessment.

7.8 Road Classification

The development entrance and internal roads are being designed in accordance with the DMURS, with specific consideration given to the sections including:

- Section 4.3.1 Footways, Verges and Strips
- Section 4.3.2 Pedestrian Crossings
- Section 4.3.3 Corner Radii
- Section 4.3.5 Cycle Facilities
- Section 4.4.1 Carriageway Widths
- Section 4.4.2 Carriageway Surfaces
- Section 4.4.3 Junction Design
- Section 4.4.4 Forward Visibility
- Section 4.4.9 On-Street Parking and Loading

The internal access roads will be used exclusively by the development and not for local traffic. It is noted, however, that as the masterplan envisages the development of adjoining lands in the future, the carriageway widths as part of the development have been upsized to cater for occasional larger vehicles and all other design parameters have been chosen under DMURS.

Table 3.1 of DMURS illustrates how this road hierarchy relates to other relevant documents. An extract of DMURS can be seen in *Figure 7.1*, following.

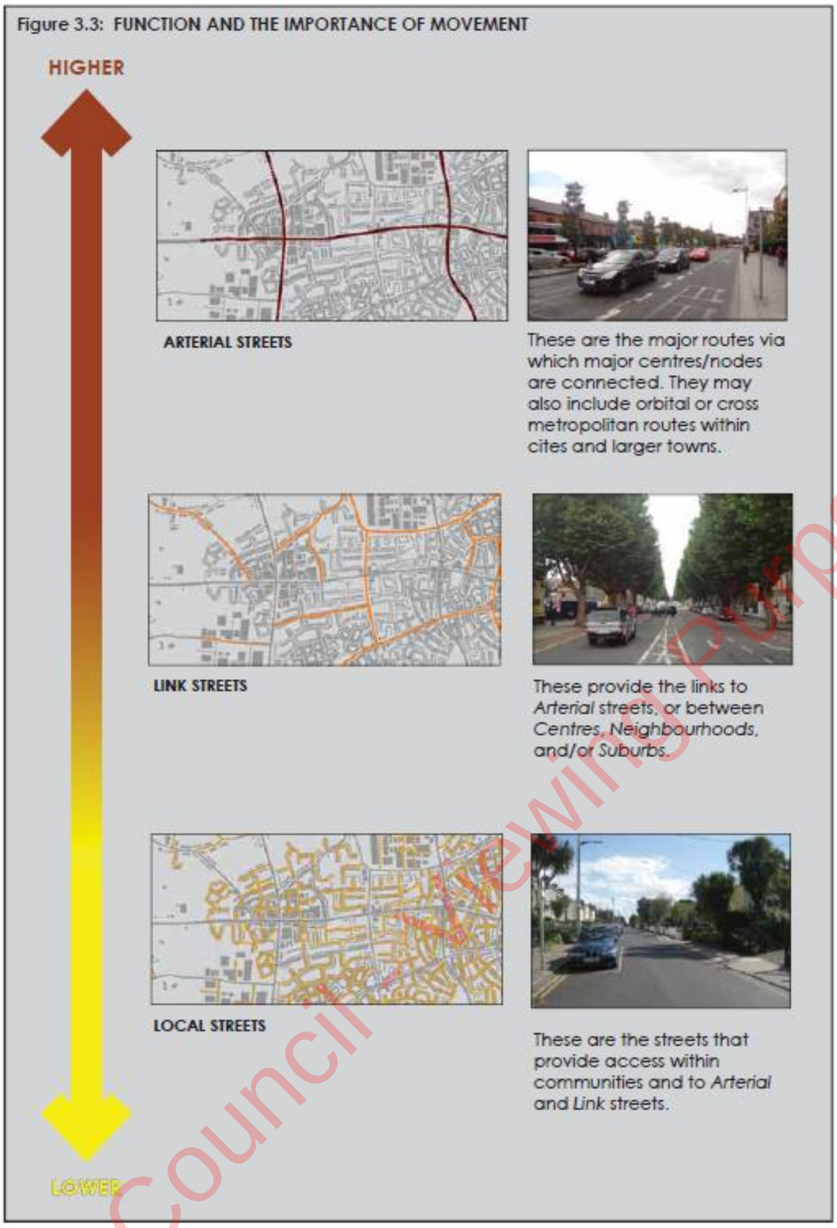


Figure 7.1 – DMURS Street Classification

DMURS Description	Roads Act/NRA DMRB	Traffic Management Guidelines	National Cycle Manual
Arterial	National	Primary Distributor Roads	Distributor
Link	Regional (see note 1)	District Distributor Local Collector (see Notes 1 and 2)	Local Collector
Local	Local	Access	Access

Notes

Note 1: Larger Regional/District Distributors may fall into the category of *Arterial* where they are the main links between major centres (i.e. towns) or have an orbital function.

Note 2: Local Distributors may fall into the category of *Local* street where they are relatively short in length and simply link a neighbourhood to the broader street network.

Table 3.1: Terminology used within this Manual compared with other key publications.

Figure 7.2 – DMURS Street Hierarchy

7.9 Road Design Speeds

The internal road has been designed to a Design Speed of 10-30 kph with geometric parameters chosen under DMURS. This is reflected in Table 4.1 below extracted from DMURS

PEDESTRIAN PRIORITY | VEHICLE PRIORITY | ***Internal Road***

FUNCTION	CENTRE	N'HOOD	SUBURBAN	BUSINESS/ INDUSTRIAL	RURAL FRINGE
ARTERIAL	30-40 KM/H	40-50 KM/H	40-50 KM/H	50-60 KM/H	60-80 KM/H
LINK	30 KM/H	30-50 KM/H	30-50 KM/H	50-60 KM/H	60-80 KM/H
LOCAL	10-30 KM/H	10-30 KM/H	10-30 KM/H	30-50 KM/H	60 KM/H

CONTEXT

Table 4.1: Design speed selection matrix indicating the links between place, movement and speed that need to be taken into account in order to achieve effective and balanced design solutions.

Figure 7.3 – DMURS Design Speeds

It is envisaged at this stage that a Design Speed of 50kph will be chosen for the upgrade of the R157 to tie in with the design of the Maynooth Outer Relief Road and the wider strategic road network including the recently approved Maynooth Eastern Ring Road planning reference P82019-08.

7.10 Horizontal and Vertical Geometry

The internal road alignments will be designed so that the geometric elements, including horizontal and vertical curvature, super elevation and sight distance will be in line with DMURS, having values consistent with the design speeds.

The relevant horizontal and vertical geometric design values are shown in DMURS *Table 4.3* below. A standard carriageway cross fall of 2.5% will be adopted throughout with super elevation applied if necessary, noting that adverse camber is allowable under DMURS designs in accordance with *Table 4.3*. A cross fall of 2.5% will also be used for footpaths and cycle facilities.

HORIZONTAL CURVATURE

Design Speed (km/h)	10	20	30	40	50	60
Minimum Radius with adverse camber of 2.5%	-	11	26	56	104	178
Minimum Radius with superelevation of 2.5 %	-	-	-	46	82	136

VERTICAL CURVATURE

Design Speed (km/h)	10	20	30	40	50	60
Crest Curve K Value	N/A	N/A	N/A	2.6	4.7	8.2
Sag Curve K Value	N/A	N/A	2.3	4.1	6.4	9.2

Table 4.3: Carriageway geometry parameters for horizontal and vertical curvature.

Figure 7.4 – DMURS Geometric Parameters

7.11 Road Cross Section

7.11.5 Carriageway

As mentioned previously, the internal road layout will consist of a 6.0m wide carriageway that allows for access to perpendicular parking within the proposed carpark in line with section 4.4.9 of DMURS.

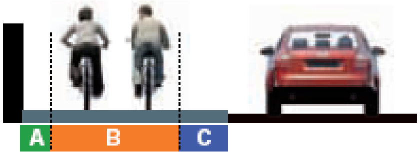
The design of the MOOR and R157 roads will consist of a carriageway width of 7.0m.

7.11.6 Footpaths

The width of the footpaths has been determined by reference to DMURS *Section 4.3.1* with a minimum required width of 1.8 m based on the space needed for two wheelchairs to pass each other.

7.11.7 Cycle Facilities

The cycle lanes along the R157 & MOOR will be designed in accordance with the National Cycle Manual (NCM). Based on the Cycle Width Calculator in the NCM the appropriate cycle path width will be 1.75m giving room for a single file lane with overtaking room. The cycle paths will be separated from traffic by a kerb and verge and there will be a vertical separation on the inside, between the cycle path and footpath.



A Inside Edge	B Cycling Regime	C Outside Edge	D Additional Features
Kerb 0.25m	Single File 0.75m	30kph, 3.0m wide lane 0.50m	Uphill 0.25m Sharp bends 0.25m
Channel Gully 0.25m	Single File + Overtaking, Partially using next lane 1.25m	50kph, 3.0m wide lane 0.75m	Cyclist stacking, Stopping and starting 0.50m
Wall, Fence or Crash Barrier 0.65m	Basic Two-Way 1.75m	Raised kerb, dropped Kerb or physical barrier 0.50m	Around primary schools, Interchanges, or for larger tourist bikes 0.25m
Poles or Bollards 0.50m	Single File + Overtaking, Partially using next lane 2.00m	Kerb to vegetation etc. (ie. cycleway) 0.25m	Taxi ranks, loading, line of parked cars 1.00m (min 0.8m)
	2 Abreast + overtaking (tracks and cycleways) 2.50m		Turning pocket cyclists 0.50m

Example:
To determine required cycle width, select the appropriate Inside Edge, Cycling Regime, Outside Edge and any Additional Features

Channel Gully 0.25m	Single File + Overtaking, Partially using next lane 1.25m	50kph, 3.0m wide lane 0.75m	Around primary schools, Interchanges, or for larger tourist bikes 0.25m

0.25m
+ 1.25m
+ 0.75m
+ 0.25m

Required width = 2.50m Note: This is the maximum width for an on road cycle lane. Cycle tracks can be wider.

Figure 7.5 – NCM Width Calculator

7.12 Road Junctions

The development's junction with the R157 has been designed with the primary principle of providing safe and consistent layouts in order to present a uniformity of approach to drivers and other road users. In addition, junctions will have sufficient capacity to accommodate design year peak traffic flows thus optimising network capacity. The primary junction strategy objectives has been:

- To optimise road safety by ensuring adequate visibility and consistency;
- To ensure capacity for the design year;
- To function as traffic calming measures;
- To provide safe crossing facilities for pedestrians and cyclists.

The operation of the junction is assessed using traffic modelling software and is detailed in a standalone Traffic Impact Assessment.

Junctions have been sized and designed to accommodate future elements of the Moygaddy Masterplan.

7.13 Consultation

OCSC have had interactions with Kildare County Council and Meath County Council on this scheme in relation to the transportation related elements of the scheme, as detailed below:

- OCSC met with Meath County Council on 19 July 2021 to open preliminary discussions on the design of the MOOR. In attendance was Martin Murry (Director of Services for Infrastructure) and Nicholas Whyatt (Senior Engineer Transportation). Since this meeting, a Traffic Modelling Scoping Report has been issues to MCC.
- As noted previously, although the scheme is planned within the Meath County Council jurisdiction, a separate application will be made to KCC for infrastructure within the County. It is however noted that as the largest nearby urban centre is within KCC jurisdiction, they have been consulted as a stakeholder. OCSC met with KCC on 9 August 2021, and 23 September 2021. In attendance was Brigette Rea, Daragh Conlan,

George Willoughby, Jonathan Hennessy, and Lisa Kirwan, all from KCC. The same Traffic Modelling Scoping Report has also been issues to KCC.

- A submission was made on the Maynooth Transport Strategy as part of public consultation no. 1 on the 12th of November 2021. This submission outlines the proposed plans for the area and noted that it should be considered as part of the future Transport Strategy.
- A submission was made to BusConnects on the 15th of November 2021 noting the upcoming proposals as part of the MOOR that noted the BusConnects project should take cognisance of the upcoming works.

OCSC received a number of comments from Meath County Council's Transportation Department as part of their Opinion Report. Following this, further workshopping was done on the MOOR. A meeting was held on 14/07/2022 with various stakeholders at MCC, after which a number of comments were received. Subsequent to this, these comments have been incorporated into the design.

Annexure A details the responses to the comments from the Opinion Report, as well as the comments received and addressed as part of the subsequent MOOR design meeting.

7.14 Traffic Impact

A Traffic Impact Assessment was carried out which considers the current traffic flows and capacity in accordance with the Traffic and Transport Assessment Guidelines May 2014 from Transport Infrastructure Ireland. The Traffic Impact Assessment was done by means of Vissim Micro-Simulation software at the request of Kildare County Council. More details of the TIA can be found in the TIA document submitted under separate cover.

7.15 Site Accessibility

The Moygaddy site is located within walking distance of the town centre of Maynooth that is well serviced by a number of existing public transport options.

The proposed site is a 30-minute walk (2.6km) from the existing Maynooth Train Station that provides convenient access along the Dublin Sligo train line that provides intermediate stops at Carrick on Shannon, Longford, Mullingar, Enfield and Drumcondra. The imminent DART+ Programme will also provide higher frequency connections and capacity to the Maynooth line connecting to Dublin Connolly & Dockland stations.

Figure 7.6 – Site Layout

APPENDIX A. Q_{BAR} Calculation and Rainfall Data

ICP SUDS Mean Annual Flood

Input

Return Period (years)	2	Soil	0.470
Area (ha)	1.000	Urban	0.000
SAAR (mm)	799	Region Number	Ireland East

Results	**l/s**
QBAR Rural	5.6
QBAR Urban	5.6
Q2 years	5.4
Q1 year	4.8
Q30 years	9.2
Q100 years	10.7

Met Eireann

Return Period Rainfall Depths for sliding Durations

Irish Grid: Easting: 294126, Northing: 239157,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.4,	3.4,	4.0,	4.9,	5.4,	5.9,	7.4,	9.2,	10.3,	12.0,	13.4,	14.6,	16.4,	17.8,	18.9,	N/A ,
10 mins	3.3,	4.8,	5.6,	6.8,	7.6,	8.2,	10.3,	12.8,	14.4,	16.7,	18.7,	20.3,	22.8,	24.8,	26.4,	N/A ,
15 mins	3.9,	5.6,	6.5,	8.0,	8.9,	9.7,	12.2,	15.0,	16.9,	19.6,	22.0,	23.9,	26.9,	29.1,	31.0,	N/A ,
30 mins	5.1,	7.3,	8.5,	10.2,	11.4,	12.3,	15.4,	18.8,	21.1,	24.3,	27.2,	29.4,	32.9,	35.6,	37.8,	N/A ,
1 hours	6.8,	9.5,	10.9,	13.1,	14.6,	15.7,	19.4,	23.6,	26.3,	30.2,	33.6,	36.2,	40.3,	43.4,	46.1,	N/A ,
2 hours	9.0,	12.3,	14.1,	16.8,	18.6,	20.0,	24.5,	29.5,	32.8,	37.4,	41.4,	44.6,	49.3,	53.0,	56.1,	N/A ,
3 hours	10.5,	14.4,	16.4,	19.5,	21.5,	23.0,	28.1,	33.7,	37.3,	42.4,	46.9,	50.3,	55.6,	59.6,	63.0,	N/A ,
4 hours	11.8,	16.1,	18.3,	21.6,	23.8,	25.5,	30.9,	37.0,	40.9,	46.4,	51.1,	54.8,	60.5,	64.8,	68.3,	N/A ,
6 hours	13.9,	18.7,	21.3,	25.0,	27.5,	29.4,	35.4,	42.2,	46.5,	52.6,	57.9,	61.9,	68.1,	72.8,	76.7,	N/A ,
9 hours	16.3,	21.9,	24.7,	28.9,	31.7,	33.8,	40.6,	48.1,	52.9,	59.6,	65.4,	69.9,	76.7,	81.9,	86.1,	N/A ,
12 hours	18.3,	24.4,	27.5,	32.1,	35.1,	37.4,	44.8,	52.8,	58.0,	65.2,	71.4,	76.2,	83.4,	88.9,	93.5,	N/A ,
18 hours	21.6,	28.4,	32.0,	37.1,	40.5,	43.1,	51.3,	60.3,	66.0,	73.9,	80.8,	86.0,	93.9,	100.0,	104.9,	N/A ,
24 hours	24.2,	31.7,	35.6,	41.2,	44.9,	47.7,	56.6,	66.2,	72.4,	80.8,	88.2,	93.8,	102.2,	108.6,	113.9,	131.9,
2 days	30.0,	38.5,	42.7,	48.8,	52.8,	55.8,	65.2,	75.3,	81.7,	90.3,	97.8,	103.4,	111.9,	118.3,	123.5,	141.2,
3 days	35.0,	44.2,	48.8,	55.3,	59.5,	62.7,	72.6,	83.2,	89.8,	98.8,	106.5,	112.2,	120.9,	127.4,	132.7,	150.5,
4 days	39.4,	49.2,	54.1,	61.0,	65.5,	68.9,	79.3,	90.3,	97.2,	106.4,	114.3,	120.3,	129.1,	135.8,	141.2,	159.3,
6 days	47.2,	58.3,	63.7,	71.3,	76.1,	79.8,	91.1,	102.9,	110.2,	120.0,	128.4,	134.6,	143.9,	150.8,	156.4,	175.2,
8 days	54.3,	66.4,	72.2,	80.4,	85.7,	89.6,	101.6,	114.1,	121.8,	132.2,	140.9,	147.4,	157.1,	164.3,	170.1,	189.5,
10 days	61.0,	73.9,	80.2,	88.9,	94.4,	98.6,	111.3,	124.4,	132.5,	143.3,	152.4,	159.1,	169.2,	176.6,	182.6,	202.6,
12 days	67.3,	81.0,	87.6,	96.8,	102.7,	107.0,	120.3,	134.1,	142.5,	153.7,	163.1,	170.1,	180.5,	188.2,	194.4,	214.9,
16 days	79.1,	94.3,	101.6,	111.7,	118.1,	122.8,	137.2,	152.0,	161.0,	173.0,	183.0,	190.4,	201.4,	209.5,	216.0,	237.6,
20 days	90.3,	106.8,	114.7,	125.6,	132.4,	137.5,	152.9,	168.5,	178.1,	190.8,	201.3,	209.1,	220.6,	229.1,	235.9,	258.4,
25 days	103.6,	121.6,	130.2,	141.9,	149.3,	154.7,	171.2,	187.9,	198.1,	211.5,	222.7,	230.9,	243.0,	251.9,	259.1,	282.6,

NOTES:

N/A Data not available

These values are derived from a Depth Duration Frequency (DDF) Model

For details refer to:

'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

APPENDIX B. Surface Water Design Criteria and Simulation Results

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	15.900	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.285	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	20	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA1.000	66.907	0.394	170.0	0.193	4.00	0.0	0.600	o	225	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA1.000	50.00	5.12	57.800	0.193	0.0	0.0	5.2	1.00	39.8	31.4

Network Design Table for Storm Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA1.001	8.085	0.048	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA2.000	67.781	0.678	100.0	0.241	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA4.000	55.131	0.324	170.0	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA3.004	13.411	0.041	325.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SA3.005	59.037	0.182	325.0	0.080	0.00	0.0	0.600	o	300	Pipe/Conduit	
SA3.006	9.009	0.022	410.0	0.007	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA1.001	50.00	5.25	57.406	0.193	0.0	0.0	5.2	1.00	39.8	31.4
SA2.000	50.00	4.86	57.283	0.241	0.0	0.0	6.5	1.31	52.0	39.2
SA4.000	50.00	4.92	58.313	0.000	0.0	0.0	0.0	1.00	39.8	0.0
SA3.004	50.00	6.51	57.489	0.253	0.0	0.0	6.9	0.87	61.3	41.1
SA3.005	50.00	7.64	57.448	0.333	0.0	0.0	9.0	0.87	61.3	54.1
SA3.006	50.00	7.81	57.191	0.340	0.0	0.0	9.2	0.89	98.1	55.2

Network Design Table for Storm Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA5.000	36.851	0.217	170.0	0.165	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA5.001	3.624	0.021	170.0	0.014	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA3.007	3.800	0.009	410.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
SA3.008	45.262	0.110	410.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
SA3.009	4.723	0.028	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA3.010	6.599	0.039	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA3.011	29.526	0.174	170.0	0.047	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA6.000	28.389	0.167	170.0	0.144	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA5.000	50.00	4.61	58.041	0.165	0.0	0.0	4.5	1.00	39.8	26.8
SA5.001	50.00	4.67	57.824	0.178	0.0	0.0	4.8	1.00	39.8	28.9
SA3.007	50.00	7.88	57.169	0.518	0.0	0.0	14.0	0.89	98.1	84.2
SA3.008	48.11	8.73	57.160	0.518	0.0	0.0	14.0	0.89	98.1	84.2
SA3.009	50.00	4.08	57.049	0.000	2.0	0.0	0.3	1.00	39.8	2.0
SA3.010	50.00	4.19	57.022	0.000	2.0	0.0	0.4	1.00	39.8	2.4
SA3.011	50.00	4.68	56.983	0.047	2.0	0.0	1.7	1.00	39.8	10.0
SA6.000	50.00	4.47	57.931	0.144	0.0	0.0	3.9	1.00	39.8	23.4

Network Design Table for Storm Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA3.012	13.503	0.079	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA7.000	17.931	0.105	170.0	0.017	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA7.001	47.522	0.280	170.0	0.160	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA3.013	22.090	0.090	245.0	0.007	0.00	0.0	0.600	o	300	Pipe/Conduit	
SA8.000	33.584	0.198	170.0	0.043	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA8.001	19.236	0.677	28.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA3.012	50.00	4.91	56.809	0.191	2.0	0.0	5.6	1.00	39.8	33.4
SA7.000	50.00	4.30	56.577	0.017	0.0	0.0	0.5	1.00	39.8	2.7
SA7.001	50.00	5.09	56.472	0.177	0.0	0.0	4.8	1.00	39.8	28.7
SA3.013	50.00	5.46	56.117	0.375	2.0	0.0	10.6	1.00	70.7	63.3
SA8.000	50.00	4.56	58.321	0.043	0.0	0.0	1.2	1.00	39.8	7.0
SA8.001	50.00	4.69	58.123	0.043	0.0	0.0	1.2	2.46	98.0	7.0

Network Design Table for Storm Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA9.000	51.615	0.304	170.0	0.083	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA8.002	9.253	0.207	44.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA10.000	51.350	0.347	148.0	0.172	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA10.001	3.447	0.020	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA3.014	5.887	0.018	325.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
SA3.015	44.008	0.135	325.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA9.000	50.00	4.86	57.750	0.083	0.0	0.0	2.2	1.00	39.8	13.5
SA8.002	50.00	4.94	57.446	0.126	0.0	0.0	3.4	1.96	78.0	20.4
SA10.000	50.00	4.80	57.546	0.172	0.0	0.0	4.7	1.07	42.6	28.0
SA10.001	50.00	4.86	57.199	0.172	0.0	0.0	4.7	1.00	39.8	28.0
SA3.014	50.00	5.55	55.877	0.673	2.0	0.0	18.6	1.12	178.5	111.7
SA3.015	50.00	6.20	55.859	0.673	2.0	0.0	18.6	1.12	178.5	111.7

Network Design Table for Storm Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA3.016	3.242	0.019	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA3.017	4.724	0.028	170.0	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA11.001	16.172	0.095	170.0	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA11.002	25.432	0.104	245.0	0.024	0.00	0.0	0.600	o	300	Pipe/Conduit	
SA11.003	20.870	0.064	325.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
SA2.001	4.465	0.014	325.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
SA14.000	27.732	0.163	170.0	0.215	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA3.016	50.00	4.05	55.723	0.000	4.3	0.0	0.7	1.00	39.8	4.3
SA3.017	50.00	4.13	55.704	0.013	4.3	0.0	1.2	1.00	39.8	7.2
SA11.001	50.00	5.24	58.115	0.054	0.0	0.0	1.5	1.00	39.8	8.7
SA11.002	50.00	6.41	57.194	0.392	0.0	0.0	10.6	1.00	70.7	63.8
SA11.003	50.00	6.76	57.015	0.392	0.0	0.0	10.6	1.00	110.4	63.8
SA2.001	50.00	6.84	55.591	0.646	4.3	0.0	18.4	1.00	110.4	110.2
SA14.000	50.00	4.46	57.185	0.215	0.0	0.0	5.8	1.00	39.8	34.9

Network Design Table for Storm Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA14.001	65.268	0.201	325.0	0.091	0.00	0.0	0.600	o	300	Pipe/Conduit	
SA14.002	4.623	0.014	325.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
SA1.002	5.364	0.009	590.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
SA1.003	52.748	0.089	590.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
SA1.004	2.721	0.016	170.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.005	25.814	0.152	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.006	10.268	0.060	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.007	42.827	0.252	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.008	49.019	0.288	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA14.001	50.00	5.72	56.947	0.306	0.0	0.0	8.3	0.87	61.3	49.7
SA14.002	50.00	5.79	56.671	0.306	0.0	0.0	8.3	1.00	110.4	49.7
SA1.002	50.00	6.93	55.427	1.146	4.3	0.0	31.9	0.91	198.1	191.3
SA1.003	50.00	7.90	55.418	1.146	4.3	0.0	31.9	0.91	198.1	191.3
SA1.004	50.00	4.05	55.329	0.000	10.2	0.0	1.7	1.00	39.7	10.2
SA1.005	50.00	4.48	55.313	0.000	10.2	0.0	2.0	1.00	39.8	12.2
SA1.006	50.00	4.65	55.161	0.000	10.2	0.0	2.0	1.00	39.8	12.2
SA1.007	47.23	9.09	55.101	0.000	10.2	0.0	2.0	1.00	39.8	12.2
SA1.008	45.36	9.91	54.849	0.000	10.2	0.0	2.0	1.00	39.8	12.2

Network Design Table for Storm Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA1.009	12.000	0.071	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA16.000	45.114	0.265	169.9	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.010	11.740	0.069	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.011	20.115	0.118	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.012	56.470	0.332	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.013	88.807	0.522	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.014	76.481	0.450	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.015	14.996	0.088	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA1.009	44.93	10.11	54.560	0.000	10.2	0.0	2.0	1.00	39.8	12.2
SA16.000	50.00	4.75	57.436	0.000	0.0	0.0	0.0	1.00	39.8	0.0
SA1.010	44.51	10.30	54.490	0.000	10.2	0.0	2.0	1.00	39.8	12.2
SA1.011	43.83	10.64	54.421	0.000	10.2	0.0	2.0	1.00	39.8	12.2
SA1.012	42.04	11.58	54.302	0.000	10.2	0.0	2.0	1.00	39.8	12.2
SA1.013	39.56	13.06	53.970	0.000	10.2	0.0	2.0	1.00	39.8	12.2
SA1.014	37.69	14.33	53.448	0.000	10.2	0.0	2.0	1.00	39.8	12.2
SA1.015	37.35	14.58	52.998	0.000	10.2	0.0	2.0	1.00	39.8	12.2

Network Design Table for Storm Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA1.016	87.760	2.990	29.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.017	50.915	2.500	20.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.018	9.300	1.070	8.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.019	44.349	1.590	27.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.020	15.661	0.092	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA1.016	36.56	15.19	52.910	0.000	10.2	0.0	2.0	2.42	96.4	12.2
SA1.017	36.19	15.48	49.920	0.000	10.2	0.0	2.0	2.91	115.8	12.2
SA1.018	36.15	15.51	46.347	0.000	10.2	0.0	2.0	4.47	177.5	12.2
SA1.019	35.79	15.81	45.277	0.000	10.2	0.0	2.0	2.49	98.9	12.2
SA1.020	35.47	16.07	43.687	0.000	10.2	0.0	2.0	1.00	39.8	12.2

Area Summary for Storm Network 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	As Zoned	Default	100	0.001	0.001	0.001
		Roof	100	0.096	0.096	0.097
	As Zoned	Default	100	0.001	0.001	0.098
		Road / Footpath	100	0.056	0.056	0.154
		Pervious Paving	70	0.057	0.040	0.193
1.001	-	-	100	0.000	0.000	0.000
2.000	As Zoned	Default	100	0.001	0.001	0.001
		Roof	100	0.165	0.165	0.165
	As Zoned	Default	100	0.013	0.013	0.179
		Road / Footpath	100	0.038	0.038	0.216
		Pervious Paving	70	0.036	0.025	0.241
4.000	-	-	100	0.000	0.000	0.000
3.004	-	-	100	0.000	0.000	0.000
3.005	As Zoned	Default	100	0.006	0.006	0.006
		Road / Footpath	100	0.042	0.042	0.047
		Pervious Paving	70	0.046	0.032	0.080
3.006	As Zoned	Road / Footpath	100	0.004	0.004	0.004
		Pervious Paving	70	0.004	0.003	0.007
5.000	As Zoned	Default	100	0.074	0.074	0.074
	As Zoned	Default	100	0.001	0.001	0.075
		Roof	100	0.089	0.089	0.165
5.001	As Zoned	Road / Footpath	100	0.009	0.009	0.009
		Pervious Paving	70	0.020	0.014	0.014
3.007	-	-	100	0.000	0.000	0.000
3.008	-	-	100	0.000	0.000	0.000
3.009	-	-	100	0.000	0.000	0.000
3.010	-	-	100	0.000	0.000	0.000

Area Summary for Storm Network 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
3.011	As Zoned	Default	100	0.006	0.006	0.006
		Road / Footpath	100	0.031	0.031	0.037
		Pervious Paving	70	0.014	0.009	0.047
6.000	As Zoned	Roof	100	0.101	0.101	0.102
	As Zoned	Default	100	0.006	0.006	0.107
		Road / Footpath	100	0.019	0.019	0.126
		Pervious Paving	70	0.025	0.017	0.144
3.012	-	-	100	0.000	0.000	0.000
7.000	As Zoned	Road / Footpath	100	0.017	0.017	0.017
7.001	As Zoned	Road / Footpath	100	0.042	0.042	0.042
	As Zoned	Default	100	0.002	0.002	0.044
		Roof	100	0.115	0.115	0.160
3.013	As Zoned	Road / Footpath	100	0.007	0.007	0.007
8.000	As Zoned	Road / Footpath	100	0.043	0.043	0.043
8.001	-	-	100	0.000	0.000	0.000
9.000	As Zoned	Default	100	0.002	0.002	0.002
		Road / Footpath	100	0.049	0.049	0.051
		Pervious Paving	70	0.046	0.032	0.083
8.002	-	-	100	0.000	0.000	0.000
10.000	As Zoned	Default	100	0.003	0.003	0.003
		Roof	100	0.105	0.105	0.108
		Road / Footpath	100	0.000	0.000	0.108
		Pervious Paving	70	0.000	0.000	0.108
	As Zoned	Road / Footpath	100	0.033	0.033	0.142
		Pervious Paving	70	0.043	0.030	0.172
10.001	-	-	100	0.000	0.000	0.000
3.014	-	-	100	0.000	0.000	0.000

Area Summary for Storm Network 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
3.015	-	-	100	0.000	0.000	0.000
3.016	-	-	100	0.000	0.000	0.000
3.017	As Zoned	Road / Footpath	100	0.013	0.013	0.013
		Pervious Paving	70	0.000	0.000	0.013
11.001	As Zoned	Road / Footpath	100	0.014	0.014	0.008
11.002	As Zoned	Road / Footpath	100	0.018	0.018	0.018
		Pervious Paving	70	0.007	0.005	0.024
11.003	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
14.000	As Zoned	Roof	100	0.178	0.178	0.178
	As Zoned	Road / Footpath	100	0.038	0.038	0.216
		Pervious Paving	70	0.012	0.008	0.215
14.001	As Zoned	Roof	100	0.007	0.007	0.007
	As Zoned	Default	100	0.003	0.003	0.010
		Road / Footpath	100	0.048	0.048	0.058
		Pervious Paving	70	0.043	0.030	0.081
	As Zoned	Road / Footpath	100	0.002	0.002	0.091
		Pervious Paving	70	0.005	0.003	0.091
14.002	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000

Area Summary for Storm Network 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
16.000	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.000	0.000	0.000
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
1.014	-	-	100	0.000	0.000	0.000
1.015	-	-	100	0.000	0.000	0.000
1.016	-	-	100	0.000	0.000	0.000
1.017	-	-	100	0.000	0.000	0.000
1.018	-	-	100	0.000	0.000	0.000
1.019	-	-	100	0.000	0.000	0.000
1.020	-	-	100	0.000	0.000	0.000
				Total 1.858	Total 1.722	Total 1.722

Free Flowing Outfall Details for Storm Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SA1.020	SA	45.910	43.595	0.000	0	0

Online Controls for Storm Network 2

Hydro-Brake® Optimum Manhole: SAMH-16, DS/PN: SA3.009, Volume (m³): 7.9

Unit Reference	MD-SHE-0056-2000-2100-2000	Sump Available	Yes
Design Head (m)	2.100	Diameter (mm)	56
Design Flow (l/s)	2.0	Invert Level (m)	57.049
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	2.0	Kick-Flo®	0.504	1.1
Flush-Flo™	0.247	1.3	Mean Flow over Head Range	-	1.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.1	0.600	1.1	1.600	1.8	2.600	2.2	5.000	3.0	7.500	3.6
0.200	1.3	0.800	1.3	1.800	1.9	3.000	2.4	5.500	3.1	8.000	3.7
0.300	1.3	1.000	1.4	2.000	2.0	3.500	2.5	6.000	3.2	8.500	3.8
0.400	1.2	1.200	1.6	2.200	2.0	4.000	2.7	6.500	3.4	9.000	3.9
0.500	1.1	1.400	1.7	2.400	2.1	4.500	2.8	7.000	3.5	9.500	4.0

Hydro-Brake® Optimum Manhole: SAMH-32, DS/PN: SA3.016, Volume (m³): 10.7

Unit Reference	MD-SHE-0084-4300-2100-4300	Sump Available	Yes
Design Head (m)	2.100	Diameter (mm)	84
Design Flow (l/s)	4.3	Invert Level (m)	55.723
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	4.3	Kick-Flo®	0.747	2.7
Flush-Flo™	0.362	3.3	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.5	0.600	3.1	1.600	3.8	2.600	4.7	5.000	6.4	7.500	7.8
0.200	3.1	0.800	2.8	1.800	4.0	3.000	5.1	5.500	6.7	8.000	8.0
0.300	3.3	1.000	3.0	2.000	4.2	3.500	5.4	6.000	7.0	8.500	8.3
0.400	3.3	1.200	3.3	2.200	4.4	4.000	5.8	6.500	7.3	9.000	8.5
0.500	3.3	1.400	3.6	2.400	4.6	4.500	6.1	7.000	7.6	9.500	8.7

Hydro-Brake® Optimum Manhole: SAMH-48, DS/PN: SA1.004, Volume (m³): 16.4

Unit Reference	MD-SHE-0131-1020-2100-1020	Flush-Flo™	Calculated
Design Head (m)	2.100	Objective	Minimise upstream storage
Design Flow (l/s)	10.2	Application	Surface

Hydro-Brake® Optimum Manhole: SAMH-48, DS/PN: SA1.004, Volume (m³): 16.4

Sump Available	Yes	Minimum Outlet Pipe Diameter (mm)	150
Diameter (mm)	131	Suggested Manhole Diameter (mm)	1500
Invert Level (m)	55.329		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	10.2	Kick-Flo®	1.165	7.7
Flush-Flo™	0.566	9.8	Mean Flow over Head Range	-	8.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.7	0.600	9.8	1.600	9.0	2.600	11.3	5.000	15.4	7.500	18.7
0.200	8.2	0.800	9.6	1.800	9.5	3.000	12.1	5.500	16.1	8.000	19.3
0.300	9.1	1.000	8.9	2.000	10.0	3.500	13.0	6.000	16.8	8.500	19.8
0.400	9.6	1.200	7.8	2.200	10.4	4.000	13.8	6.500	17.5	9.000	20.4
0.500	9.8	1.400	8.4	2.400	10.9	4.500	14.6	7.000	18.1	9.500	20.9

Storage Structures for Storm Network 2

Cellular Storage Manhole: SAMH-16, DS/PN: SA3.009

Invert Level (m) 57.049 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)
0.000	250.0	0.0	2.100	250.0	0.0	2.101	0.0	0.0

Cellular Storage Manhole: SAMH-32, DS/PN: SA3.016

Invert Level (m) 55.723 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)
0.000	240.0	0.0	2.100	240.0	0.0	2.101	0.0	0.0

Cellular Storage Manhole: SAMH-48, DS/PN: SA1.004

Invert Level (m) 55.479 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)
0.000	290.0	0.0	2.100	290.0	0.0	2.101	0.0	0.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm Network 2

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 15.900 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.285 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flow / Cap.	Pipe Flow (l/s)	Status
SA1.000	SAMH-1	15 minute 100 year Winter I+20%	58.775	58.756	0.731	1.55	59.6	FLOOD RISK
SA1.001	SAMH-2	15 minute 100 year Winter I+20%	58.701	57.747	0.116	1.92	58.9	SURCHARGED

Summary of Critical Results by Maximum Level (Rank 1) for Storm Network 2

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flow / Cap.	Pipe Flow (l/s)	Status
SA2.000	SAMH-3	15 minute 100 year Winter I+20%	58.258	58.254	0.746	1.45	73.3	FLOOD RISK
SA4.000	SAMH-6	15 minute 100 year Winter I+20%	59.288	58.334	-0.204	0.00	0.1	OK
SA3.004	SAMH-9	2160 minute 100 year Winter I+20%	59.315	58.317	0.529	0.08	4.1	SURCHARGED
SA3.005	SAMH-10	2160 minute 100 year Winter I+20%	59.320	58.317	0.569	0.09	5.4	SURCHARGED
SA3.006	SAMH-11	2160 minute 100 year Winter I+20%	59.351	58.315	0.749	0.09	5.4	SURCHARGED
SA5.000	SAMH-12	15 minute 100 year Winter I+20%	59.016	58.718	0.452	1.51	56.7	FLOOD RISK
SA5.001	SAMH-13	2160 minute 100 year Winter I+20%	59.167	58.315	0.266	0.12	3.2	SURCHARGED
SA3.007	SAMH-14	2160 minute 100 year Winter I+20%	59.212	58.315	0.771	0.11	8.6	SURCHARGED
SA3.008	SAMH-15	2160 minute 100 year Winter I+20%	59.290	58.315	0.780	0.09	8.5	SURCHARGED
SA3.009	SAMH-16	2160 minute 100 year Winter I+20%	59.176	58.314	1.039	0.05	1.4	SURCHARGED
SA3.010	SAMH-17	1440 minute 100 year Winter I+20%	59.272	57.465	0.219	0.05	1.4	SURCHARGED
SA3.011	SAMH-18	1440 minute 100 year Winter I+20%	59.207	57.464	0.256	0.06	2.4	SURCHARGED
SA6.000	SAMH-19	15 minute 100 year Winter I+20%	58.906	58.365	0.209	1.50	55.5	SURCHARGED
SA3.012	SAMH-20	1440 minute 100 year Winter I+20%	59.065	57.461	0.426	0.17	5.8	SURCHARGED
SA7.000	SAMH-21	1440 minute 100 year Winter I+20%	57.552	57.459	0.657	0.01	0.4	FLOOD RISK
SA7.001	SAMH-22	1440 minute 100 year Winter I+20%	57.926	57.459	0.762	0.11	4.0	SURCHARGED
SA3.013	SAMH-23	1440 minute 100 year Winter I+20%	58.910	57.457	1.040	0.15	9.6	SURCHARGED
SA8.000	SAMH-24	15 minute 100 year Winter I+20%	59.296	58.428	-0.118	0.46	17.0	OK
SA8.001	SAMH-25	15 minute 100 year Winter I+20%	59.476	58.191	-0.158	0.19	16.9	OK
SA9.000	SAMH-26	15 minute 100 year Winter I+20%	58.725	57.914	-0.061	0.83	31.6	OK
SA8.002	SAMH-27	15 minute 100 year Winter I+20%	58.442	57.595	-0.076	0.77	49.2	OK
SA10.000	SAMH-28	15 minute 100 year Winter I+20%	58.521	58.261	0.490	1.40	57.1	FLOOD RISK
SA10.001	SAMH-29	15 minute 100 year Winter I+20%	58.174	57.555	0.131	2.15	56.7	SURCHARGED
SA3.014	SAMH-30	1440 minute 100 year Winter I+20%	58.214	57.455	1.128	0.15	16.7	SURCHARGED
SA3.015	SAMH-31	1440 minute 100 year Winter I+20%	58.242	57.454	1.145	0.10	16.6	SURCHARGED

Summary of Critical Results by Maximum Level (Rank 1) for Storm Network 2

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flow / Cap.	Pipe Flow (l/s)	Status
SA3.016	SAMH-32	1440 minute 100 year Winter I+20%	58.450	57.452	1.504	0.13	3.3	SURCHARGED
SA3.017	SAMH-33	960 minute 100 year Winter I+20%	58.669	57.200	1.271	0.12	3.5	SURCHARGED
SA11.001	SAMH-35	15 minute 100 year Winter I+20%	59.160	58.239	-0.102	0.58	20.4	OK
SA11.002	SAMH-40	15 minute 100 year Winter I+20%	59.125	57.689	0.195	1.68	106.2	SURCHARGED
SA11.003	SAMH-41	15 minute 100 year Winter I+20%	58.868	57.390	0.000	1.14	106.2	SURCHARGED
SA2.001	SAMH-42	960 minute 100 year Winter I+20%	58.701	57.198	1.232	0.30	23.2	SURCHARGED
SA14.000	SAMH-43	15 minute 100 year Winter I+20%	58.160	58.156	0.746	1.86	68.7	FLOOD RISK
SA14.001	SAMH-44	15 minute 100 year Winter I+20%	58.496	57.605	0.358	1.59	93.0	SURCHARGED
SA14.002	SAMH-45	960 minute 100 year Winter I+20%	58.523	57.197	0.151	0.13	9.8	SURCHARGED
SA1.002	SAMH-46	960 minute 100 year Winter I+20%	58.717	57.196	1.244	0.24	39.0	SURCHARGED
SA1.003	SAMH-47	960 minute 100 year Winter I+20%	58.582	57.195	1.252	0.22	38.8	SURCHARGED
SA1.004	SAMH-48	960 minute 100 year Winter I+20%	58.347	57.192	1.638	0.36	9.8	SURCHARGED
SA1.005	SAMH-49	15 minute 100 year Summer I+20%	58.582	55.391	-0.146	0.27	9.8	OK
SA1.006	SAMH-50	720 minute 100 year Winter I+20%	58.197	55.244	-0.142	0.29	9.8	OK
SA1.007	SAMH-56	720 minute 100 year Winter I+20%	58.063	55.178	-0.148	0.26	9.8	OK
SA1.008	SAMH-57	8640 minute 100 year Summer I+20%	57.830	54.926	-0.148	0.26	9.8	OK
SA1.009	SAMH-58	8640 minute 100 year Summer I+20%	57.146	54.642	-0.143	0.29	9.8	OK
SA16.000	SAMH-59	15 minute 100 year Summer I+20%	58.661	57.436	-0.225	0.00	0.0	OK
SA1.010	SAMH-66	8640 minute 100 year Summer I+20%	57.269	54.572	-0.143	0.29	9.8	OK
SA1.011	SAMH-74	7200 minute 100 year Winter I+20%	56.664	54.500	-0.146	0.27	9.8	OK
SA1.012	SAMH-75	7200 minute 100 year Summer I+20%	56.562	54.379	-0.148	0.26	9.8	OK
SA1.013	SAMH-76	480 minute 100 year Winter I+20%	55.950	54.046	-0.149	0.25	9.8	OK
SA1.014	SAMH-77	4320 minute 100 year Winter I+20%	55.088	53.524	-0.149	0.25	9.8	OK
SA1.015	SAMH-78	7200 minute 100 year Winter I+20%	54.600	53.079	-0.144	0.28	9.8	OK
SA1.016	SAMH-79	7200 minute 100 year Winter I+20%	54.190	52.958	-0.177	0.10	9.8	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm Network 2

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flow / Cap.	Pipe Flow (l/s)	Status
SA1.017	SAMH-80	7200 minute 100 year Winter I+20%	51.070	49.964	-0.180	0.09	9.8	OK
SA1.018	SAMH-91	7200 minute 100 year Winter I+20%	48.570	46.385	-0.187	0.07	9.8	OK
SA1.019	SAMH-92	7200 minute 100 year Winter I+20%	46.500	45.325	-0.177	0.10	9.8	OK
SA1.020	SAMH-93	7200 minute 100 year Winter I+20%	45.910	43.768	-0.145	0.28	9.8	OK

APPENDIX C. Wastewater Design Calculation and Network Details

O'Connor Sutton Cronin		Page 1
9 Prussia Street Dublin 7 Ireland	Strategic Employment Campus (Biotechnology & Life Sciences) Development	
Date 24/08/2022 16:16 File S665-OCSC-1A-XX-M2-C-0001-S1-P01.10.MDX	Designed by EH Checked by MK	
XP Solutions	Network 2020.1.3	

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Unit

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Domestic (l/s/ha)	0.00	Maximum Backdrop Height (m)	1.500
Industrial Peak Flow Factor	0.00	Domestic Peak Flow Factor	6.00	Min Design Depth for Optimisation (m)	0.900
Calculation Method	BS 8301	Add Flow / Climate Change (%)	0	Min Vel for Auto Design only (m/s)	0.75
Frequency Factor	0.00	Minimum Backdrop Height (m)	0.200	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WA1.000	27.100	0.417	65.0	0.000	15.0	0.0	1.500	o	150	Pipe/Conduit	🔒

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WA1.000	57.214	0.000	0.0	15.0	0.0	37	0.75	1.09	19.2	2.6

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WA2.000	33.314	0.513	65.0	0.000	15.0	0.0	1.500	o	150	Pipe/Conduit	
WA2.001	61.697	0.949	65.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
WA3.000	63.004	0.969	65.0	0.000	15.0	0.0	1.500	o	150	Pipe/Conduit	
WA4.012	20.711	0.238	87.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
WA4.013	11.424	0.131	87.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
WA12.000	56.990	0.877	65.0	0.000	15.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WA2.000	57.300	0.000	0.0	15.0	0.0	37	0.75	1.09	19.2	2.6
WA2.001	56.787	0.000	0.0	15.0	0.0	37	0.75	1.09	19.2	2.6
WA3.000	57.258	0.000	0.0	15.0	0.0	37	0.75	1.09	19.2	2.6
WA4.012	53.485	0.000	0.0	120.0	0.0	44	0.75	1.23	48.9	4.1
WA4.013	53.247	0.000	0.0	120.0	0.0	44	0.75	1.23	48.9	4.1
WA12.000	58.277	0.000	0.0	15.0	0.0	37	0.75	1.09	19.2	2.6

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WA13.000	55.795	0.858	65.0	0.000	15.0	0.0	1.500	o	150	Pipe/Conduit	
WA12.001	20.261	0.270	75.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
WA14.004	17.048	0.227	75.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
WA12.002	52.183	0.614	85.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
WA12.003	24.566	0.289	85.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
WA4.014	17.937	0.193	93.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WA13.000	58.095	0.000	0.0	15.0	0.0	37	0.75	1.09	19.2	2.6
WA12.001	57.237	0.000	0.0	30.0	0.0	42	0.75	1.01	17.9	3.0
WA14.004	56.474	0.000	0.0	30.0	0.0	42	0.75	1.01	17.9	3.0
WA12.002	56.246	0.000	0.0	60.0	0.0	47	0.75	0.95	16.8	3.5
WA12.003	55.632	0.000	0.0	60.0	0.0	47	0.75	0.95	16.8	3.5
WA4.014	53.116	0.000	0.0	180.0	0.0	47	0.75	1.19	47.3	4.5

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WA2.002	67.249	0.708	95.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
WA1.001	38.801	0.408	95.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
WA16.002	35.707	0.143	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	
WA16.003	53.188	0.213	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	
WA16.004	80.613	0.322	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	
WA1.002	47.930	0.192	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WA2.002	52.923	0.000	0.0	210.0	0.0	48	0.75	1.18	46.8	4.7
WA1.001	52.215	0.000	0.0	225.0	0.0	49	0.76	1.18	46.8	4.8
WA16.002	56.964	0.000	0.0	0.0	0.0	0	0.00	0.88	61.9	0.0
WA16.003	56.821	0.000	0.0	0.0	0.0	0	0.00	0.88	61.9	0.0
WA16.004	56.608	0.000	0.0	0.0	0.0	0	0.00	0.88	61.9	0.0
WA1.002	51.732	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WA1.003	46.675	0.187	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒
WA1.004	25.633	0.103	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒
WA1.005	38.575	0.154	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒
WA1.006	55.795	0.223	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒
WA1.007	29.183	0.117	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒
WA1.008	55.695	0.223	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒
WA1.009	60.667	0.243	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒
WA1.010	35.940	0.144	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒
WA1.011	36.895	0.148	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒
WA1.012	38.447	0.154	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	🔒

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WA1.003	51.540	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.004	51.353	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.005	51.251	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.006	51.096	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.007	50.873	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.008	50.756	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.009	50.534	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.010	50.291	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.011	50.147	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.012	50.000	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WA1.013	54.446	0.218	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	
WA1.014	50.011	0.200	250.0	0.000	0.0	0.0	1.500	o	300	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WA1.013	49.846	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8
WA1.014	49.628	0.000	0.0	225.0	0.0	56	0.52	0.88	61.9	4.8

O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

APPENDIX D. Irish Water Correspondence

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

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

www.water.ie

Mark Killian

9 Prussia Street
Stoneybatter
Dublin 7
D07KT57

20 October 2021

Re: CDS21003387 pre-connection enquiry - Subject to contract | Contract denied

Connection for Business Connection of 12 unit(s) at Phase 1B, Moygaddy, Meath

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Phase 1B, Moygaddy, Meath (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	There are water network capacity constraints in this catchment.
Wastewater Connection	There are wastewater network capacity constraints in this catchment.
SITE SPECIFIC COMMENTS	
Water Connection	In order to accommodate the proposed connection at this development, upgrade works are required to increase the capacity of the Irish Water network. Irish Water does not currently have any plans to carry out the works required to provide the necessary upgrade and capacity. Should you wish to have such upgrade works progressed, Irish Water will require you to provide a contribution of a relevant portion of the costs for the required upgrades, please contact Irish Water to discuss this further. 1. Connection main – Approx. 50m of new 250mm ID main to be laid to connect the site development (see yellow section below) to the new 300mm ID upgrade main. Connection main shown below (See green line in figure 1). 2. Trunk/Distribution main 1 – Approx. 950m of 300mm ID main to be laid to link connection main and new 350mm ID main (see red

<table>
<tr><td></td><td>dashed line in figure 1). To service the lands a total of 3500m of 300mm ID main (seen as black line in figure 1) which links in with Mariavilla.
3. Trunk/Distribution main 2 – Approx. 1400m of new 350mm ID main to be laid to link new 300mm ID TM 1 and the existing 400mm AC main together.
4. Onsite storage required for commercial units, 24-hour storage at ADPW demand, storage units must also be able to be refilled from empty within 12-hour period

IW currently have a project ‘Maynooth East Ring Road’ which is currently at design stage and on our current investment plan consisting of approx. 1400m of 350mm ID main (shown below (black dashed line in figure 2) and will be carried out in conjunction with Kildare County Councils ‘Maynooth Eastern Ring Road’ project.</td></tr>
<tr><td>Wastewater Connection</td><td>In order to accommodate the proposed connection at the Premises, upgrade works are required to increase the capacity of the Maynooth Wastewater Pump Station and Rising Main. Irish Water currently has a project on our current investment plan which will provide the necessary upgrade and capacity. This upgrade project is currently scheduled to be completed by Q4 2025 (this may be subject to change, as planning has yet to be granted in both Kildare and Meath and the appropriate consents for the project).

The addition discharge would cause a back up of flows in the existing gravity network entering the pump station. Upgrade works would be required to increase the capacity of the wastewater network (upgrade of approx. 175m of network directly upstream of the Pump Station). Irish Water are currently reviewing these works which are not currently on the Capital Investment Plan. Please contact Irish Water to discuss this further.

Where a connection is proposed in advance of the delivery of strategic solutions in this area, Irish water are willing to review Storm Sewer Separation proposals (from the combined network) in the Maynooth area, in order to provide additional wastewater capacity. This would require co-operation and agreement from Kildare County Council, as the storm drainage authority.

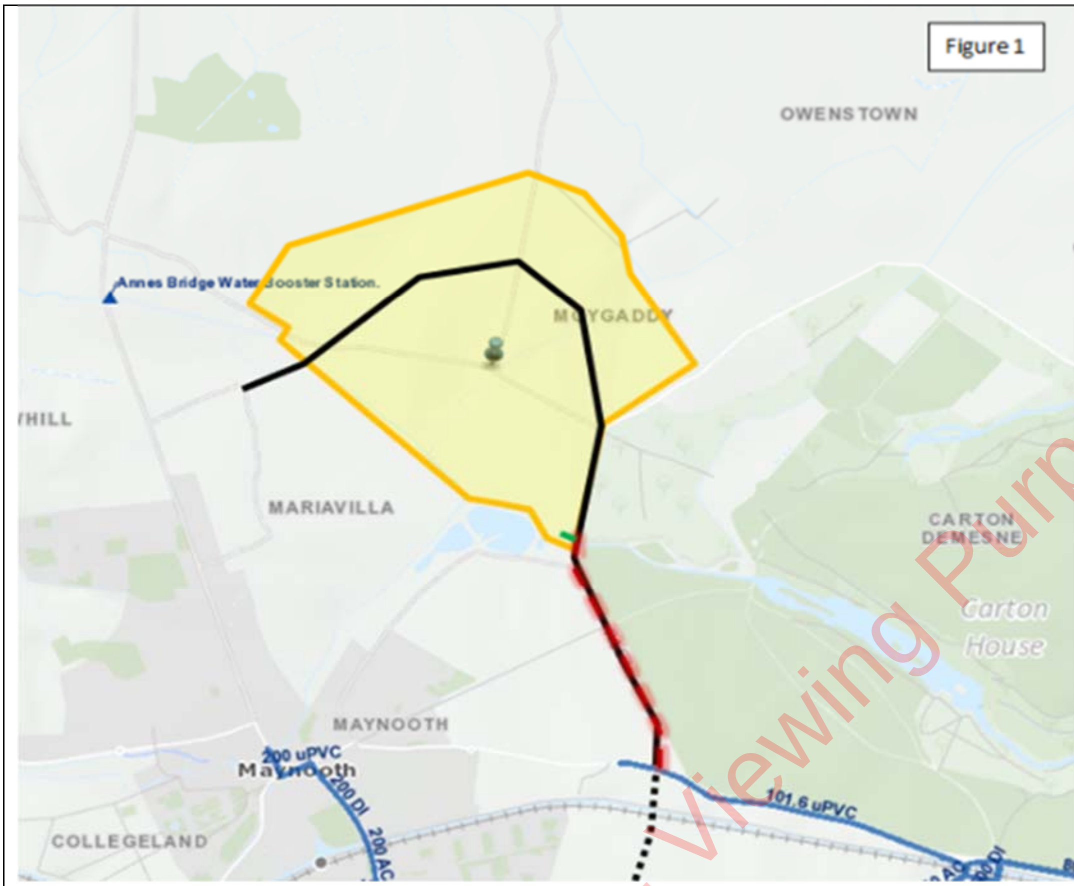
Further measures are currently being investigated by Irish Water in this area via the Capital Maintenance Programme, including:

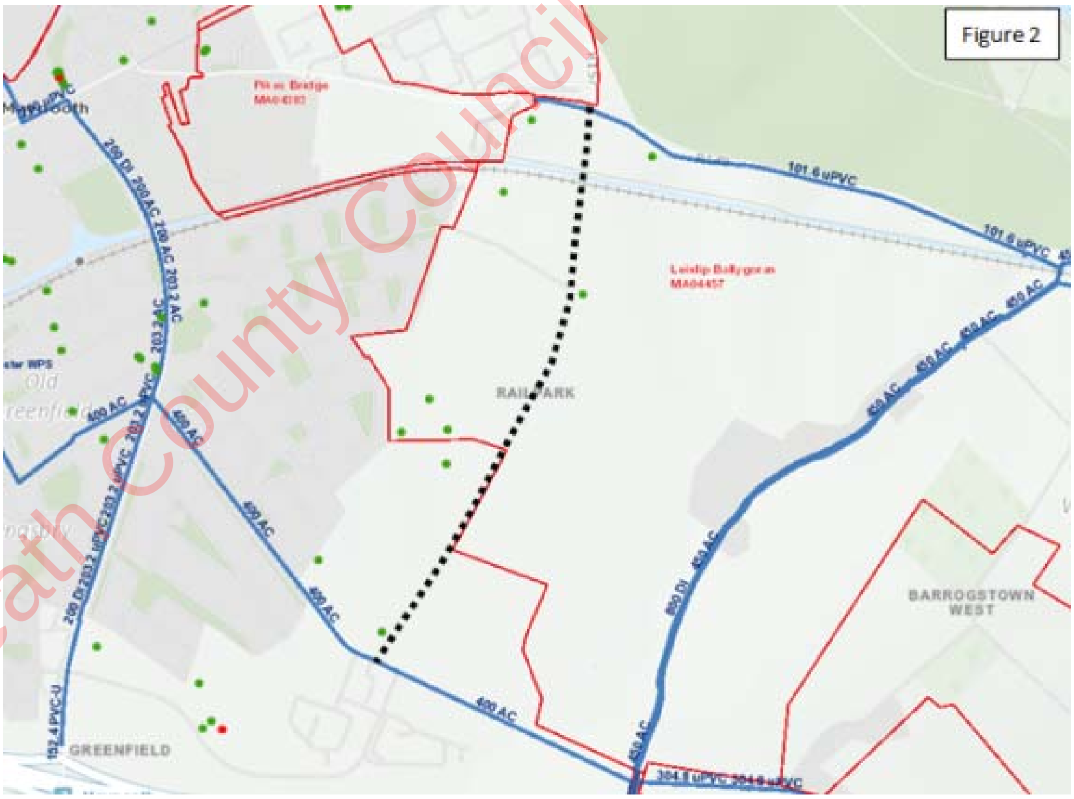
- identifying and repairing areas of infiltration

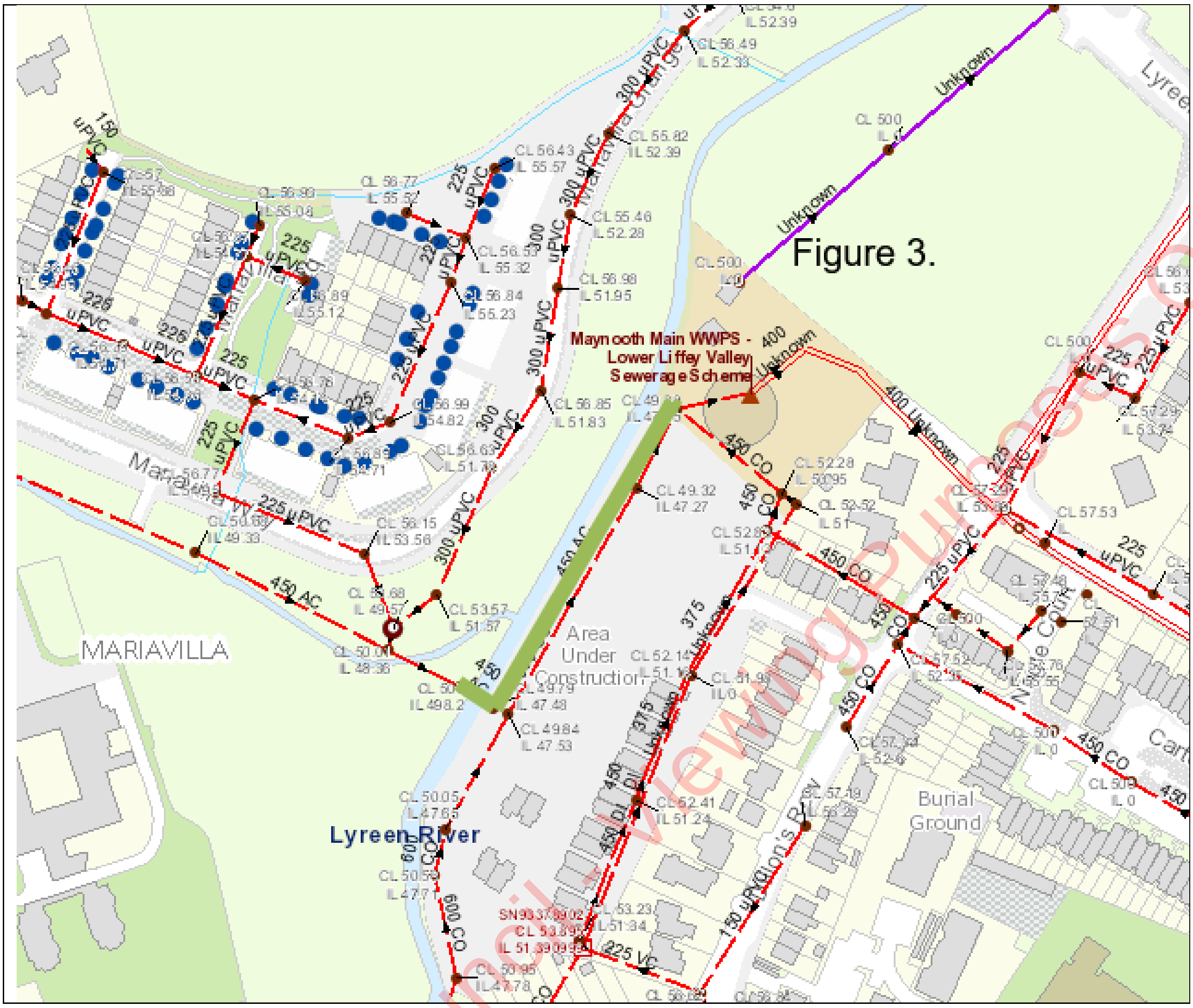
- control of pumping stations in the catchment

- increasing local storage in the area</td></tr>
<tr><td colspan="2">The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.</td></tr>
</table>

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







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

General Notes:

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

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

If you have any further questions, please contact Paul Lowry from the design team on 018230377 or email paullowr@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

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Head of Customer Operations

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