Engineering Assessment Report

Application at Church Fields East, Mulhuddart, Dublin 15.

May 2023

Waterman Moylan Consulting Engineers Limited
Block S, Eastpoint Business Park, Alfie Byrne Road, Dublin D03 H3F4
www.waterman-moylan.ie

Client Name:	Fingal County Council
Document Reference:	20-074r.4001
Project Number:	20-074

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1	May 23	NM	IW	IAn Worrell

Comments

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Content

Figures

Tables

Appendices

1. Introduction

1.1 Context

This Engineering Assessment Report (EAR) has been prepared by Waterman Moylan as part of the documentation in support of the Church Fields East development planning application for a proposed residential development at Damastown Avenue, Mulhuddart, Dublin 15.

This report assesses wastewater and surface water drainage, water supply infrastructure and the road and transportation network in the vicinity of the site, and details the criteria used to design the proposed wastewater and surface water drainage, water supply and transport networks.

1.2 Site & Proposed Development Description

The proposed development relates to a site of c.5.52 hectares at Church Fields East, Mulhuddart, Dublin 15. The development site is located south of Damastown Avenue; west of Church Road; east of previously permitted residential development at Church Fields (Planning Reg. Ref.: PARTXI/012/21); and north of a permitted linear park (Eastern Linear Park Planning Reg. Ref.: PARTXI/012/21), in the townland of Tyrrelstown, Dublin 15. The proposed development seeks the construction of 217 no. residential units (ranging from 2 – 4 storeys in height) in a mixed tenure development, comprising of 121 no. houses and 96 no. apartments. The development will also include the provision of car parking, cycle parking, new pedestrian / cycle links, services, drainage and attenuation, and all associated site and infrastructural works.

Refer to Figure 1 for the location of the proposed development. Refer to Waterman Moylan Drawing 20-074-P4010 for details.

The proposed development consists of:

- 217 Residential units (121 houses, 96 apartments)
- The provision of access roads and associated infrastructure
- SuDS features such as swales, permeable paving, green roofs, and rain garden planters.
- Upgrading 2No. attenuation systems in the Church Fields Housing and Eastern Linear Park

Figure 1: Site Location (image taken from Google Earth)

The site falls from northeast to southwest at a natural slope of c. 1:54, ranging in levels from 87.00m to 80.00m OD Malin. Vehicular access to the site is via the Church Fields Housing and Eastern Linear Park Development (Permitted under FCC Ref.: Part XI/012/21) lands to the west. The Church Fields Link Road and cycle network (currently under construction) services the entire Church Fields lands by linking Ladyswell Road to the south and Damastown Avenue to the north.

Figure 2: Church Fields Site Strategy (image taken from Google Earth)

The subject site is zoned as “RS” by the local authority and is deemed appropriate for the provision of residential development and to protect and improve residential amenities as set out in the Fingal Development Plan 2023-2029.

Figure 3: Fingal County Council Zoning

1.3 Background of Report and Summary

This report describes the criteria used to design and detail the options available for the disposal of stormwater (subject to a restriction to the discharge rate), disposal of wastewater, water supply and the road layout for the proposed development. The proposed development consists of 217 No. units which consists of a mixture of residential houses and apartments.

1.3.1 Wastewater

It is proposed that the foul water from the overall Church Fields development will drain via gravity in a south-westerly direction and discharge into the existing Ø900mm foul water trunk sewer located along the western boundary, approximately 800m from the subject site. The Ø900mm trunk sewer conveys the foul water in a southerly direction and ultimately to Ringsend WWTW.

1.3.2 Surface Water

It is proposed that the surface water requirements will be served by a network of gravity pipes ranging in size from Ø225mm to Ø525mm diameter. The drainage catchment that will outfall at a restricted rate equal to 3.70 l/s/Ha. The subject site has its own attenuation system, consisting of an above ground detention basin combined with a supplementary below ground cellular stone storage area.

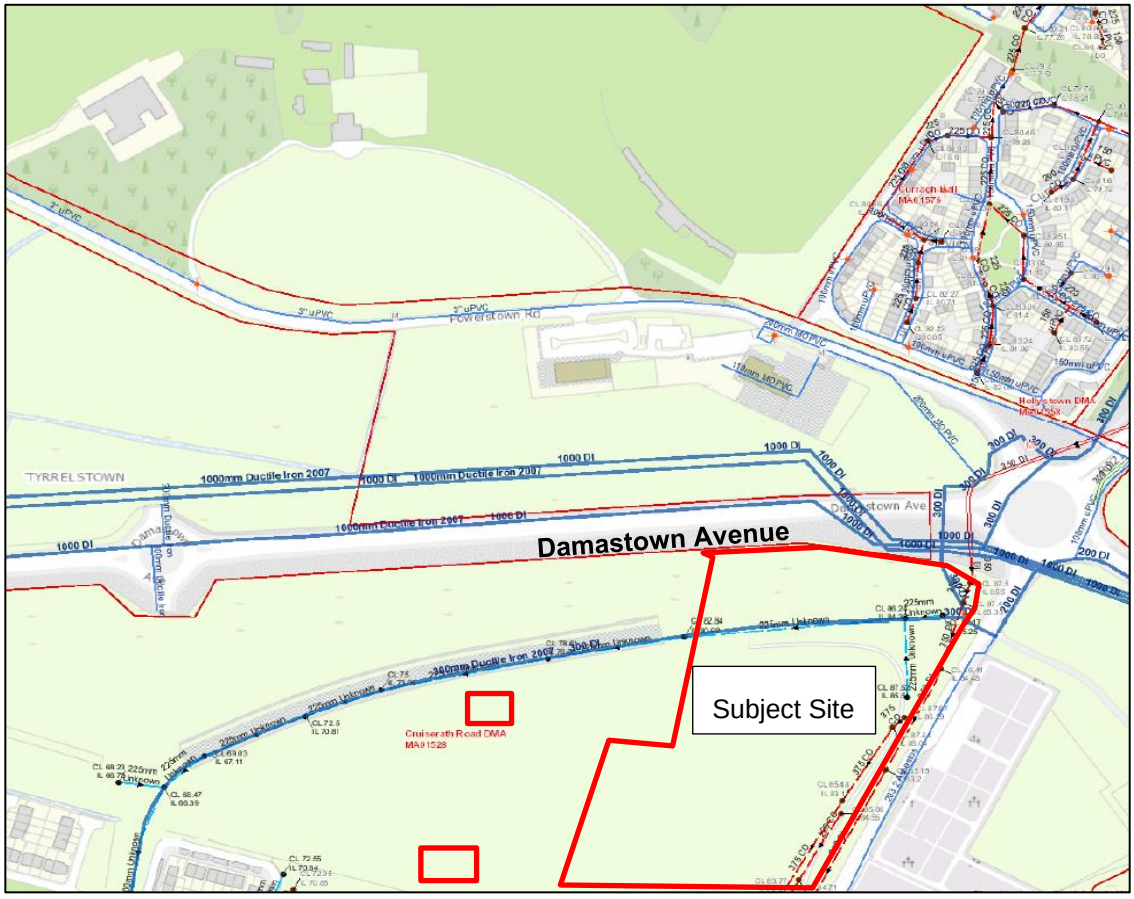
The surface water from the subject site will outfall into the Church Fields Housing and Eastern Linear Park Development (Permitted under FCC Ref.: Part XI/012/21) drainage network to the west of the site. Church Fields Housing and Eastern Linear Park Development drains westwards ultimately outfalling at the

southwestern corner of the overall Church Fields lands via the existing infrastructure provided by the external roads project and outfall through their network into the River Pinkeen.

1.3.3 Water Supply

Currently, there is an existing Ø300mm diameter watermain traversing the subject site from the southwest towards the northeast of the site. Irish Water have granted a diversion application for this watermain, under DIV22229. The diverted watermain will run along Damastown Avenue to the north and then south along the new Church Fields link road. A new watermain layout will be constructed for Church Fields Housing and Eastern Linear Park Development (Permitted under FCC Ref.: Part XI/012/21) which will be fed from the Church Fields link road. The subject site will connect into the Church Fields Housing and Eastern Linear Park Development network.

Figure 4: Existing Services



1.3.4 Flood Risk Assessment

A site-specific Flood Risk Assessment has been carried out for the proposed development and accompanies this submission under separate cover. The report assesses the flood risks at the site considering; coastal, fluvial, pluvial, groundwater, and for human/ mechanical error. The site is classified as Flood Zone C and the overall risk of flooding is deemed to be low.

2. Wastewater Network

2.1 Existing Wastewater Network

It is proposed that the foul water from the Church Fields development will drain by gravity in a southwestern direction and discharge into the existing Ø900mm foul water trunk sewer located along the western boundary via a single outfall. The entire Church Fields lands will be served by a Ø300mm diameter trunk sewer, that branches off into each of the development areas. All of these areas will be served by Ø150mm to Ø300mm diameter pipes in line with the Irish Water requirements.

The impact of the foul flow based on the entire Church Fields lands (c. 1,000 No. units) on the Irish Water network was assessed following the submission of a pre-connection enquiry form issued to Irish Water. A Confirmation of Feasibility has been issued by Irish Water on the 18th of April 2023 which confirms capacity for the subject site in the surrounding network. Please refer to Appendix A for the details.

2.2 Wastewater Network Design

Drains generally will consist of PVC pipes (to IS 123) and all foul water sewers within the development will be laid to comply with the requirement of the Building Regulations and in accordance with the recommendations contained in the Technical Guidance Documents, Section H.

Wastewater sewers which will be taken into charge will be laid strictly in accordance with Irish Water's requirements for taking in charge. In accordance with the Irish Water "Code of Practice for Wastewater Supply", Ø150mm nominal internal diameter sewers have been proposed for carrying wastewater from 20 properties or less: whilst Ø225mm nominal internal diameter carrying Wastewater from more than 20 properties. Furthermore, where there are at least ten dwelling units connected, the Ø150mm diameter pipes are laid at a minimum gradient of 1:60 for up to nine connected dwelling units. All manholes will be watertight to prevent groundwater ingress into the foul drainage system. Construction details for the proposed drainage systems are included in the accompanying planning submission drawings.

As part of this planning application, we have submitted the wastewater & watermains design to Irish Water for design vetting. A statement of design acceptance was issued, please refer to Appendix C.

2.3 Wastewater Calculations

The wastewater drainage for the proposed development has been designed so that minimum cleansing velocities outlined in the "Irish Water Code of Practice for Wastewater Infrastructure" are achieved for all foul sewers. The peak foul flow is based on Irish Water recommended peak demand/flow factors which are provided in the Irish Water 'Code of Practice for Wastewater Infrastructure', Wastewater Flow Rates for Design. Pipe capacities and velocities have been calculated using Colebrook-White formula with a roughness coefficient (Ks) of 1.5mm.

As per the Code of Practice, the domestic wastewater loads have been calculated based on 2.7 persons per unit with a per capita foul flow of 150 litres per head per day. Based on the Irish Waters Code of Practice, the peak foul flow from the subject site will be as follows:

Table 1: Calculation of approved Foul Water Flow

Description	No. of Units /	Flow l/h/day	Population per Unit / Floor Area	Infiltration Factor	Total Discharge (l/d)
Apartment Units	96	150	2.7	1.1	42,768
Housing Units	121	150	2.7	1.1	53,906
				Total	***96,674 l/d***

Table 2: Calculation of Proposed Foul Water Flow

Calculation of Proposed Peak Foul Flow		
Total Daily Discharge *(from Table 1.)*	96,674	l/d
Dry Weather Flow - Residential (DWF)	1.119	l/s
Peak Foul Flow Residential (=6 x DWF)	***6.713***	***l/s***

The total dry weather flow from the development is 1.119 l/s, with a peak flow of 6.713 l/s. A peak foul flow factor of 6 has been used, as per the Irish Water Wastewater Code of Practice.

* Domestic Wastewater Peaking Factors: For the design of new or upgraded wastewater networks, the peaking factors applied to domestic wastewater flows (PfDom) are to be in accordance with the Figure 5 below.

Figure 5: Peaking Factor Design for Wastewater, Section 2.2.5 IW Wastewater Code of Practice

Population	Peaking Factor (Pf_{Dom})
0 to 750	6
751 to 1,000	4.5
1001 to 5,000	3.0
5,001 to 10,000	2.5

As shown in the table above the peak flow from the proposed foul network will be 6.713 l /s. The proposed foul network is designed with a minimum gradient at a range as set out in the Irish Water Code of Practise.

The outfall pipe from the development is a Ø300mm pipe laid at a minimum gradient of 1:200 which has sufficient capacity to serve all of the future development on the Church Fields lands, and outfall into the existing 900mm diameter infrastructure located approximately 800m to the west of the site. Therefore, there is adequate capacity in the public foul sewer available to cater for the proposed development. The proposed foul network has been designed with Causeway Flow software and will discharge via gravity. Please see Appendix B for details of the foul water design calculations.

3. Surface Water Drainage

3.1 Introduction

The greenfield runoff rate of the site has been calculated using the Institute of Hydrology report No 124 “Flood Estimation for Small Catchments”. The subject site’s runoff will be restricted to the equivalent of the Qbar runoff rate of 3.70 l/s as agreed with Fingal County Council’s drainage department in discussions as part of finalising the overall site strategy for the Church Fields lands.

Surface water runoff shall be restricted via a Hydro-Brake, or similar approved, installed at the outfall manhole of the surface water catchment with excess stormwater attenuated within the development site.

The proposed surface water drainage system for this development will be designed as a sustainable urban drainage system and will use above and below ground attenuation together with a flow control device, grass swales, green roofs, rain garden planters, filter drains, and permeable paving to:

- Treat runoff and remove pollutants to improve quality.
- Restrict outflow and control the quantity.
- Increase amenity value.

Strict separation of surface water and wastewater will be implemented within the development. Drains will be laid out to minimise the risk of inadvertent connection of waste pipes etc. to the surface water system. Excess stormwater shall be attenuated within the 800mm deep detention basin and below ground stone tank system.

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

Surface water local drains will be Ø150 mm to Ø225 mm and generally will consist of PVC (to IS 123) or concrete socket and spigot pipes (to IS 6). These drains will be laid to comply with the Requirement of the Building Regulations 2010, and in accordance with the recommendations contained in the Technical Guidance Documents, Section H. Surface water public sewers will be Ø225 mm to Ø525 mm and generally will consist of PVC or concrete socket and spigot pipes (to IS 6) and will be laid strictly in accordance with the requirements of Fingal County Council.

3.2 Surface Water – Existing

The subject site is bounded by Damastown Avenue to the north, by Church Road to the east, the proposed linear park bounds the site to the south, Church Fields Housing and Eastern Linear Park Development (Permitted under FCC Ref.: Part XI/012/21) of the Church Fields lands bound the site to the west. The river Pinkeen is located further west along the boundary of Church Fields West of the Church Fields lands.

The existing record drawings for the area surrounding the subject site were obtained from a GPR survey conducted by CSS Land Surveys in September 2020. The existing records drawings show that there is an existing Ø225mm diameter surface water sewer used to discharge surface water from the Avondale Park development to a dry ditch via a headwall at a rate of 4.38 l/s, located adjacent the southwestern boundary

of the Church Fields lands, approximately 800m from the subject site. The dry ditch continues further south-west and ultimately discharges to River Pinkeen. It is not required to be diverted.

Figure 6: Watercourses in Close Proximity to the Site

As part of the Church Field Link Road works contract, it is proposed to install a Ø750mm diameter pipe which will serve the development, as well as the road upgrade. The surface water is proposed to outfall and flow through 3 No. detention basins, located in the southwestern corner of the overall Church Fields Site Strategic development. It will be constructed as part of the roadworks contract, with an outfall into the dry ditch to the west of the Church Fields site which ultimately traverses to the river Pinkeen.

3.3 Site Characteristics

The site characteristics are specified in the following sections.

Soil type 2 has been used for attenuation calculations below. Additionally, see the extract from Soil Map of Ireland below with Site Location shown:

Figure 7: Soil Map of Ireland extract

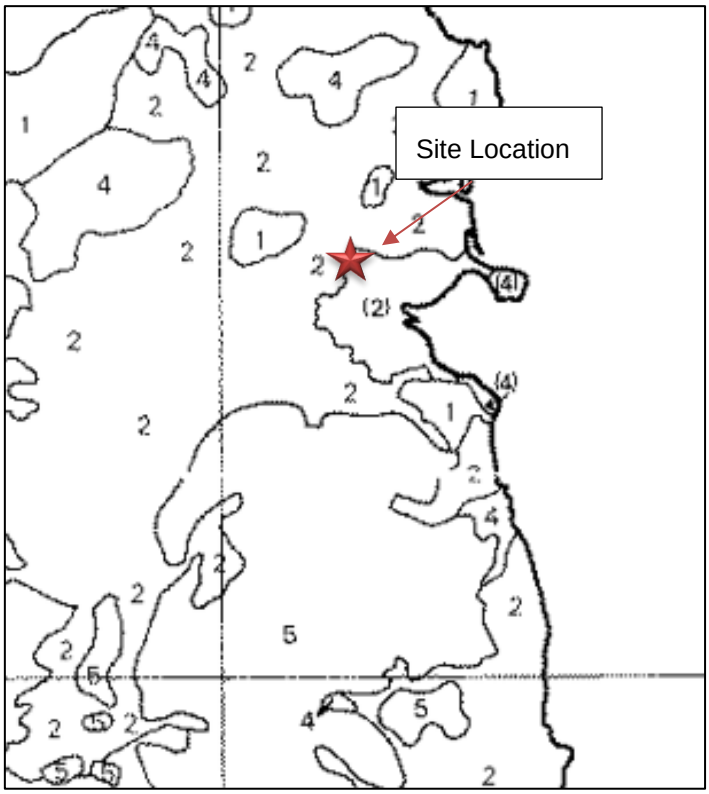


Table 3: Site Characteristics

SAAR	815 mm
Soil Index	Soil Type 2 = 0.3
Climate Change	20 %
Qbar / Hectare	3.70 l/s/Hectare*

** It has been agreed with Fingal County Council in pre-application meetings that the allowable outfall for the Church Fields Site Strategic Plan area is 3.70 l/s/Ha.*

3.3.1 Drainage Catchment

It is proposed to attenuate the surface water run off for the catchment in the open space at the centre of the subject site. Due to the topography of the site, it is not possible to attenuate the full area within the open space. The western boundary of the site will connect into the surface water network for Church Fields Housing and Eastern Linear Park Development (Permitted under FCC Ref.: Part XI/012/21), into catchments A3 & A4. A design capacity check was completed on the granted attenuation systems.

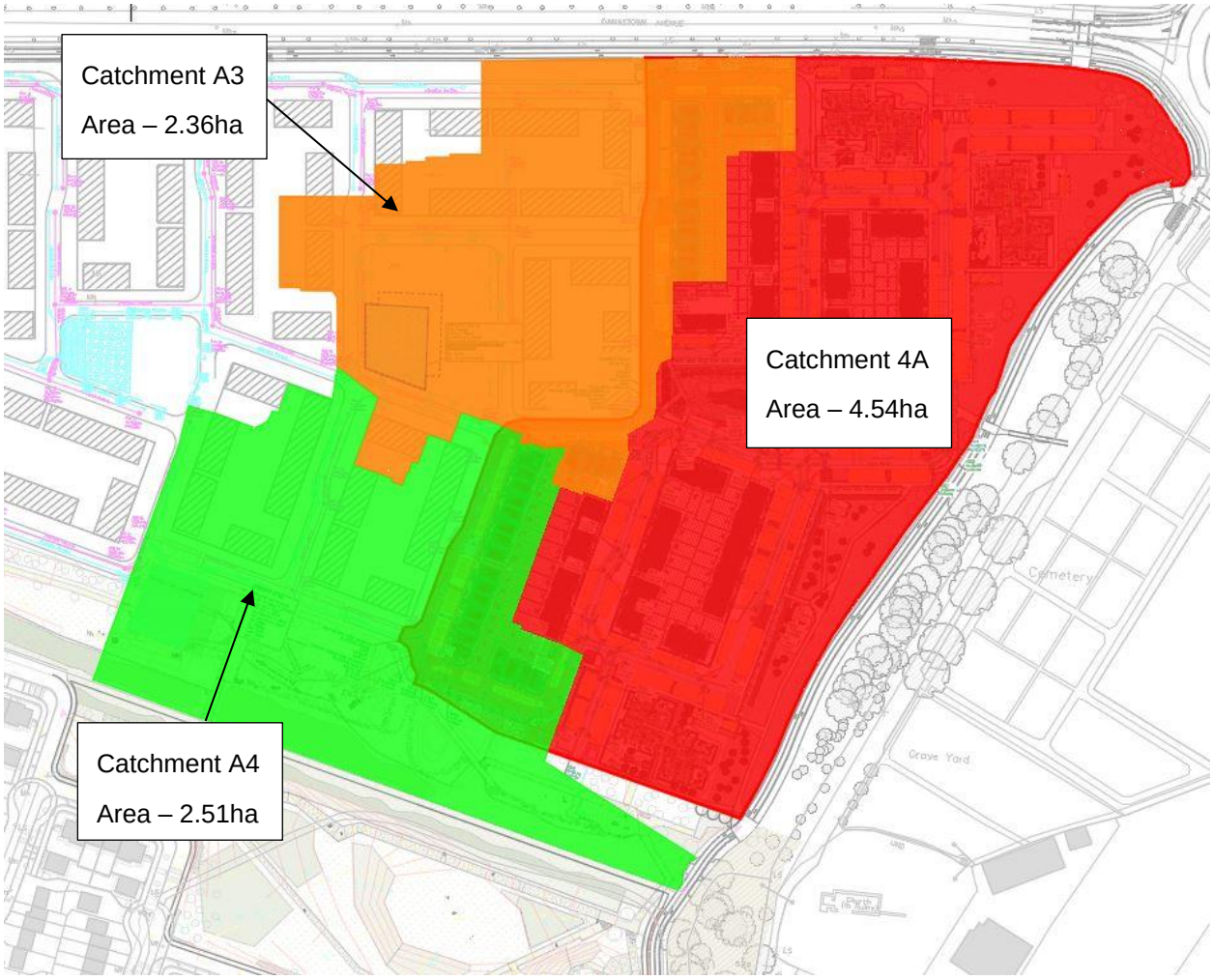
We have liaised with Mr Daragh Sheedy (Executive Engineer FCC) and a design capacity check was completed on the granted attenuation systems. We have agreed to upgrade the capacities of the attenuation systems A3 & A4 using cellular storage systems (Stormtech or similar approved) to cater for the additional flows. We note that the previously granted overground detention basin at A3 will be unchanged and remain the same. Attenuation A4 is solely an underground storage system, the proposed cellular storage tank will have a smaller footprint than was previously granted.

Please refer to Appendix G for capacity checks and drawings 20-074-P4202 & 4203 for details. The catchment and hardstanding areas are indicated in the figure below:

Table 4: Catchment Attributes

	Catchment Area (m^2)	Impermeable Area (m^2)	% Hardstanding
Catchment 4A	45,408	18,163	40 %
Catchment A3 (Church Fields Housing and Eastern Linear Park Development (Permitted under FCC Ref.: Part XI/012/21))	23,582	11,908	51 %
Catchment A4 (Church Fields Housing and Eastern Linear Park Development (Permitted under FCC Ref.: Part XI/012/21))	25,123	12,723	51 %

Figure 8: Drainage Catchment Areas



3.4 Outflow Limits

It has been agreed with Fingal County Council to have an allowable outfall of 3.7 l/s/Ha as part of the initial development of the Site Strategic Plan layout for the Church Fields development. Each catchment of the overall lands is proposed to be restricted by a Hydro-Brake, or similar flow control device approved, which will be located immediately upstream of the catchment outfall. The outfall from the subject site is calculated to be 16.8 l/s and will be achieved by means of a Hydro-Brake. The allowable outflow for the entire Church Fields lands is calculated as 35.01 l/s whereafter the surface water will outflow into the river Pinkeen via the 3 No. Detention Basins built as part of the Church Field Link Road works under a separate contract.

3.5 Surface Water – Proposed

The proposed development will ultimately outfall into the Pinkeen River to the far west of the site at an overall allowable outfall rate of 35.01 l/s. Surface water runoff shall be restricted via a Hydro-Brake, or

similar approved, installed at the outfall manhole of the surface water catchment with excess stormwater attenuated within the development site.

As part of this planning application a site Investigation has been conducted by Ground Investigations Ireland and indicated that the proposed site does not have adequate percolation, therefore it is proposed that a combination of above-and-below ground storage within each catchment. A shallow above-ground detention basin is proposed within each catchment which will predominantly be dry and only fill up in larger storm events, combined with a below-ground stone storage area to provide the majority of the storage.

3.5.1 Surface Water Storage Estimate (Housing Development)

The hardstanding area has been calculated by assuming a runoff factor of 0.95 for the roofs and the 0.90 roads/footpaths as outlined in the CIRIA C753 SuDS Manual. Conservatively we have not deducted the storage capacity of the SuDS features in our attenuation volumes.

Table 5: Catchment 4A

	Qbar Outflow (l/s)	Duration of Critical Event	Storage Required
1:1-Year +20% Climate Change	16.80 l/s	360-minute Storm Event	251 m^3
1:30-Year +20% Climate Change		480-minute Storm Event	664 m^3
1:100-Year +20% Climate Change		480-minute Storm Event	**860 m^3**

It is proposed to provide sufficient attenuation capacity to cater for the 1:100-year critical storm events with 20% climate change allowed for. Refer to Appendix F for the 1, 30 & 100-year storm storage estimates.

3.6 Storm Water Calculation

The total drained area of the proposed development is approximately 45,408m^2 (4.54 Ha). The permitted outflow for the site is 3.7l/s/ha in accordance with the criteria set out in Section 3.4. Calculations for pipe sizes and gradients are based on stormwater runoff from the roofs and surfaced areas using the Rational Method for surface water design (Bilhams Formula), with a storm return period (N) of 5 years. Pipe capacities and velocities have been calculated using Colebrook-White formula with a roughness coefficient (Ks) of 0.6mm.

Surface water sewers will be designed and laid strictly in accordance with Fingal County Council requirements for taking in charge. It is intended that all sewers within the public domain will be handed over to Fingal County Council for taking in charge. All wayleave requirements will be assessed during the detailed design stage. All private outfall manholes will be built in accordance with the Greater Dublin Regional Code of Practice for Drainage Works. No private drainage will be located within the public areas.

Drains will be laid in accordance with the requirements of the Building Regulations, Technical Guidance Document H. Excess stormwater shall be attenuated in a detention basin consisting of above and below ground storage. The proposed storage system will gradually fill up during storm events and will release attenuated surface water after the storm at a controlled rate via a Hydro-Brake.

The calculations for the storage design are included in Appendix F of this report; these indicate that for a return period of 100 years. Refer to Appendix D for the paved area factors calculations. We conservatively have not counted the storage capacity of the permeable paving, green roofs, rain gardens and swales in our attenuation calculations. This will allow for removal of any features and future blockages / sand silting.

The following runs off rates factors have been applied to the scheme to calculate the Percentage Run-off or PIMP:

1. 95% from Roofs
2. 95% Green roofs
3. 90% from Roads/Hardstanding
4. 90% from Roads draining to SuDS features.
5. 95% from Permeable Paving
6. 5% from Grassed areas

3.6.1 Surface Water Storage Estimate

It is proposed that the attenuation for the catchment will be provided within the public open space at the centre of the site. It is proposed that this will be provided in the form of a shallow detention basin, along with storage provision below ground in a cellular attenuation system (Stormtech or similar approved, consisting of 60% voids). Refer to the summary below for the exact details:

Table 6: Attenuation Provision

Characteristic	Value
Cover Level	83.50 m
Above-Ground Depression Invert Level	82.90 m
Top of Water Level	83.40 m
Volume of Depression	205 m^3
Top of Stone Level	82.535 m
Stone Invert Level	80.835 m
Footprint of Underground System	703 m^2
Volume of Underground System	690 m^3
Total Volume	895 m^3

3.7 SUDS Selection Criteria

Sustainable Urban Drainage Systems (SUDS) have been developed and are in use to alleviate the detrimental effects of traditional urban stormwater drainage practices that typically consisted of piping runoff of rainfall from developments to the nearest receiving watercourse. Surface water drainage methods that take account of quantity, quality and amenity issues are collectively referred to as sustainable urban drainage systems; they are typically made up of one or more structures built to manage surface water runoff.

The proposed surface water drainage system for this development has been designed as a sustainable urban drainage system and uses. Roadside swales with infiltration trenches, green roofs (a minimum of 70% of the roof area of apartments will be green roof), an attenuation storage system, permeable paving together with a flow control device and petrol interceptor have been included in the design.

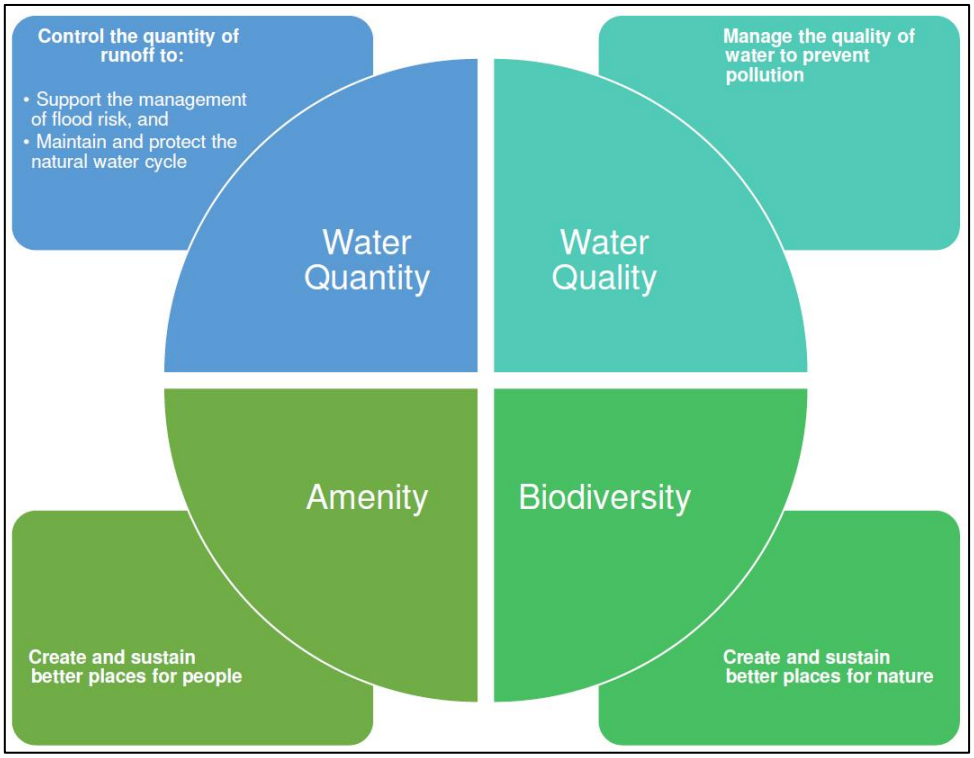
The proposed drainage sitewide system has been designed in such a manner that, where possible, surface water mimics the natural water cycle processes including infiltration, evaporation, transpiration, reuse and attenuation of rainfall.

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

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

The target development and design criteria for SuDS, set out in the CIRIA SuDS manual, is as follows:

- **Water Quantity** – Ensuring that the surface water runoff from the proposed development does not have a detrimental impact on the people, property, and environment.
- **Water Quality –** Reducing urban runoff by SuDS and increasing the quality of the water.
- **Amenity** – Aims to deliver pleasant, attractive and good-looking urban environments.
- **Biodiversity –** Creating new habitats and rehabilitating or enhancing habitats through SuDS measures.

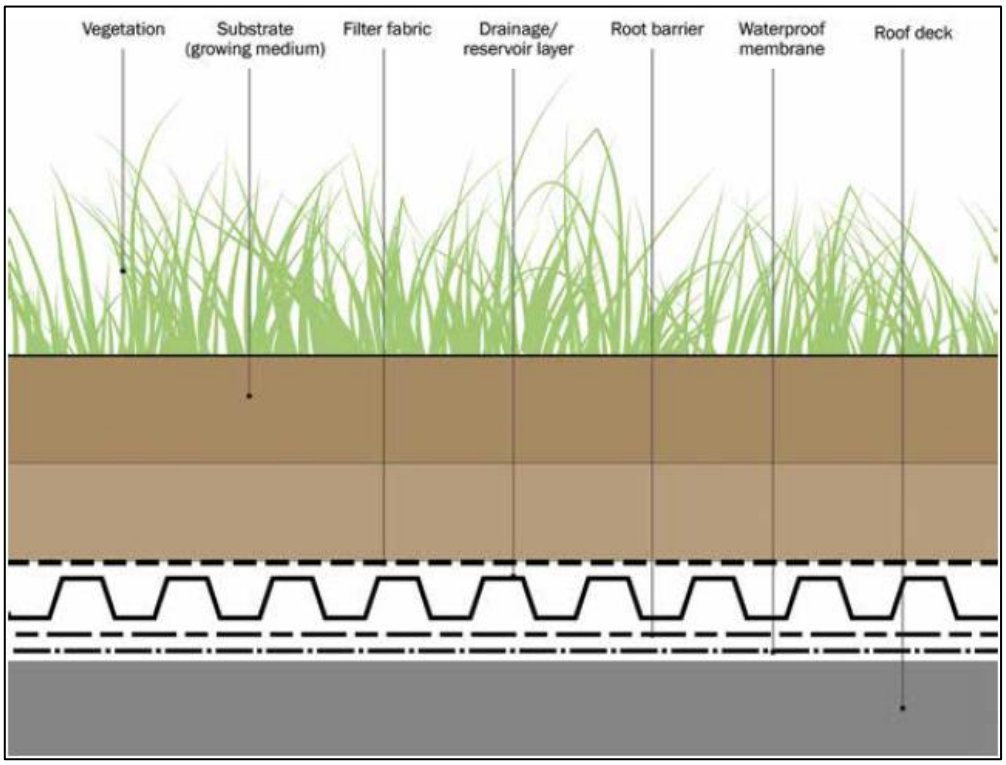


The applicant has considered the use of all appropriate SUDS devices as part of the site SUDS strategy. All of the proposed SuDS features considered for the proposed development are highlighted below:

3.7.1 Green Roofs

These are areas of living vegetation, installed on the top of the building, for a range of reasons including visual benefit, ecological value, enhanced building performance, and the reduction of surface water run-off.

Figure 9: Typical Extensive Green Roof Schematic



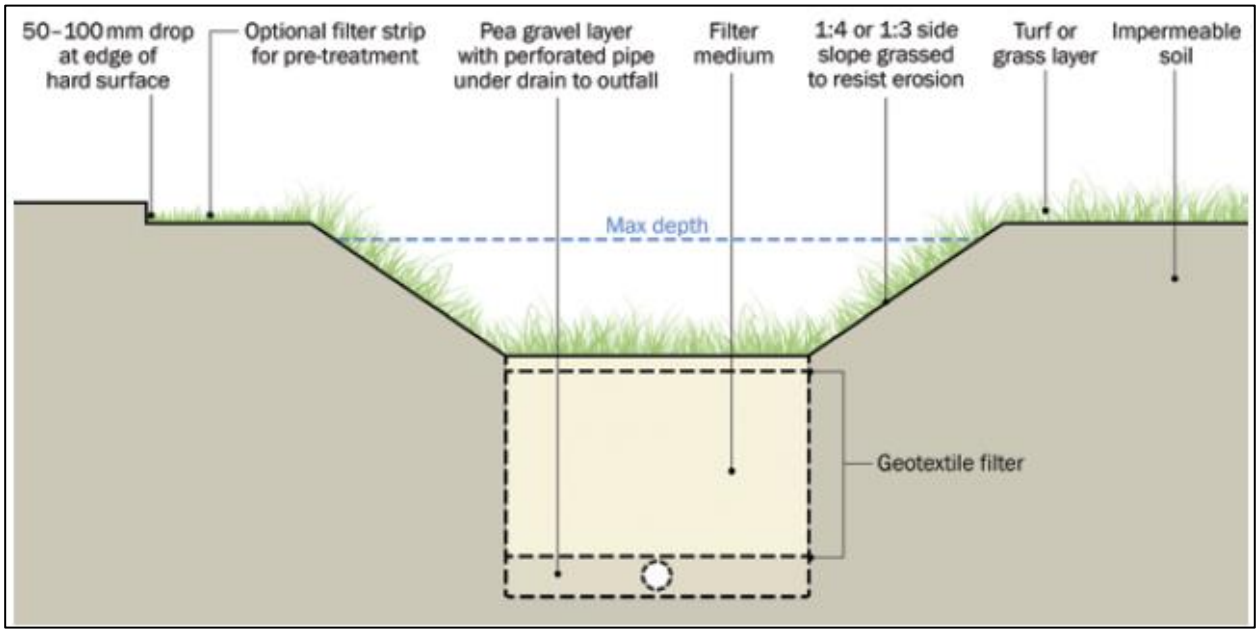
It is proposed that at least 70% of the apartments' roof area be utilized for the green roof area. Conservatively we have not included any storage capacity of the green roof in our attenuation calculations.

3.7.2 Swales

Swales are shallow, flat bottomed, vegetated open channels designed to convey and treat surface water runoff. When incorporated in a site-wide design, they can enhance the natural landscape and provide aesthetic and biodiversity benefits. They will be used to drain roads where it is convenient to collect distributed inflows of runoff or as a means of conveying runoff on the surface while enhancing access corridors or other open spaces.

Swales can have a variety of profiles and can incorporate a range of different planting strategies or form part of the overall landscape development and be included as part of the play areas in some cases. It is proposed to implement shallow roadside swales at the proposed development at appropriate locations. These will typically be c. 200mm deep vegetated channels with below-ground pea gravel and a perforated pipe.

Figure 10: General Swale Schematic



3.7.3 Detention Basin

Detention basins are landscaped depressions that are normally dry except during and immediately following storm events. They can typically be on-line/flow-through systems where surface water runoff from regular storm events is routed through the basin's below-ground stone layer and when the flows rise due to the restricted outflow, the basin fills and provides storage for the surface water runoff.

It is proposed to provide a detention basin consisting of above and below-ground storage. The below-ground cellular storage system will cater for the low flow/regular storm events greater than 30 years, whereas the above-ground storage will provide attenuation in larger storm events. The attenuation system is designed so the detention basin will only fill during extreme events.

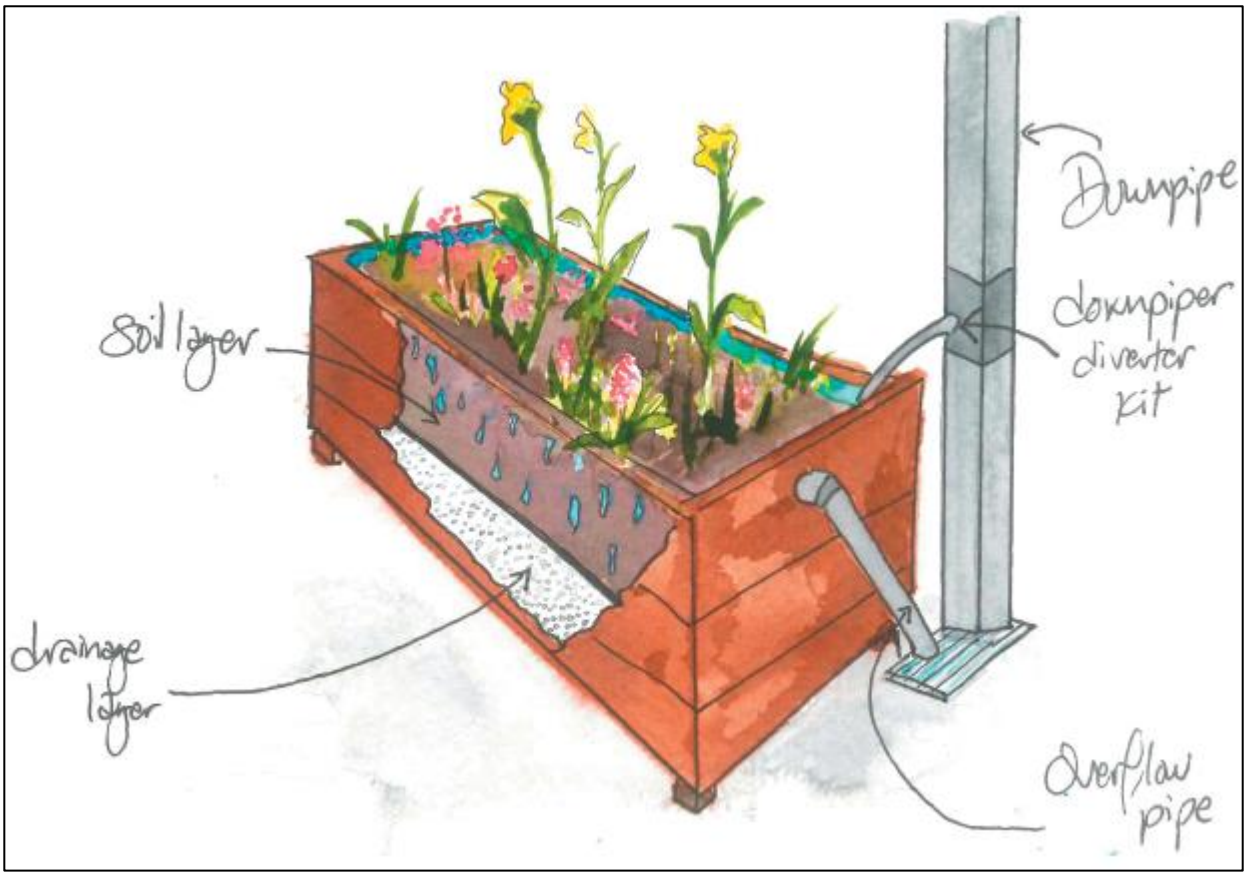
The above-ground depression will be vegetated and planted as part of the landscape architect's proposal. The detention basin, therefore, acts in a way as a bio-retention due to the positive planting/vegetation and habitual effects thereof.

3.7.4 Bioretention System / Rain Gardens / Rainwater Planters

Bioretention systems, including rain gardens, are shallow landscaped depressions that can reduce runoff. As part of the proposal for the subject site, it is proposed to utilize rain gardens and rainwater planters, rather than shallow vegetated depressions.

These are attractive landscape features that are mainly self-irrigating and self-fertilising. Boxes/planters will use rainwater runoff originating from a building/house roof and in essence, slows the flow/runoff from the roof before it enters the main drainage. A downpipe would typically discharge into these and have an overflow into the main external drainage. The most common system is a flow-through rainwater planter and will be utilized where possible.

Figure 11: Flow-Through Rainwater Planter



3.7.5 Flow Control Device

A Hydrobrake or similar approved flow control device will be used to limit the discharge to the greenfield equivalent runoff rate. It is proposed that each catchment's flow will be restricted and attenuated within its own boundaries.

3.7.6 Petrol Interceptor

A petrol interceptor is a trap to filter out pollutants and hydrocarbons from the surface water runoff. It is proposed that a petrol interceptor be installed immediately upstream of the site's overall outfall.

3.8 SUDS Maintenance

In order to comply with the County Development Plan “Development Design Standards,” it is proposed to:

- Separate foul and surface water
- Include appropriate on-site disposal of surface water.
- Comply with the standards set out in the GDSDS.
- Implement appropriate SUDS measures.

All SUDS measures included will be designed in accordance with the CIRIA SUDS Manual C753 as required by the GDSDS prepared by Fingal County Council and the other Local Authorities in the Greater Dublin Area.

For the proposed SUDS strategy to work as designed, the entire drainage system must be well maintained. It will be the responsibility of the site management team to ensure the drainage system is maintained during the construction stage and initial phases of occupation. This will include maintenance and cleaning of gullies drain manholes (including catch pits) and attenuation basins will ensure adequate performance. The recommended program is outlined in the tables below.

Table 7: Maintenance Schedule for Green Roofs - CIRIA C753 The SuDS Manual

Operation and maintenance requirements for green roofs		
Maintenance schedule	**Required action**	**Typical frequency**
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Table 8: Maintenance Schedule for Swales - CIRIA C753 The SuDS Manual

Operation and maintenance requirements for swales		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Table 9: Maintenance Schedule for Detention Basins - CIRIA C753 The SuDS Manual

Operation and maintenance requirements for detention basins		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Table 10: Maintenance Schedule for Bioretention Systems - CIRIA C753 The SuDS Manual

Operation and maintenance requirements for bioretention systems		
Maintenance schedule	**Required action**	**Typical frequency**
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Table 11: Maintenance Schedule for Tree Pits - CIRIA C753 The SuDS Manual

Operation and maintenance requirements for trees (after CRWA, 2009)		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets and outlets	Inspect monthly
Occasional maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
	Water	As required (in periods of drought)
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

Petrol and Flow Control Device Maintenance:

To perform the required maintenance for the flow control device(s) and petrol interceptor, refer to the specific manufacturers' recommendation on the frequency of maintenance and the task that should be completed.

4. Water Supply

4.1 Water Supply – General

At present, there is a water pipeline with a diameter of 300 mm that traverses the subject site, running from the southwest side of the site towards the northeast side. However, Irish Water have granted a diversion application for this watermain, under the reference DIV22229. The new route for the water pipeline diversion will start from Damastown Avenue on the north side of the site and then southwards along the new Church Fields link road. The Church Fields link road will now serve as the new route for the diverted water pipeline, servicing Church Field West to the west and the permitted Church Fields development and the proposed Church Fields East development (subject site) to the east. The subject site will be connected to the watermain network that is granted for Church Fields Housing and Eastern Linear Park Development (Permitted under FCC Ref.: Part XI/012/21).

The impact of the water supply from the overall Church Fields development on the Irish Water network was assessed following the submission of a pre-connection enquiry form issued to Irish Water. A Confirmation of Feasibility has been issued by Irish Water on the 18th of April 2023 which confirms capacity for the subject site in the surrounding network. Please refer to Appendix A for details.

Water Mains suitable for Works and approved by Irish Water shall be either ductile iron (DI) or polyethylene (PE), with PE80 or PE100 rating (MDPE, HDPE or HPPE). The minimum depth of cover from the finished ground level to the external crown of a Water Main shall be 900mm. A greater depth of cover and/or greater strength pipe and/or a higher class of bedding may be required where high traffic loading is anticipated. Depths may be altered to avoid obstructions, including separation distances between other utility services. The desirable maximum cover for a Service Connection pipe or a Water Main should be 1200mm, where practicable.

As part of this planning application, we have submitted the wastewater & watermains design to Irish Water for design vetting. A statement of design acceptance was issued, please refer to Appendix C.

Please refer to Waterman Moylan Drawing 20-074-P300 for details of the watermain to serve the subject lands.

4.2 Water Demand Calculation

An estimate of water demand from the public water supply system for the proposed site has been based on the development of 217 units, with an average occupancy of 2.7 persons (in compliance with Irish Water – Code of Practice for Water Infrastructure). Details are shown below. The average daily demand from the public supply for the development is estimated at 87.9 m^3/day.

Table 12: Calculation of approved Water Demand

Description	No. of Units /	Demand l/h/day	Population per Unit / Floor Area	Total Demand (l/d)
Apartment Units	96	150	2.7	38,880
Housing Units	121	150	2.7	49,005
				87,885 l/d

Table 13: Calculation of Proposed Water Peak Demand

Calculation of Proposed Peak Foul Flow		
Total Daily Discharge *(from Table 1.)*	87,885	l/d
Average Daily Consumption	1.02	l/s
Average Peak Demand (Daily Consumption x 1.25)	1.275	l/s
Peak Water Demand (=5 x Average Peak)	***6.375***	***l/s***

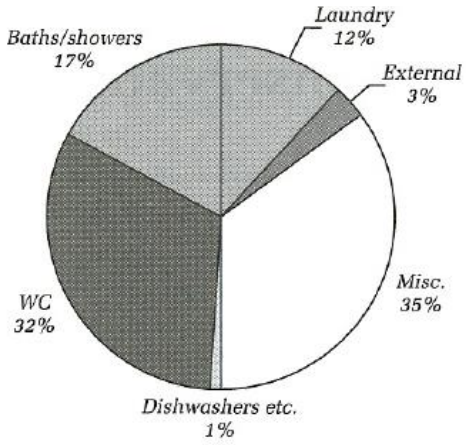
4.3 Water Conservation

The water demand for the development can be subdivided as follows:

- Potable / Non-potable Breakdown

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

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



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

- Low volume flush / dual flush WC's
- Aerated shower heads
- Spray taps
- Draw off tap controls.
- Rainwater reuse – water butts where applicable / raingardens
- Leak detection measures – through the metering of supply

5. Roads and Transport

5.1 Site Access

Vehicular access to the site will be fed via the Church Fields Housing and Eastern Linear Park Development (Permitted under FCC Ref.: Part XI/012/21) lands to the west. The main access road to both sites will be located off Wellview Avenue roundabout traversing the overall development, currently under construction as part of the road upgrade project linking Wellview and Damastown Avenue.

5.2 Proposed Road Network

The roads have been designed to comply with Design Manual for Urban Roads and Streets (DMURS) as required by the Fingal County Development Plan 2023-2029. In this regard, the internal roads generally are generally 6.0m in width. The road network design ensures sufficient clearance for all large vehicles, including refuse and fire engine turning movements. A Stage 1 Road Safety Audit was completed by Norman Bruton Consulting Engineers as part of this planning application. The issues highlighted by the auditor have been addressed, and the site layouts are updated. Please refer to the Stage 1 Road Safety Audit submitted as part of this application.

5.3 DMURS

Waterman Moylan Consulting Engineers considers that the proposed development is consistent with the principles and guidance outlined in the Design Manual for Urban Roads and Streets (DMURS). Outlined below are some of the specific design features that have been incorporated within the proposed scheme with the objective of delivering a design that is in full compliance with DMURS.

In order of importance, DMURS prioritises pedestrians, cyclists, public transport and private cars. The proposed development has been designed with pedestrians and cyclists taking precedence over other modes of transport. In this regard, footpaths are provided throughout the development, with the required pedestrian and cyclist linkages onto the facilities in the close proximity of the site.

Active edges are recommended in DMURS to enliven the edges of the street, creating a more interesting and engaging environment. An active frontage is achieved with frequent entrances and openings that ensure the street is overlooked and generate pedestrian activity as people come and go from buildings. The roads throughout the development have regular junctions and driveways in accordance with this recommendation.

On-street parking is proposed throughout the site. On-street parking separates pedestrians from the vehicle roadway and, as per DMURS Section 4.4.9, can calm traffic by increasing driver caution, contribute to pedestrian comfort by providing a buffer between the vehicular carriageway and footpath and provide good levels of passive security. Streets have been designed in accordance with the alignment and curvature recommendations set out in DMURS Section 4.4.6.

Suitable sightlines will be provided throughout the development, ensuring that localised planting does not obscure visibility as cars make turning manoeuvres, improving pedestrian safety at crossing points.

Public areas fronting and within the proposed development will be designed by a multidisciplinary design team to accommodate pedestrians and cyclists in accordance with the appropriate principles and guidelines set out in DMURS. In particular, the vehicular access and public footways within the remit of the development will incorporate the relevant DMURS requirements and guidelines as set out above.

A full DMURS Statement is done under separate cover. Please refer to 20-074r.4006 DMURS Statement of Consistency.

5.4 Proposed Pedestrian and Cyclist Facilities

New footpaths will be provided in accordance with Section 4.3.1 of DMURS which suggests that a minimum 1.8m footpath should be provided on all footways. In this regard, footpaths are generally provided with a width of 2.0m. Crossing points are located at various points within the development such that unimpeded pedestrian movement is facilitated. Cyclists will be kept on-road within the proposed development. Accordingly, the proposed development is consistent with the principles outlined in DMURS.

5.5 Traffic and Transport Assessment

A full traffic and transport assessment is done under separate cover. Please refer to 20-074r.4005 Traffic and Transport Assessment.

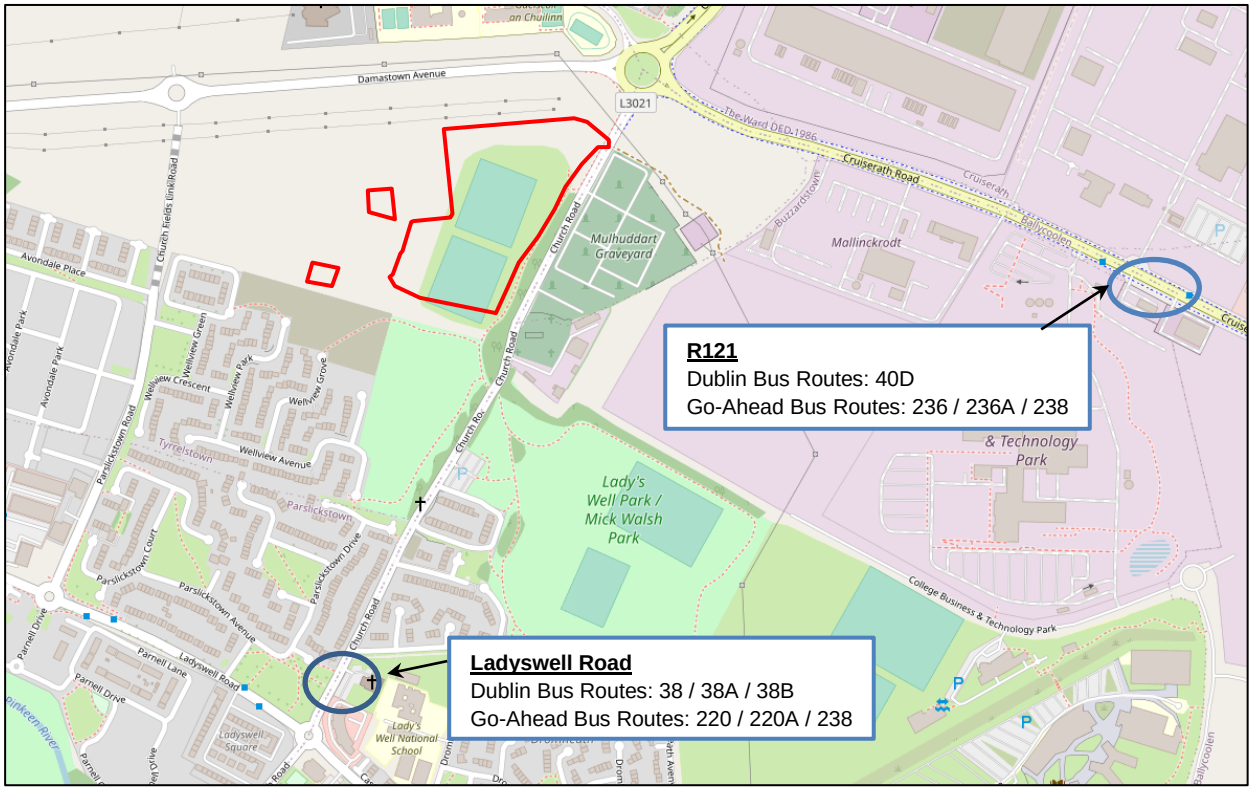
5.6 Car Parking

The proposed development comprises a mixture of terraced housing units and apartments. It is proposed to provide long-term and visitor parking spaces for the house and apartment units. This totals c. 306 No. car parking spaces to be provided for the c. 217 No housing units.

5.7 Public Transport

The subject site is mainly served by 2 No. bus stops in the close vicinity to the site. These are Lady's Well Road Stop, c. 850m south of the subject site, and the R121 stop approximately 950m to the east.

Figure 12: Public Transport in Close Proximity to the Site



Both bus stops are located approximately 5 minute's walk from the subject site and serve the following bus routes as indicated in the below tables:

Table 14: R121 Bus Stop

Route	From	To	Weekday Services	Weekend Services
40d Dublin Bus	Parnell St.	Tyrrelstown	46 in each direction	25 in each direction
236/A GoAhead	Blanchardstown	IBM Campus (via Tyrrelstown)	6 in each direction	N/A
238 GoAhead	Tyrrelstown	Mulhuddart	20 in each direction	18 in each direction (Sat.) 15 in each direction (Sun.)

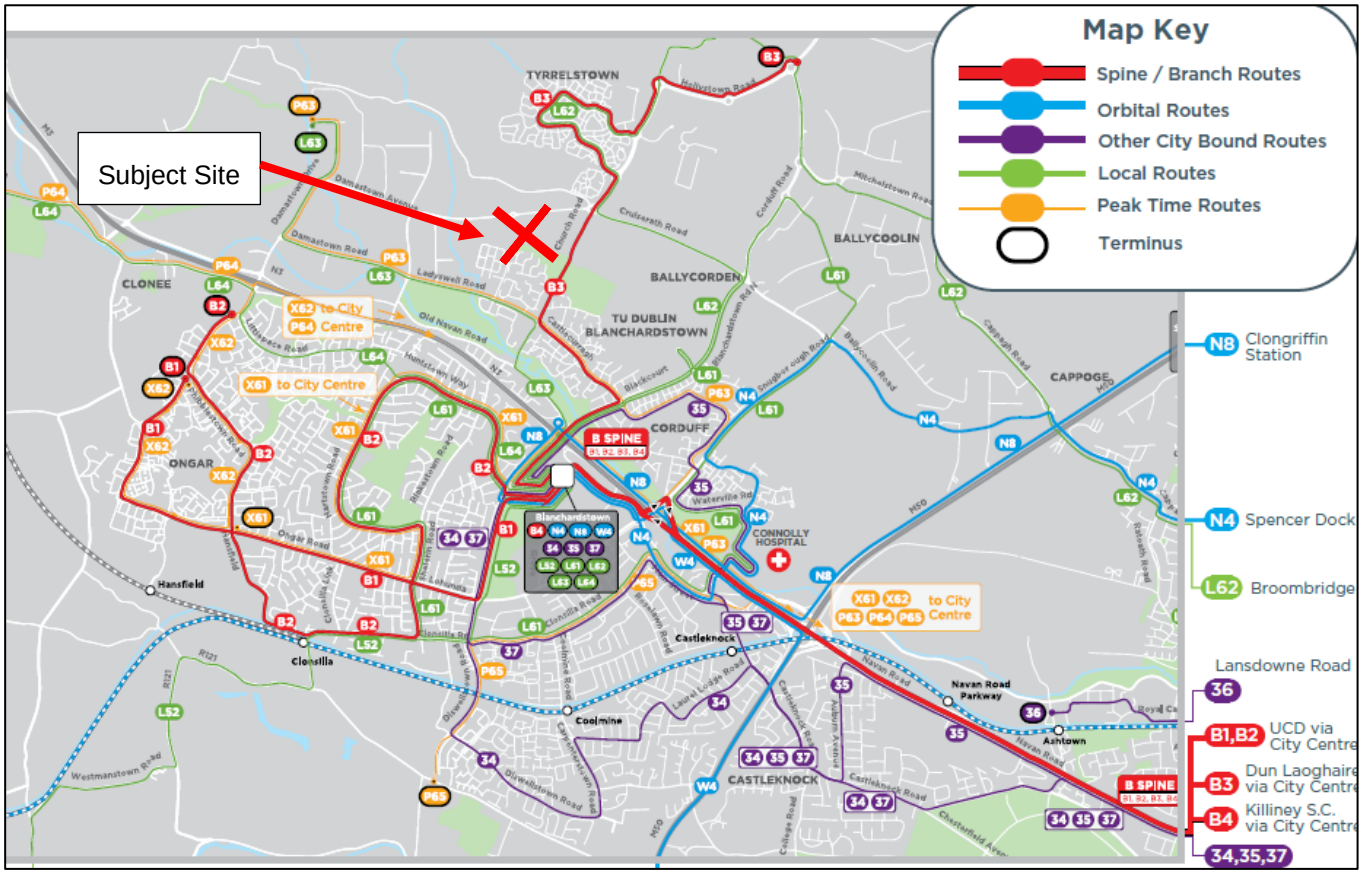
Table 15: Lady's Well Road Bus Stop

Route	From	To	Weekday Services	Weekend Services
38 Dublin Bus	Damastown	Burlington Road	38 in each direction	32 in each direction
38a Dublin Bus	Damastown	Burlington Road	39 in each direction	30 in each direction
38b Dublin Bus	Damastown	Burlington Road	7 in each direction	-
220/A GoAhead	DCU	Lady's well Road	16 in each direction	16 in each direction (Sat. only)
238 GoAhead	Tyrrelstown	Mulhuddart	20 in each direction	18 in each direction (Sat.) 15 in each direction (Sun.)

5.7.1 Bus Connects

The subject site is located in close proximity to various new Bus Connects routes that will be in place in the future. The same bus stops mentioned in the section above will be served by the B3 Branch route, the L62 and L63 Local routes and the P63 Peak Time Route.

Figure 13: Bus Connects Local Area Map



The frequency of these routes are summarized in the table below:

Table 16: Bus Connects Trip Frequency

Route	From	To	Weekday Services	Weekend Services
B3-Branch	Tyrrelstown	Dun Laoghaire (via City Centre)	Generally, every 15 minutes	Generally, every 15-30 minutes
L62	Blanchardstown	Broombridge (Via Tyrrelstown)	Generally, every 15-30 minutes	Generally, every 30-60 minutes
L63	Damastown	Blanchardstown	Generally, every 15 minutes	Generally, every 15-30 minutes
P63	Damastown	City Centre (Via Corduff)	From 7:00-8:00 & 15:00-17:00 every 3 minutes	N/A

5.8 Local Amenities

Further to the site being well-served by the bus network as well as the proposed future Bus Connects Network, the site is also well served by amenities in close proximity to the subject site. The table below summarises all of the amenities which is located within 15 minutes of walking from the subject site.

Table 17: Amenities within 15 minutes of walking distance.

Amenity	Distance (m)	Time
AllCare Pharmacy Mulhuddart	700	9 min
Spar Mulhuddart	850	11 min
Hillview Stores	650	8 min
Maxwell Hair & Beauty	650	8 min
Hopkins Park	700	8 min
Jorag Stores	700	9 min
Gaelscoil an Chuilinn	1000	13 min

Most of these amenities will be accessed via a quicker route once the linear park to the south of the subject site is completed.

5.9 Conclusion

The subject development is fully Design Manual for Urban Roads and Streets (DMURS) compliant and all roads, local streets, on-street parking and pedestrian/cycling facilities has been designed to keep the hierarchy of road users in mind as specified in the DMURS Manual. The site is well served with public transport with various transport options available to commute into the city center with the future Bus Connects transport extension project only further enhancing this. The site is generally located close to amenities, however, if need be to travel any further, any of the transport options can easily be accessed/utilized.

Appendix A

Irish Water Confirmation of Feasibility – Church Fields lands (1,000 units)

CONFIRMATION OF FEASIBILITY

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

Noel Mahon

Waterman Moylan
Block S
Eastpoint Business Park, Alfie Byrne Road
D03H3F4

18 April 2023

Our Ref: CDS23001981 Pre-Connection Enquiry
Sectors 1, 2, 3, 4, Church Fields, Tyrrelstown, Dublin

Dear Applicant/Agent,

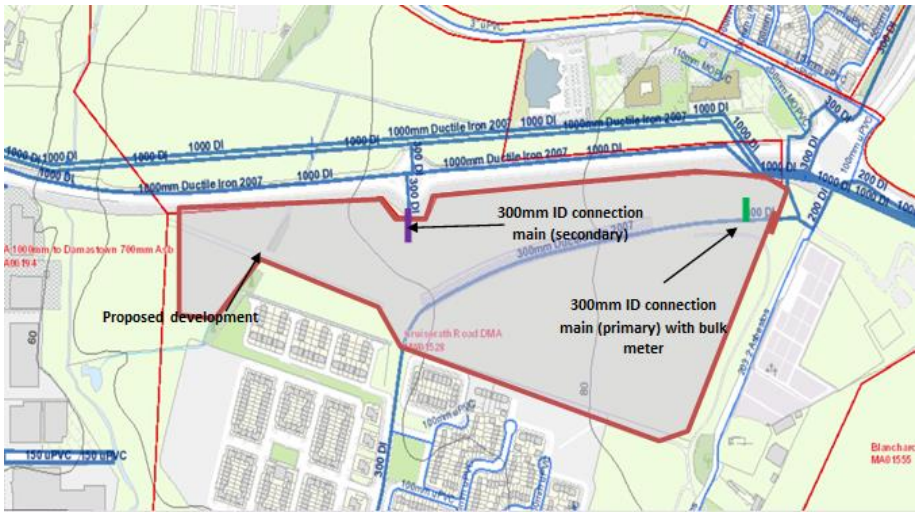
We have completed the review of the Pre-Connection Enquiry.

Irish Water has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 1,000 unit(s) at Sectors 1, 2, 3, 4, Church Fields, Tyrrelstown, Dublin, (the **Development)**.

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

- **Water Connection** - Feasible without infrastructure upgrade by Irish Water

- Primary connection main should be a 300mm ID pipe connected to the existing 300mm DI main, as proposed by the Applicant.
- Secondary connection main should be a 300mm ID pipe connected to the existing 300mm DI main at Damastown Avenue Roundabout with installation of a control valve on the line. The valve should be closed during normal operation and opened at times of emergency.



- The proposed Development indicates that Irish Water assets are present on the site. The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the assets during and after the works. Drawings (showing clearance distances, changing to ground levels) and Method Statements should be included in the Detailed Design of the Development. A wayleave in favour of Irish Water will be required over the assets that are not located within the Public Space. For design submissions and queries related to diversion/build near or over, please contact IW Diversion Team via email address diversions@water.ie

- **Wastewater Connection**
  - Feasible without infrastructure upgrade by Irish Water

- The Development should be connected to the existing 750 CO gravity sever as proposed by the Applicant (via proposed foul sewer within the site boundaries, granted under CDS2200712901 connection application).
- The proposed Development indicates that Irish Water assets are present on the site. The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the assets during and after the works. Drawings (showing clearance distances, changing to ground levels) and Method Statements should be included in the Detailed Design of the Development. A wayleave in favour of Irish Water will be required over the assets that are not located within the Public Space. For design submissions and queries related to diversion/build near or over, please contact IW Diversion Team via email address diversions@water.ie

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

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

Where can you find more information?

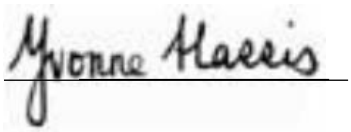
- **Section A -** What is important to know?
- **Section B -** Details of Irish Water's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Irish Water's network(s). This is not a

connection offer and capacity in Irish Water's network(s) may only be secured by entering into a connection agreement with Irish Water.

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

Yours sincerely,



Yvonne Harris
Head of Customer Operations

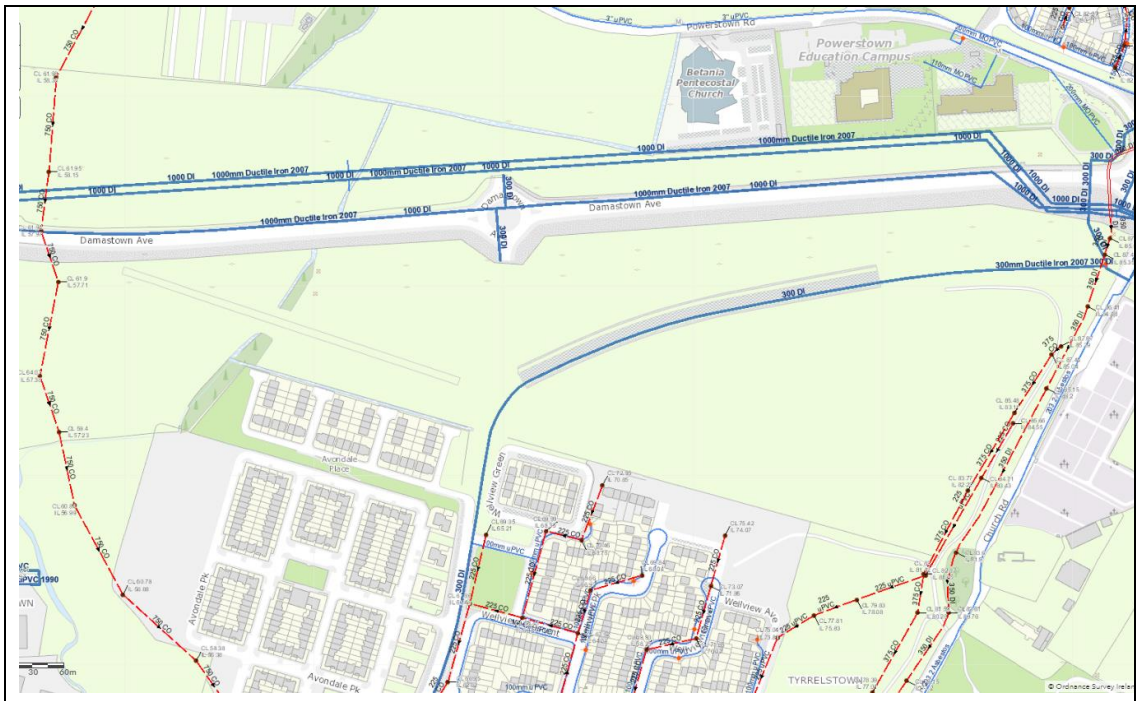
Section A - What is important to know?

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

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

Section B – Details of Irish Water's Network(s)

The map included below outlines the current Irish Water infrastructure adjacent the Development: To access Irish Water Maps email datarequests@water.ie



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Note: The information provided on the included maps as to the position of Irish Water's underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Irish Water.

Whilst every care has been taken in respect of the information on Irish Water's network(s), Irish Water assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Irish Water's underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Irish Water's underground network(s) 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.

Appendix B

Wastewater Pipe Design

Design Settings

Frequency of use (kDU)	1.00	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	405	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.600
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	10	Include Intermediate Ground	✓

Nodes

Name	Dwellings	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
F1	3	83.600	Adoptable	707005.326	741579.052	1.495
F2	17	82.871	Adoptable	706963.959	741575.011	1.286
F3	6	84.895	Adoptable	707028.423	741537.180	1.942
F4	20	85.950	Adoptable	707064.462	741541.033	1.425
F5	12	85.125	Adoptable	707031.436	741505.506	2.331
F6	6	84.895	Adoptable	707034.544	741471.713	2.271
F7	3	83.970	Adoptable	706998.195	741468.889	1.528
F8	3	84.595	Adoptable	707038.764	741423.600	2.688
F9	2	84.147	Adoptable	707021.891	741422.638	2.324
F10	2	83.405	Adoptable	706985.836	741432.182	1.768
F11		83.185	Adoptable	706978.296	741428.878	1.589
F12	4	83.325	Adoptable	706977.663	741412.259	1.812
F13	3	83.060	Adoptable	706964.126	741370.748	1.767
F14	4	82.760	Adoptable	706957.466	741344.112	1.604
F15	2	82.960	Adoptable	706971.338	741340.945	1.518
F16	19	83.750	Adoptable	707005.537	741332.070	1.425
F17	16	82.990	Adoptable	706967.576	741326.119	1.425
F18		83.395	Adoptable	706961.784	741304.555	1.425
F19	4	84.468	Adoptable	707039.477	741413.460	2.493
F20	6	84.200	Adoptable	707025.606	741362.781	1.350
F21		85.947	Adoptable	707092.882	741428.859	1.564
F22	4	86.430	Adoptable	707099.214	741434.590	1.990
F23	8	86.760	Adoptable	707095.162	741481.430	2.085
F24	32	86.500	Adoptable	707089.671	741541.443	1.425
FMH 4		83.330	Adoptable	706970.486	741465.997	1.177
F26		82.395	Adoptable	706950.213	741315.828	1.432
F27		82.161	Adoptable	706939.512	741309.864	1.425
F28	4	81.245	Adoptable	706903.694	741318.742	1.425
F29		80.770	Adoptable	706888.134	741330.429	1.606
FHM 48		79.870	Adoptable	706889.314	741338.230	1.512
F30	6	83.135	Adoptable	706968.668	741379.561	1.792
F31		80.989	Adoptable	706891.183	741323.413	1.586
FMH - 1		82.690	Adoptable	706964.840	741560.310	1.350
FMH3A		84.625	Adoptable	707027.303	741548.888	1.400
FW-2.1		84.789	Adoptable	707036.030	741454.775	1.350

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
8.000_1	F1	F2	41.564	1.500	82.105	81.585	0.520	79.9	150
7.001	F2	FMH - 1	14.728	1.500	81.585	81.340	0.245	60.1	150
3.000	F4	F3	36.244	1.500	84.525	84.072	0.453	80.0	225
5.001_1	F3	F5	31.817	1.500	82.953	82.794	0.159	200.0	225
5.002_1	F5	F6	33.936	1.500	82.794	82.624	0.170	200.0	225
8.000	F7	FMH 4	27.860	1.500	82.442	82.153	0.289	96.4	225
5.003	F6	F7	36.459	1.500	82.624	82.442	0.182	200.0	225
7.000_1	FW-2.1	F6	17.003	1.500	83.439	82.699	0.740	23.0	150
1.001	F24	F23	60.264	1.500	85.075	84.675	0.400	150.7	225
1.002	F23	F22	47.015	1.500	84.675	84.440	0.235	200.1	225
1.003	F22	F21	8.540	1.500	84.440	84.383	0.057	149.8	225
1.004	F21	F8	54.373	1.500	84.383	83.147	1.236	44.0	225
1.014_1	F28	F31	13.355	1.500	79.820	79.403	0.417	32.0	225
5.000	F20	F19	38.308	1.500	82.850	81.975	0.875	43.8	225
4.001	F19	F8	10.166	1.500	81.975	81.907	0.068	149.5	225
1.004_1	F8	F9	16.900	1.500	81.907	81.823	0.084	201.2	225
1.005	F9	F10	37.297	1.500	81.823	81.637	0.186	200.5	225
1.006	F10	F11	8.232	1.500	81.637	81.596	0.041	200.8	225
1.007	F11	F12	16.631	1.500	81.596	81.513	0.083	200.4	225
1.008	F12	F30	33.913	1.500	81.513	81.343	0.170	199.5	225
1.009	F30	F13	9.915	1.500	81.343	81.293	0.050	198.3	225
1.010	F13	F14	27.456	1.500	81.293	81.156	0.137	200.4	225
7.000	F16	F15	35.332	1.500	82.325	81.442	0.883	40.0	225
5.002	F15	F14	14.229	1.500	81.442	81.156	0.286	49.8	225

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
8.000_1	0.097	0.980	17.3	0.0	1.345	1.136	0.000	3	0.0	0.0	4	0.133
7.001	0.192	1.131	20.0	0.1	1.136	1.200	0.000	20	0.0	0.0	8	0.274
3.000	0.162	1.284	51.0	0.1	1.200	0.598	0.000	20	0.0	0.0	7	0.228
5.001_1	0.129	0.810	32.2	0.1	1.717	2.106	0.000	26	0.0	0.0	11	0.191
5.002_1	0.143	0.810	32.2	0.2	2.106	2.046	0.000	38	0.0	0.0	13	0.213
8.000	0.208	1.169	46.5	0.2	1.303	0.952	0.000	47	0.0	0.0	12	0.293
5.003	0.155	0.810	32.2	0.2	2.046	1.303	0.000	44	0.0	0.0	14	0.223
7.000_1	0.000	1.833	32.4	0.0	1.200	2.046	0.000	0	0.0	0.0	0	0.000
1.001	0.150	0.934	37.1	0.2	1.200	1.860	0.000	32	0.0	0.0	11	0.221
1.002	0.155	0.810	32.2	0.2	1.860	1.765	0.000	40	0.0	0.0	14	0.223
1.003	0.166	0.937	37.2	0.2	1.765	1.339	0.000	44	0.0	0.0	13	0.246
1.004	0.252	1.733	68.9	0.2	1.339	1.223	0.000	44	0.0	0.0	10	0.388
1.014_1	0.396	2.032	80.8	0.6	1.200	1.361	0.000	119	0.0	0.0	15	0.591
5.000	0.113	1.737	69.1	0.0	1.125	2.268	0.000	6	0.0	0.0	4	0.188
4.001	0.100	0.938	37.3	0.1	2.268	2.463	0.000	10	0.0	0.0	7	0.151
1.004_1	0.167	0.808	32.1	0.3	2.463	2.099	0.000	57	0.0	0.0	15	0.243
1.005	0.167	0.809	32.2	0.3	2.099	1.543	0.000	59	0.0	0.0	15	0.243
1.006	0.179	0.808	32.1	0.3	1.543	1.364	0.000	61	0.0	0.0	16	0.253
1.007	0.179	0.809	32.2	0.3	1.364	1.587	0.000	61	0.0	0.0	16	0.253
1.008	0.180	0.811	32.2	0.3	1.587	1.567	0.000	65	0.0	0.0	16	0.253
1.009	0.180	0.813	32.3	0.4	1.567	1.542	0.000	71	0.0	0.0	17	0.264
1.010	0.191	0.809	32.2	0.4	1.542	1.379	0.000	74	0.0	0.0	17	0.262
7.000	0.197	1.817	72.3	0.1	1.200	1.293	0.000	19	0.0	0.0	7	0.295
5.002	0.237	1.629	64.8	0.2	1.293	1.379	0.000	37	0.0	0.0	9	0.341

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
5.001	F17	F15	15.296	1.500	81.565	81.442	0.123	124.4	225
1.012	F14	F26	29.200	1.500	81.156	80.963	0.193	151.3	225
6.000	F18	F17	22.328	1.500	81.970	81.565	0.405	55.1	225
1.013	F26	F27	9.482	1.500	80.963	80.736	0.227	41.8	225
1.014	F27	F28	22.894	1.500	80.736	79.820	0.916	25.0	225
1.015	F31	F29	7.650	1.500	79.403	79.164	0.239	32.0	225
1.016	F29	FHM 48	13.259	1.500	79.164	78.358	0.806	16.5	225
3.000_1	FMH3A	F3	11.762	1.500	83.225	83.028	0.197	59.7	150

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
5.001	0.129	1.029	40.9	0.1	1.200	1.293	0.000	16	0.0	0.0	7	0.182
1.012	0.233	0.932	37.1	0.6	1.379	1.207	0.000	115	0.0	0.0	20	0.334
6.000	0.000	1.548	61.5	0.0	1.200	1.200	0.000	0	0.0	0.0	0	0.000
1.013	0.373	1.779	70.7	0.6	1.207	1.200	0.000	115	0.0	0.0	15	0.517
1.014	0.449	2.301	91.5	0.6	1.200	1.200	0.000	115	0.0	0.0	14	0.640
1.015	0.396	2.033	80.8	0.6	1.361	1.381	0.000	119	0.0	0.0	15	0.591
1.016	0.510	2.837	112.8	0.6	1.381	1.287	0.000	119	0.0	0.0	12	0.716
3.000_1	0.000	1.135	20.1	0.0	1.250	1.717	0.000	0	0.0	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
8.000_1	41.564	79.9	150	Circular	83.600	82.105	1.345	82.871	81.585	1.136
7.001	14.728	60.1	150	Circular	82.871	81.585	1.136	82.690	81.340	1.200
3.000	36.244	80.0	225	Circular	85.950	84.525	1.200	84.895	84.072	0.598
5.001_1	31.817	200.0	225	Circular	84.895	82.953	1.717	85.125	82.794	2.106
5.002_1	33.936	200.0	225	Circular	85.125	82.794	2.106	84.895	82.624	2.046
8.000	27.860	96.4	225	Circular	83.970	82.442	1.303	83.330	82.153	0.952
5.003	36.459	200.0	225	Circular	84.895	82.624	2.046	83.970	82.442	1.303
7.000_1	17.003	23.0	150	Circular	84.789	83.439	1.200	84.895	82.699	2.046
1.001	60.264	150.7	225	Circular	86.500	85.075	1.200	86.760	84.675	1.860
1.002	47.015	200.1	225	Circular	86.760	84.675	1.860	86.430	84.440	1.765
1.003	8.540	149.8	225	Circular	86.430	84.440	1.765	85.947	84.383	1.339
1.004	54.373	44.0	225	Circular	85.947	84.383	1.339	84.595	83.147	1.223

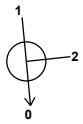
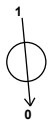
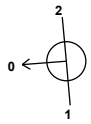
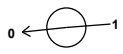
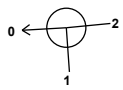
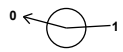
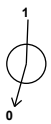
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
8.000_1	F1	1200	Manhole	Adoptable	F2	1200	Manhole	Adoptable
7.001	F2	1200	Manhole	Adoptable	FMH - 1	1200	Manhole	Adoptable
3.000	F4	1200	Manhole	Adoptable	F3	1200	Manhole	Adoptable
5.001_1	F3	1200	Manhole	Adoptable	F5	1200	Manhole	Adoptable
5.002_1	F5	1200	Manhole	Adoptable	F6	1200	Manhole	Adoptable
8.000	F7	1200	Manhole	Adoptable	FMH 4	1200	Manhole	Adoptable
5.003	F6	1200	Manhole	Adoptable	F7	1200	Manhole	Adoptable
7.000_1	FW-2.1	1200	Manhole	Adoptable	F6	1200	Manhole	Adoptable
1.001	F24	1200	Manhole	Adoptable	F23	1200	Manhole	Adoptable
1.002	F23	1200	Manhole	Adoptable	F22	1200	Manhole	Adoptable
1.003	F22	1200	Manhole	Adoptable	F21	1200	Manhole	Adoptable
1.004	F21	1200	Manhole	Adoptable	F8	1200	Manhole	Adoptable

Pipeline Schedule

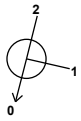
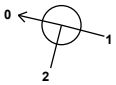
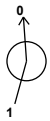
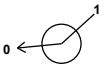
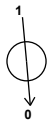
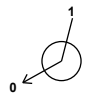
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.014_1	13.355	32.0	225	Circular	81.245	79.820	1.200	80.989	79.403	1.361
5.000	38.308	43.8	225	Circular	84.200	82.850	1.125	84.468	81.975	2.268
4.001	10.166	149.5	225	Circular	84.468	81.975	2.268	84.595	81.907	2.463
1.004_1	16.900	201.2	225	Circular	84.595	81.907	2.463	84.147	81.823	2.099
1.005	37.297	200.5	225	Circular	84.147	81.823	2.099	83.405	81.637	1.543
1.006	8.232	200.8	225	Circular	83.405	81.637	1.543	83.185	81.596	1.364
1.007	16.631	200.4	225	Circular	83.185	81.596	1.364	83.325	81.513	1.587
1.008	33.913	199.5	225	Circular	83.325	81.513	1.587	83.135	81.343	1.567
1.009	9.915	198.3	225	Circular	83.135	81.343	1.567	83.060	81.293	1.542
1.010	27.456	200.4	225	Circular	83.060	81.293	1.542	82.760	81.156	1.379
7.000	35.332	40.0	225	Circular	83.750	82.325	1.200	82.960	81.442	1.293
5.002	14.229	49.8	225	Circular	82.960	81.442	1.293	82.760	81.156	1.379
5.001	15.296	124.4	225	Circular	82.990	81.565	1.200	82.960	81.442	1.293
1.012	29.200	151.3	225	Circular	82.760	81.156	1.379	82.395	80.963	1.207
6.000	22.328	55.1	225	Circular	83.395	81.970	1.200	82.990	81.565	1.200
1.013	9.482	41.8	225	Circular	82.395	80.963	1.207	82.161	80.736	1.200
1.014	22.894	25.0	225	Circular	82.161	80.736	1.200	81.245	79.820	1.200
1.015	7.650	32.0	225	Circular	80.989	79.403	1.361	80.770	79.164	1.381
1.016	13.259	16.5	225	Circular	80.770	79.164	1.381	79.870	78.358	1.287
3.000_1	11.762	59.7	150	Circular	84.625	83.225	1.250	84.895	83.028	1.717

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.014_1	F28	1200	Manhole	Adoptable	F31	1200	Manhole	Adoptable
5.000	F20	1200	Manhole	Adoptable	F19	1200	Manhole	Adoptable
4.001	F19	1200	Manhole	Adoptable	F8	1200	Manhole	Adoptable
1.004_1	F8	1200	Manhole	Adoptable	F9	1200	Manhole	Adoptable
1.005	F9	1200	Manhole	Adoptable	F10	1200	Manhole	Adoptable
1.006	F10	1200	Manhole	Adoptable	F11	1200	Manhole	Adoptable
1.007	F11	1200	Manhole	Adoptable	F12	1200	Manhole	Adoptable
1.008	F12	1200	Manhole	Adoptable	F30	1200	Manhole	Adoptable
1.009	F30	1200	Manhole	Adoptable	F13	1200	Manhole	Adoptable
1.010	F13	1200	Manhole	Adoptable	F14	1200	Manhole	Adoptable
7.000	F16	1200	Manhole	Adoptable	F15	1200	Manhole	Adoptable
5.002	F15	1200	Manhole	Adoptable	F14	1200	Manhole	Adoptable
5.001	F17	1200	Manhole	Adoptable	F15	1200	Manhole	Adoptable
1.012	F14	1200	Manhole	Adoptable	F26	1200	Manhole	Adoptable
6.000	F18	1200	Manhole	Adoptable	F17	1200	Manhole	Adoptable
1.013	F26	1200	Manhole	Adoptable	F27	1200	Manhole	Adoptable
1.014	F27	1200	Manhole	Adoptable	F28	1200	Manhole	Adoptable
1.015	F31	1200	Manhole	Adoptable	F29	1200	Manhole	Adoptable
1.016	F29	1200	Manhole	Adoptable	FHM 48	1200	Manhole	Adoptable
3.000_1	FMH3A	1200	Manhole	Adoptable	F3	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
F1	707005.326	741579.052	83.600	1.495	1200				
						0	8.000_1	82.105	150
F2	706963.959	741575.011	82.871	1.286	1200	1	8.000_1	81.585	150
									
						0	7.001	81.585	150
F3	707028.423	741537.180	84.895	1.942	1200		1	3.000_1	83.028	150
							2	3.000	84.072	225
							0	5.001_1	82.953	225
F4	707064.462	741541.033	85.950	1.425	1200				
						0	3.000	84.525	225
F5	707031.436	741505.506	85.125	2.331	1200		1	5.001_1	82.794	225
							0	5.002_1	82.794	225
F6	707034.544	741471.713	84.895	2.271	1200		1	7.000_1	82.699	150
							2	5.002_1	82.624	225
							0	5.003	82.624	225
F7	706998.195	741468.889	83.970	1.528	1200		1	5.003	82.442	225
							0	8.000	82.442	225
F8	707038.764	741423.600	84.595	2.688	1200		1	4.001	81.907	225
							2	1.004	83.147	225
							0	1.004_1	81.907	225
F9	707021.891	741422.638	84.147	2.324	1200		1	1.004_1	81.823	225
							0	1.005	81.823	225
F10	706985.836	741432.182	83.405	1.768	1200		1	1.005	81.637	225
							0	1.006	81.637	225
F11	706978.296	741428.878	83.185	1.589	1200		1	1.006	81.596	225
							0	1.007	81.596	225
F12	706977.663	741412.259	83.325	1.812	1200		1	1.007	81.513	225
							0	1.008	81.513	225
F13	706964.126	741370.748	83.060	1.767	1200		1	1.009	81.293	225
							0	1.010	81.293	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
F14	706957.466	741344.112	82.760	1.604	1200		1 5.002 2 1.010 0 1.012	81.156 81.156 81.156	225 225 225
F15	706971.338	741340.945	82.960	1.518	1200		1 7.000 2 5.001 0 5.002	81.442 81.442 81.442	225 225 225
F16	707005.537	741332.070	83.750	1.425	1200		0 7.000	82.325	225
F17	706967.576	741326.119	82.990	1.425	1200		1 6.000 0 5.001	81.565 81.565	225 225
F18	706961.784	741304.555	83.395	1.425	1200		0 6.000	81.970	225
F19	707039.477	741413.460	84.468	2.493	1200		1 5.000 0 4.001	81.975 81.975	225 225
F20	707025.606	741362.781	84.200	1.350	1200		0 5.000	82.850	225
F21	707092.882	741428.859	85.947	1.564	1200		1 1.003 0 1.004	84.383 84.383	225 225
F22	707099.214	741434.590	86.430	1.990	1200		1 1.002 0 1.003	84.440 84.440	225 225
F23	707095.162	741481.430	86.760	2.085	1200		1 1.001 0 1.002	84.675 84.675	225 225
F24	707089.671	741541.443	86.500	1.425	1200		0 1.001	85.075	225
FMH 4	706970.486	741465.997	83.330	1.177	1200		1 8.000	82.153	225
F26	706950.213	741315.828	82.395	1.432	1200		1 1.012 0 1.013	80.963 80.963	225 225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
F27	706939.512	741309.864	82.161	1.425	1200	1	1.013	80.736	225
						0	1.014	80.736	225
F28	706903.694	741318.742	81.245	1.425	1200	1	1.014	79.820	225
						0	1.014_1	79.820	225
F29	706888.134	741330.429	80.770	1.606	1200	1	1.015	79.164	225
						0	1.016	79.164	225
FHM 48	706889.314	741338.230	79.870	1.512	1200	1	1.016	78.358	225
F30	706968.668	741379.561	83.135	1.792	1200	1	1.008	81.343	225
						0	1.009	81.343	225
F31	706891.183	741323.413	80.989	1.586	1200	1	1.014_1	79.403	225
						0	1.015	79.403	225
FMH - 1	706964.840	741560.310	82.690	1.350	1200	1	7.001	81.340	150
FMH3A	707027.303	741548.888	84.625	1.400	1200	0	3.000_1	83.225	150
FW-2.1	707036.030	741454.775	84.789	1.350	1200	0	7.000_1	83.439	150

Appendix C

Statement of Design Acceptance – IW

Noel Mahon
Waterman Moylan
Block S
Eastpoint Business Park
Alfie Byrne Road
Dublin
D03H3F4

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

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

www.water.ie

18 May 2023

Re: Design Submission for Church Fields East, Tyrrelstown, Dublin (the "Development") (the "Design Submission") / Connection Reference No: CDS23001981

Dear Noel Mahon,

Many thanks for your recent Design Submission.

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

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

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

If you have any further questions, please contact your Irish Water representative:
Name: Antonio Garzón
Phone: 087 475 0587
Email: antonio.garzonmielgo@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- 20-074 - P4200 - Proposed Drainage Layout - Sector 4 - Sheet 1 of 2
- 20-074 - P4201 - Proposed Drainage Layout - Sector 4 - Sheet 2 of 2
- 20-074 - P4230 -Foul Water Longsections - Sheet 1 of 2 - Sector 4
- 20-074 - P4231 -Foul Water Longsections - Sheet 2 of 2 - Sector 4
- 20-074 - P4300 - Proposed Watermain Layout - Sector 4 - Sheet 1 of 2
- 20-074 - P4301 - Proposed Watermain Layout - Sector 4 - Sheet 2 of 2

Additional Comments

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

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

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

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

Appendix D

Paved Area Factors

Project :	**Church Fields East**
WM Ref:	**20-074**
Title:	**Paved Area Factors**
Date:	**Apr-23**

Drainage Network
Element

Roof SuDS(m²)	2338
Roof Gully (m²)	3109
Green Roof (m²)	1800
Roads SuDS (m²)	3363
Roads Gully (m²)	6218
Permeable Paving (m²)	2970
Grass (m²)	25610
Total Drained Area of New Development (m²)	**45408**

Paved Area Factors (PIMP Factors)

Roof SuDS	=	0.60
Roof Gully	=	0.95
Green Roof	=	0.60
Roads SuDS	=	0.90
Roads Gully	=	0.90
Permeable Paving	=	0.95
Grass	=	0.05

PIMP factor for Site 4

Element	
Roof SuDS	3.1%
Roof Gully	6.5%
Green Roof	2.4%
Roads SuDS	6.7%
Roads Gully	12.3%
Permeable Paving	6.2%
Grass	2.8%
Average PIMP Factor Per site	**40.0%**
Impermeable Area ha	**1.82** ha

Greenfield Outflow

Total Allowed based on 3.7litres/second/hectare

Site Area (Ha)	4.54
QBar formula	3.7x(4.54)
Qbar allowed ouflow for Total Area (l/s)	**16.80**

Project :	**Church Fields East**
WM Ref:	**20-074**
Title:	**Paved Area Factors**
Date:	**Apr-23**

Attenuation Tank
Element

Roof SuDS(m²)	2338
Roof Gully (m²)	3109
Green Roof (m²)	1800
Roads SuDS (m²)	3363
Roads Gully (m²)	6218
Permeable Paving (m²)	2970
Grass (m²)	25610
Total Drained Area of New Development (m²)	**45408**

Paved Area Factors (PIMP Factors)

Roof SuDS	=	0.95
Roof Gully	=	0.95
Green Roof	=	0.95
Roads SuDS	=	0.90
Roads Gully	=	0.90
Permeable Paving	=	0.95
Grass	=	0.05

PIMP factor for Site 4

Element		
Roof SuDS	4.9%	
Roof Gully	6.5%	
Green Roof	3.8%	
Roads SuDS	6.7%	
Roads Gully	12.3%	
Permeable Paving	6.2%	
Grass	2.8%	
Average PIMP Factor Per site	**43.2%**	(Attenuation Check)
Impermeable Area ha	**1.96**	ha

Greenfield Outflow

Total Allowed based on 3.7litres/second/hectare

Site Area (Ha)	4.54
QBar formula	3.7x(4.71)
Qbar allowed ouflow for Total Area (l/s)	**16.80**

Appendix E

Surface Water Pipe Design

Met Eireann
Return Period Rainfall Depths for sliding Durations
Location - Damastown - Irish Grid: Easting: 306642, Northing: 241431,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.6,	3.6,	4.2,	5.0,	5.6,	6.0,	7.5,	9.1,	10.2,	11.7,	13.1,	14.1,	15.7,	17.0,	18.0,	N/A ,
10 mins	3.6,	5.0,	5.8,	7.0,	7.8,	8.4,	10.4,	12.7,	14.2,	16.3,	18.2,	19.7,	21.9,	23.7,	25.1,	N/A ,
15 mins	4.2,	5.9,	6.9,	8.2,	9.2,	9.9,	12.3,	14.9,	16.7,	19.2,	21.4,	23.1,	25.8,	27.8,	29.5,	N/A ,
30 mins	5.6,	7.7,	8.9,	10.6,	11.8,	12.6,	15.5,	18.8,	20.9,	23.9,	26.6,	28.6,	31.8,	34.2,	36.2,	N/A ,
1 hours	7.4,	10.1,	11.5,	13.6,	15.1,	16.2,	19.7,	23.6,	26.2,	29.8,	32.9,	35.4,	39.1,	41.9,	44.3,	N/A ,
2 hours	9.7,	13.2,	14.9,	17.6,	19.3,	20.7,	25.0,	29.7,	32.8,	37.1,	40.9,	43.7,	48.1,	51.5,	54.3,	N/A ,
3 hours	11.5,	15.4,	17.4,	20.4,	22.3,	23.9,	28.7,	34.0,	37.4,	42.2,	46.3,	49.5,	54.3,	58.0,	61.1,	N/A ,
4 hours	12.9,	17.2,	19.4,	22.6,	24.8,	26.4,	31.7,	37.4,	41.1,	46.2,	50.7,	54.1,	59.2,	63.2,	66.4,	N/A ,
6 hours	15.2,	20.0,	22.6,	26.2,	28.6,	30.5,	36.4,	42.8,	46.9,	52.5,	57.5,	61.2,	66.9,	71.2,	74.8,	N/A ,
9 hours	17.8,	23.4,	26.3,	30.4,	33.1,	35.2,	41.8,	48.9,	53.5,	59.7,	65.2,	69.3,	75.6,	80.3,	84.2,	N/A ,
12 hours	20.0,	26.1,	29.3,	33.8,	36.7,	39.0,	46.1,	53.8,	58.7,	65.4,	71.3,	75.7,	82.4,	87.4,	91.6,	N/A ,
18 hours	23.6,	30.5,	34.1,	39.2,	42.5,	45.0,	53.0,	61.5,	67.0,	74.4,	80.8,	85.7,	93.0,	98.6,	103.1,	N/A ,
24 hours	26.5,	34.1,	37.9,	43.5,	47.1,	49.8,	58.4,	67.7,	73.5,	81.5,	88.4,	93.6,	101.4,	107.3,	112.2,	128.6,
2 days	32.9,	41.6,	45.9,	52.1,	56.1,	59.1,	68.5,	78.4,	84.7,	93.2,	100.4,	105.9,	114.0,	120.2,	125.2,	142.1,
3 days	38.1,	47.6,	52.4,	59.0,	63.3,	66.6,	76.6,	87.2,	93.8,	102.7,	110.4,	116.1,	124.6,	131.0,	136.2,	153.6,
4 days	42.7,	52.9,	58.0,	65.1,	69.7,	73.1,	83.7,	94.8,	101.8,	111.1,	119.1,	125.0,	133.8,	140.5,	145.8,	163.8,
6 days	50.7,	62.2,	67.8,	75.7,	80.7,	84.4,	96.0,	108.1,	115.6,	125.7,	134.2,	140.5,	149.9,	157.0,	162.6,	181.6,
8 days	57.8,	70.3,	76.4,	84.9,	90.3,	94.4,	106.8,	119.7,	127.7,	138.3,	147.3,	154.0,	163.9,	171.3,	177.3,	197.1,
10 days	64.3,	77.7,	84.3,	93.4,	99.1,	103.4,	116.6,	130.2,	138.6,	149.8,	159.2,	166.2,	176.6,	184.3,	190.5,	211.1,
12 days	70.3,	84.7,	91.6,	101.2,	107.3,	111.8,	125.7,	139.9,	148.7,	160.4,	170.2,	177.5,	188.3,	196.3,	202.7,	224.1,
16 days	81.6,	97.5,	105.1,	115.6,	122.3,	127.2,	142.3,	157.7,	167.2,	179.7,	190.3,	198.1,	209.6,	218.1,	224.9,	247.6,
20 days	92.0,	109.3,	117.5,	128.9,	136.0,	141.3,	157.5,	173.9,	184.0,	197.3,	208.5,	216.7,	228.9,	237.9,	245.1,	268.9,
25 days	104.3,	123.0,	132.0,	144.2,	152.0,	157.7,	175.0,	192.7,	203.4,	217.6,	229.5,	238.2,	251.1,	260.6,	268.2,	293.3,

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

M5 60 = 16.2
M5 2day = 59.1
Ratio = 0.27

M10 120 = 25mm
Roof Area = 35 m^2
Req Vol = $(35x10^{-3})x25$
Req Vol = $0.875m^3 = 0.88m^3$
Voids = 40%
Req Vol Soil = $(0.88/0.40) = 2.2\ m^3$
Planter Vol = $(2.3x1.1x0.90) = 2.28\ m^3$

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	0.600
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.047	4.00	83.600	1200	707002.750	741581.052	1.758
S2			82.871	1200	706966.243	741577.809	1.494
S3	0.070	4.00	84.895	1200	707030.758	741535.520	1.961
S4	0.269	4.00	85.950	1200	707067.617	741539.250	1.425
S5	0.075	4.00	85.125	1200	707033.883	741503.733	2.356
S6	0.049	4.00	84.895	1200	707037.139	741469.373	2.291
S7	0.065	4.00	84.000	1200	706999.405	741465.917	1.735
S8	0.010	4.00	84.595	1350	707041.289	741426.286	2.584
S9	0.040	4.00	84.147	1350	707020.716	741424.719	2.315
S10	0.006	4.00	83.405	1500	706987.471	741433.762	2.283
S11			83.250	1500	706999.064	741447.003	2.415
S12			83.250	1800	706986.000	741442.290	2.488
SW- A3 MH5			83.130	1500	706976.090	741438.432	2.430
S14	0.029	4.00	85.947	1350	707091.128	741431.216	2.232
S15	0.029	4.00	86.430	1350	707097.089	741435.548	2.677
S16	0.052	4.00	86.760	1200	707092.789	741484.068	2.762
S17	0.200	4.00	86.450	1200	707087.404	741543.902	2.160
S18	0.024	4.00	86.000	1200	707085.274	741567.903	1.580
S19	0.210	4.00	86.200	1200	707149.519	741574.057	1.350
SW-A3 MH1			82.690	1200	706967.121	741560.524	1.400
S20			83.185	1200	706974.684	741430.850	2.014
S21	0.086	4.00	83.325	1200	706975.763	741414.579	2.072
S22	0.036	4.00	83.135	1200	706966.883	741382.051	1.713
S23	0.059	4.00	83.060	1200	706961.848	741372.932	1.585
S24	0.037	4.00	82.760	1200	706954.232	741342.633	1.132
S25	0.007	4.00	82.960	1200	706967.987	741339.226	1.261
S26	0.053	4.00	82.990	1200	706965.439	741328.885	1.238
S27	0.151	4.00	84.200	1200	707029.945	741369.559	1.640
S28	0.116	4.00	84.025	1350	707026.009	741358.768	1.388
S29	0.025	4.00	83.750	1200	707008.177	741328.688	1.419
S30		4.00	83.395	1200	706959.541	741306.447	1.425
S31	0.211	4.00	84.468	1200	707042.262	741416.181	2.251
1		4.00	84.575	1200	707029.181	741552.408	1.425
SW-2.1		4.00	84.670	1200	707040.123	741436.991	1.425
SW-2.2			83.613	1500	707000.979	741430.063	2.689
SW-2.3			83.367	1500	707002.804	741436.783	2.501

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.011	S12	SW- A3 MH5	10.634	0.600	80.762	80.700	0.062	171.5	525	8.44	50.0
1.009	S11	S12	8.128	0.600	80.835	80.762	0.073	111.3	450	8.34	50.0
1.007	S9	SW-2.2	20.448	0.600	81.832	81.730	0.102	200.0	450	8.06	50.0
4.007	S10	SW-2.2	9.632	0.600	81.122	81.074	0.048	200.7	300	6.74	50.0
6.006	S20	S10	9.737	0.600	81.171	81.122	0.049	198.7	300	6.60	50.0
6.005	S21	S20	16.307	0.600	81.253	81.171	0.082	198.9	300	6.45	50.0
6.004	S22	S21	33.718	0.600	81.422	81.253	0.169	199.5	225	6.21	50.0
6.003	S23	S22	10.416	0.600	81.475	81.422	0.053	196.5	225	5.60	50.0
6.002	S24	S23	30.647	0.600	81.628	81.475	0.153	200.3	225	5.41	50.0
6.001	S25	S24	14.170	0.600	81.699	81.628	0.071	199.6	225	4.86	50.0
7.001	S26	S25	10.650	0.600	81.752	81.699	0.053	200.9	225	4.60	50.0
4.000	S29	S25	41.549	0.600	82.331	81.699	0.632	65.7	225	4.43	50.0
7.000	S30	S26	28.070	0.600	81.970	81.752	0.218	128.8	225	4.41	50.0
1.006	S8	S9	20.447	0.600	82.011	81.832	0.179	114.2	450	7.82	50.0
5.004	S7	S11	18.211	0.600	82.265	81.658	0.607	30.0	300	5.77	50.0
5.002	S31	S8	10.136	0.600	82.217	82.161	0.056	181.0	300	5.15	50.0
1.005	S14	S8	49.915	0.600	83.715	83.020	0.695	71.8	300	7.65	50.0
1.004	S15	S14	7.505	0.600	83.753	83.715	0.038	197.5	300	7.20	50.0
1.003	S16	S15	48.710	0.600	83.998	83.753	0.245	198.8	300	7.09	50.0
1.002	S17	S16	58.113	0.600	84.290	83.998	0.292	199.0	300	6.35	50.0
1.001	S18	S17	26.058	0.600	84.420	84.290	0.130	200.4	225	5.48	50.0
1.000	S19	S18	64.539	0.600	84.850	84.420	0.430	150.1	225	5.01	50.0
5.001	S27	S31	48.222	0.600	82.560	82.292	0.268	179.9	225	5.01	50.0
5.000	S28	S27	11.486	0.600	82.637	82.560	0.077	149.2	225	4.18	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.011	1.707	369.5	258.7	1.963	1.905	1.909	0.0	325	1.840
1.009	1.926	306.3	258.7	1.965	2.038	1.909	0.0	319	2.147
1.007	1.434	228.0	145.3	1.865	1.433	1.072	0.0	261	1.516
4.007	1.106	78.2	41.9	1.983	2.239	0.309	0.0	156	1.124
6.006	1.111	78.6	41.1	1.714	1.983	0.303	0.0	154	1.123
6.005	1.111	78.5	41.1	1.772	1.714	0.303	0.0	154	1.122
6.004	0.922	36.7	29.4	1.488	1.847	0.217	0.0	153	1.022
6.003	0.929	36.9	24.5	1.360	1.488	0.181	0.0	134	0.992
6.002	0.920	36.6	16.5	0.907	1.360	0.122	0.0	106	0.897
6.001	0.922	36.6	11.5	1.036	0.907	0.085	0.0	87	0.818
7.001	0.918	36.5	7.2	1.013	1.036	0.053	0.0	67	0.715
4.000	1.615	64.2	3.4	1.194	1.036	0.025	0.0	35	0.859
7.000	1.150	45.7	0.0	1.200	1.013	0.000	0.0	0	0.000
1.006	1.901	302.4	139.9	2.134	1.865	1.032	0.0	215	1.866
5.004	2.881	203.6	71.6	1.435	1.292	0.528	0.0	123	2.638
5.002	1.165	82.4	64.8	1.951	2.134	0.478	0.0	201	1.286
1.005	1.857	131.3	73.7	1.932	1.275	0.544	0.0	161	1.909
1.004	1.115	78.8	69.8	2.377	1.932	0.515	0.0	221	1.253
1.003	1.111	78.5	65.9	2.462	2.377	0.486	0.0	211	1.240
1.002	1.111	78.5	58.8	1.860	2.462	0.434	0.0	194	1.215
1.001	0.920	36.6	31.7	1.355	1.935	0.234	0.0	162	1.032
1.000	1.065	42.3	28.5	1.125	1.355	0.210	0.0	135	1.139
5.001	0.971	38.6	36.2	1.415	1.951	0.267	0.0	174	1.100
5.000	1.068	42.5	15.7	1.163	1.415	0.116	0.0	94	0.989

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.003	S5	S6	32.969	0.600	82.769	82.604	0.165	199.8	300	5.24	50.0
5.003	S6	S7	37.892	0.600	82.604	82.265	0.339	111.8	300	5.66	50.0
2.002	S3	S5	33.078	0.600	82.934	82.769	0.165	200.5	300	4.74	50.0
7.001_1	S2	SW-A3 MH1	17.307	0.600	81.377	81.290	0.087	198.9	225	4.73	50.0
3.000	S4	S3	34.163	0.600	84.525	83.457	1.068	32.0	225	4.25	50.0
7.000_1	S1	S2	36.651	0.600	81.842	81.377	0.465	78.8	225	4.41	50.0
7.000_2	1	S3	16.961	0.600	83.150	83.009	0.141	120.0	225	4.24	50.0
3.000_1	SW-2.1	S8	10.768	0.600	83.245	83.064	0.181	59.5	225	4.11	50.0
1.008	SW-2.2	SW-2.3	11.542	0.600	80.924	80.866	0.058	199.0	450	8.20	50.0
1.009_1	SW-2.3	S11	6.157	0.600	80.866	80.835	0.031	198.6	450	8.27	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.003	1.108	78.3	56.1	2.056	1.991	0.414	0.0	188	1.202
5.003	1.486	105.1	62.7	1.991	1.435	0.463	0.0	167	1.550
2.002	1.107	78.2	45.9	1.661	2.056	0.339	0.0	166	1.150
7.001_1	0.923	36.7	6.4	1.269	1.175	0.047	0.0	63	0.693
3.000	2.321	92.3	36.5	1.200	1.213	0.269	0.0	98	2.187
7.000_1	1.474	58.6	6.4	1.533	1.269	0.047	0.0	50	0.970
7.000_2	1.192	47.4	0.0	1.200	1.661	0.000	0.0	0	0.000
3.000_1	1.698	67.5	0.0	1.200	1.306	0.000	0.0	0	0.000
1.008	1.437	228.6	187.2	2.239	2.051	1.381	0.0	312	1.596
1.009_1	1.439	228.8	187.2	2.051	1.965	1.381	0.0	311	1.596

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.011	10.634	171.5	525	Circular	83.250	80.762	1.963	83.130	80.700	1.905
1.009	8.128	111.3	450	Circular	83.250	80.835	1.965	83.250	80.762	2.038
1.007	20.448	200.0	450	Circular	84.147	81.832	1.865	83.613	81.730	1.433
4.007	9.632	200.7	300	Circular	83.405	81.122	1.983	83.613	81.074	2.239
6.006	9.737	198.7	300	Circular	83.185	81.171	1.714	83.405	81.122	1.983
6.005	16.307	198.9	300	Circular	83.325	81.253	1.772	83.185	81.171	1.714
6.004	33.718	199.5	225	Circular	83.135	81.422	1.488	83.325	81.253	1.847
6.003	10.416	196.5	225	Circular	83.060	81.475	1.360	83.135	81.422	1.488
6.002	30.647	200.3	225	Circular	82.760	81.628	0.907	83.060	81.475	1.360

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.011	S12	1800	Manhole	Adoptable	SW- A3 MH5	1500	Manhole	Adoptable
1.009	S11	1500	Manhole	Adoptable	S12	1800	Manhole	Adoptable
1.007	S9	1350	Manhole	Adoptable	SW-2.2	1500	Manhole	Adoptable
4.007	S10	1500	Manhole	Adoptable	SW-2.2	1500	Manhole	Adoptable
6.006	S20	1200	Manhole	Adoptable	S10	1500	Manhole	Adoptable
6.005	S21	1200	Manhole	Adoptable	S20	1200	Manhole	Adoptable
6.004	S22	1200	Manhole	Adoptable	S21	1200	Manhole	Adoptable
6.003	S23	1200	Manhole	Adoptable	S22	1200	Manhole	Adoptable
6.002	S24	1200	Manhole	Adoptable	S23	1200	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.001	14.170	199.6	225	Circular	82.960	81.699	1.036	82.760	81.628	0.907
7.001	10.650	200.9	225	Circular	82.990	81.752	1.013	82.960	81.699	1.036
4.000	41.549	65.7	225	Circular	83.750	82.331	1.194	82.960	81.699	1.036
7.000	28.070	128.8	225	Circular	83.395	81.970	1.200	82.990	81.752	1.013
1.006	20.447	114.2	450	Circular	84.595	82.011	2.134	84.147	81.832	1.865
5.004	18.211	30.0	300	Circular	84.000	82.265	1.435	83.250	81.658	1.292
5.002	10.136	181.0	300	Circular	84.468	82.217	1.951	84.595	82.161	2.134
1.005	49.915	71.8	300	Circular	85.947	83.715	1.932	84.595	83.020	1.275
1.004	7.505	197.5	300	Circular	86.430	83.753	2.377	85.947	83.715	1.932
1.003	48.710	198.8	300	Circular	86.760	83.998	2.462	86.430	83.753	2.377
1.002	58.113	199.0	300	Circular	86.450	84.290	1.860	86.760	83.998	2.462
1.001	26.058	200.4	225	Circular	86.000	84.420	1.355	86.450	84.290	1.935
1.000	64.539	150.1	225	Circular	86.200	84.850	1.125	86.000	84.420	1.355
5.001	48.222	179.9	225	Circular	84.200	82.560	1.415	84.468	82.292	1.951
5.000	11.486	149.2	225	Circular	84.025	82.637	1.163	84.200	82.560	1.415
2.003	32.969	199.8	300	Circular	85.125	82.769	2.056	84.895	82.604	1.991
5.003	37.892	111.8	300	Circular	84.895	82.604	1.991	84.000	82.265	1.435
2.002	33.078	200.5	300	Circular	84.895	82.934	1.661	85.125	82.769	2.056
7.001_1	17.307	198.9	225	Circular	82.871	81.377	1.269	82.690	81.290	1.175
3.000	34.163	32.0	225	Circular	85.950	84.525	1.200	84.895	83.457	1.213
7.000_1	36.651	78.8	225	Circular	83.600	81.842	1.533	82.871	81.377	1.269
7.000_2	16.961	120.0	225	Circular	84.575	83.150	1.200	84.895	83.009	1.661
3.000_1	10.768	59.5	225	Circular	84.670	83.245	1.200	84.595	83.064	1.306
1.008	11.542	199.0	450	Circular	83.613	80.924	2.239	83.367	80.866	2.051

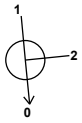
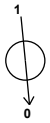
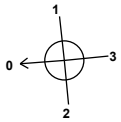
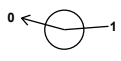
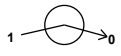
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
6.001	S25	1200	Manhole	Adoptable	S24	1200	Manhole	Adoptable
7.001	S26	1200	Manhole	Adoptable	S25	1200	Manhole	Adoptable
4.000	S29	1200	Manhole	Adoptable	S25	1200	Manhole	Adoptable
7.000	S30	1200	Manhole	Adoptable	S26	1200	Manhole	Adoptable
1.006	S8	1350	Manhole	Adoptable	S9	1350	Manhole	Adoptable
5.004	S7	1200	Manhole	Adoptable	S11	1500	Manhole	Adoptable
5.002	S31	1200	Manhole	Adoptable	S8	1350	Manhole	Adoptable
1.005	S14	1350	Manhole	Adoptable	S8	1350	Manhole	Adoptable
1.004	S15	1350	Manhole	Adoptable	S14	1350	Manhole	Adoptable
1.003	S16	1200	Manhole	Adoptable	S15	1350	Manhole	Adoptable
1.002	S17	1200	Manhole	Adoptable	S16	1200	Manhole	Adoptable
1.001	S18	1200	Manhole	Adoptable	S17	1200	Manhole	Adoptable
1.000	S19	1200	Manhole	Adoptable	S18	1200	Manhole	Adoptable
5.001	S27	1200	Manhole	Adoptable	S31	1200	Manhole	Adoptable
5.000	S28	1350	Manhole	Adoptable	S27	1200	Manhole	Adoptable
2.003	S5	1200	Manhole	Adoptable	S6	1200	Manhole	Adoptable
5.003	S6	1200	Manhole	Adoptable	S7	1200	Manhole	Adoptable
2.002	S3	1200	Manhole	Adoptable	S5	1200	Manhole	Adoptable
7.001_1	S2	1200	Manhole	Adoptable	SW-A3 MH1	1200	Manhole	Adoptable
3.000	S4	1200	Manhole	Adoptable	S3	1200	Manhole	Adoptable
7.000_1	S1	1200	Manhole	Adoptable	S2	1200	Manhole	Adoptable
7.000_2	1	1200	Manhole	Adoptable	S3	1200	Manhole	Adoptable
3.000_1	SW-2.1	1200	Manhole	Adoptable	S8	1350	Manhole	Adoptable
1.008	SW-2.2	1500	Manhole	Adoptable	SW-2.3	1500	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.009_1	6.157	198.6	450	Circular	83.367	80.866	2.051	83.250	80.835	1.965

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.009_1	SW-2.3	1500	Manhole	Adoptable	S11	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	707002.750	741581.052	83.600	1.758	1200				
						0	7.000_1	81.842	225
S2	706966.243	741577.809	82.871	1.494	1200	1	7.000_1	81.377	225
									
						0	7.001_1	81.377	225
S3	707030.758	741535.520	84.895	1.961	1200	1	7.000_2	83.009	225
						2	3.000	83.457	225
									
						0	2.002	82.934	300
S4	707067.617	741539.250	85.950	1.425	1200				
						0	3.000	84.525	225
S5	707033.883	741503.733	85.125	2.356	1200	1	2.002	82.769	300
									
						0	2.003	82.769	300
S6	707037.139	741469.373	84.895	2.291	1200	1	2.003	82.604	300
									
						0	5.003	82.604	300
S7	706999.405	741465.917	84.000	1.735	1200	1	5.003	82.265	300
									
						0	5.004	82.265	300
S8	707041.289	741426.286	84.595	2.584	1350	1	3.000_1	83.064	225
						2	5.002	82.161	300
						3	1.005	83.020	300
									
						0	1.006	82.011	450
S9	707020.716	741424.719	84.147	2.315	1350	1	1.006	81.832	450
									
						0	1.007	81.832	450
S10	706987.471	741433.762	83.405	2.283	1500	1	6.006	81.122	300
									
						0	4.007	81.122	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S11	706999.064	741447.003	83.250	2.415	1500	1	5.004	81.658	300
						2	1.009_1	80.835	450
						0	1.009	80.835	450
S12	706986.000	741442.290	83.250	2.488	1800	1	1.009	80.762	450
						0	1.011	80.762	525
SW- A3 MH5	706976.090	741438.432	83.130	2.430	1500	1	1.011	80.700	525
S14	707091.128	741431.216	85.947	2.232	1350	1	1.004	83.715	300
						0	1.005	83.715	300
S15	707097.089	741435.548	86.430	2.677	1350	1	1.003	83.753	300
						0	1.004	83.753	300
S16	707092.789	741484.068	86.760	2.762	1200	1	1.002	83.998	300
						0	1.003	83.998	300
S17	707087.404	741543.902	86.450	2.160	1200	1	1.001	84.290	225
						0	1.002	84.290	300
S18	707085.274	741567.903	86.000	1.580	1200	1	1.000	84.420	225
						0	1.001	84.420	225
S19	707149.519	741574.057	86.200	1.350	1200	0	1.000	84.850	225
SW-A3 MH1	706967.121	741560.524	82.690	1.400	1200	1	7.001_1	81.290	225
S20	706974.684	741430.850	83.185	2.014	1200	1	6.005	81.171	300
						0	6.006	81.171	300
S21	706975.763	741414.579	83.325	2.072	1200	1	6.004	81.253	225
						0	6.005	81.253	300
S22	706966.883	741382.051	83.135	1.713	1200	1	6.003	81.422	225
						0	6.004	81.422	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S23	706961.848	741372.932	83.060	1.585	1200	1	6.002	81.475	225
						0	6.003	81.475	225
S24	706954.232	741342.633	82.760	1.132	1200	1	6.001	81.628	225
						0	6.002	81.628	225
S25	706967.987	741339.226	82.960	1.261	1200	1	7.001	81.699	225
						2	4.000	81.699	225
						0	6.001	81.699	225
S26	706965.439	741328.885	82.990	1.238	1200	1	7.000	81.752	225
						0	7.001	81.752	225
S27	707029.945	741369.559	84.200	1.640	1200	1	5.000	82.560	225
						0	5.001	82.560	225
S28	707026.009	741358.768	84.025	1.388	1350	0	5.000	82.637	225
S29	707008.177	741328.688	83.750	1.419	1200	0	4.000	82.331	225
S30	706959.541	741306.447	83.395	1.425	1200	0	7.000	81.970	225
S31	707042.262	741416.181	84.468	2.251	1200	1	5.001	82.292	225
						0	5.002	82.217	300
1	707029.181	741552.408	84.575	1.425	1200	0	7.000_2	83.150	225
SW-2.1	707040.123	741436.991	84.670	1.425	1200	0	3.000_1	83.245	225
SW-2.2	707000.979	741430.063	83.613	2.689	1500	1	4.007	81.074	300
						2	1.007	81.730	450
						0	1.008	80.924	450
SW-2.3	707002.804	741436.783	83.367	2.501	1500	1	1.008	80.866	450
						0	1.009_1	80.866	450

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.800	Drain Down Time (mins)	240
Ratio-R	0.270	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node S12 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.011	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0162-1680-2500-1680
Invert Level (m)	80.762	Min Outlet Diameter (m)	0.225
Design Depth (m)	2.500	Min Node Diameter (mm)	1800
Design Flow (l/s)	16.8		

Node S11 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.06300	Safety Factor	1.0	Invert Level (m)	80.835
Side Inf Coefficient (m/hr)	0.06300	Porosity	0.40	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1100.0	0.0	1.765	1100.0	0.0	1.766	0.0	1300.0

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	81.906	0.064	10.4	0.1062	0.0000	OK
15 minute winter	S2	10	81.461	0.084	10.4	0.0954	0.0000	OK
15 minute winter	S3	11	83.205	0.271	75.2	0.4996	0.0000	OK
15 minute winter	S4	10	84.663	0.138	59.7	0.6779	0.0000	OK
15 minute winter	S5	11	83.073	0.304	87.3	0.5371	0.0000	SURCHARGED
15 minute winter	S6	11	82.843	0.239	95.5	0.3728	0.0000	OK
15 minute winter	S7	11	82.438	0.173	108.0	0.3255	0.0000	OK
15 minute winter	S8	11	82.327	0.316	190.8	0.4769	0.0000	OK
15 minute winter	S9	11	82.195	0.363	198.8	0.6447	0.0000	OK
360 minute winter	S10	280	81.647	0.525	11.4	0.9548	0.0000	SURCHARGED
360 minute winter	S11	280	81.646	0.811	70.9	358.2812	0.0000	SURCHARGED
360 minute winter	S12	280	81.646	0.884	39.2	2.2486	0.0000	SURCHARGED
15 minute summer	SW- A3 MH5	1	80.700	0.000	15.6	0.0000	0.0000	OK
15 minute winter	S14	11	83.916	0.201	97.0	0.3400	0.0000	OK
15 minute winter	S15	11	84.021	0.268	92.0	0.4419	0.0000	OK
15 minute winter	S16	11	84.343	0.345	90.4	0.5199	0.0000	SURCHARGED
15 minute winter	S17	11	84.667	0.377	84.7	1.1248	0.0000	SURCHARGED
15 minute winter	S18	11	84.863	0.443	46.8	0.6360	0.0000	SURCHARGED
15 minute winter	S19	11	85.228	0.378	46.6	1.6031	0.0000	SURCHARGED
15 minute winter	SW-A3 MH1	10	81.370	0.080	10.2	0.0000	0.0000	OK
360 minute winter	S20	280	81.647	0.476	11.7	0.5380	0.0000	SURCHARGED
360 minute winter	S21	280	81.647	0.394	11.6	0.7723	0.0000	SURCHARGED
15 minute winter	S22	11	81.700	0.278	39.6	0.4309	0.0000	SURCHARGED
15 minute winter	S23	11	81.759	0.284	37.0	0.5324	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	7.000_1	S2	10.4	0.930	0.177	0.4178	
15 minute winter	S2	7.001_1	SW-A3 MH1	10.2	0.776	0.278	0.2274	4.5
15 minute winter	S3	2.002	S5	70.7	1.077	0.903	2.2718	
15 minute winter	S4	3.000	S3	59.7	2.411	0.647	0.8453	
15 minute winter	S5	2.003	S6	85.0	1.291	1.085	2.1534	
15 minute winter	S6	5.003	S7	95.4	1.854	0.908	1.9386	
15 minute winter	S7	5.004	S11	108.4	2.759	0.533	0.7155	
15 minute winter	S8	1.006	S9	191.2	1.492	0.632	2.6162	
15 minute winter	S9	1.007	SW-2.2	198.5	1.552	0.870	2.6085	
360 minute winter	S10	4.007	SW-2.2	10.9	0.737	0.139	0.6783	
360 minute winter	S11	1.009	S12	39.2	0.539	0.128	1.2878	
360 minute winter	S11	Infiltration		0.0				
360 minute winter	S12	Hydro-Brake®	SW- A3 MH5	16.5				503.7
15 minute winter	S14	1.005	S8	97.1	2.001	0.740	2.4233	
15 minute winter	S15	1.004	S14	91.5	1.557	1.161	0.4377	
15 minute winter	S16	1.003	S15	86.4	1.236	1.100	3.3334	
15 minute winter	S17	1.002	S16	78.9	1.189	1.005	4.0923	
15 minute winter	S18	1.001	S17	42.6	1.070	1.164	1.0364	
15 minute winter	S19	1.000	S18	41.5	1.099	0.981	2.5668	
360 minute winter	S20	6.006	S10	11.2	0.696	0.143	0.6857	
360 minute winter	S21	6.005	S20	11.7	0.728	0.148	1.1483	
15 minute winter	S22	6.004	S21	38.6	0.991	1.054	1.3410	
15 minute winter	S23	6.003	S22	32.7	0.859	0.885	0.4143	

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S24	11	81.811	0.183	26.1	0.3274	0.0000	OK
15 minute winter	S25	12	81.822	0.123	18.7	0.1530	0.0000	OK
15 minute winter	S26	10	81.848	0.096	11.8	0.1910	0.0000	OK
15 minute winter	S27	11	83.043	0.483	53.1	1.4345	0.0000	SURCHARGED
15 minute winter	S28	11	83.073	0.436	25.7	1.3527	0.0000	SURCHARGED
15 minute winter	S29	10	82.375	0.044	5.5	0.0656	0.0000	OK
15 minute summer	S30	1	81.970	0.000	0.0	0.0000	0.0000	OK
15 minute winter	S31	10	82.532	0.315	94.1	0.9467	0.0000	SURCHARGED
15 minute winter	1	11	83.215	0.065	1.3	0.0731	0.0000	OK
15 minute summer	SW-2.1	1	83.245	0.000	0.0	0.0000	0.0000	OK
360 minute winter	SW-2.2	280	81.647	0.723	51.8	1.2767	0.0000	SURCHARGED
360 minute winter	SW-2.3	280	81.646	0.780	51.2	1.3787	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S24	6.002	S23	23.9	0.734	0.655	1.1407	
15 minute winter	S25	6.001	S24	17.9	0.762	0.489	0.4021	
15 minute winter	S26	7.001	S25	11.6	0.625	0.318	0.2024	
15 minute winter	S27	5.001	S31	51.0	1.283	1.320	1.9178	
15 minute winter	S28	5.000	S27	22.9	0.660	0.539	0.4568	
15 minute winter	S29	4.000	S25	5.5	0.482	0.085	0.5679	
15 minute summer	S30	7.000	S26	0.0	0.000	0.000	0.2263	
15 minute winter	S31	5.002	S8	93.1	1.372	1.130	0.6600	
15 minute winter	1	7.000_2	S3	-1.3	-0.092	-0.026	0.3909	
15 minute summer	SW-2.1	3.000_1	S8	0.0	0.000	0.000	0.0000	
360 minute winter	SW-2.2	1.008	SW-2.3	51.2	0.772	0.224	1.8288	
360 minute winter	SW-2.3	1.009_1	S11	50.7	1.172	0.221	0.9755	

Appendix F

Attenuation Design – 1, 30 & 100 Year Storms (+20% Climate change)

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	0.75
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	0.600
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	1.960	4.00	82.900	13.556	61.037	2.065

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.800	Drain Down Time (mins)	240
Ratio-R	0.270	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	20	0	0

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	80.800	Product Number	CTL-SHE-0162-1680-2500-1680
Design Depth (m)	2.500	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	16.8	Min Node Diameter (mm)	1800

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.06300	Safety Factor	1.0	Invert Level (m)	80.835
Side Inf Coefficient (m/hr)	0.06300	Porosity	0.40	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1170.0	0.0	1.765	1170.0	0.0	1.766	0.0	1100.0

Results for 1 year +20% CC Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Depth/Area 1	264	81.350	0.515	53.7	250.8400	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
360 minute winter	Depth/Area 1	Hydro-Brake®	16.3	428.3
360 minute winter	Depth/Area 1	Infiltration	0.0	

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	0.75
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	0.600
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	1.960	4.00	82.900	13.556	61.037	2.065

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.800	Drain Down Time (mins)	240
Ratio-R	0.270	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	80.800	Product Number	CTL-SHE-0162-1680-2500-1680
Design Depth (m)	2.500	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	16.8	Min Node Diameter (mm)	1800

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.06300	Safety Factor	1.0	Invert Level (m)	80.835
Side Inf Coefficient (m/hr)	0.06300	Porosity	0.40	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1170.0	0.0	1.765	1170.0	0.0	1.766	0.0	1100.0

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Depth/Area 1	456	82.199	1.364	88.1	664.4689	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
480 minute winter	Depth/Area 1	Hydro-Brake®	16.5	570.0
480 minute winter	Depth/Area 1	Infiltration	0.0	

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	0.75
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	0.200
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	1.960	4.00	82.900	13.556	61.037	2.065

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.800	Drain Down Time (mins)	240
Ratio-R	0.270	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	80.800	Product Number	CTL-SHE-0162-1680-2500-1680
Design Depth (m)	2.500	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	16.8	Min Node Diameter (mm)	1800

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.06300	Safety Factor	1.0	Invert Level (m)	80.835
Side Inf Coefficient (m/hr)	0.06300	Porosity	0.40	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1170.0	0.0	1.765	1170.0	0.0	1.766	0.0	1100.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Depth/Area 1	352	82.610	1.775	110.8	860.1888	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
480 minute winter	Depth/Area 1	Hydro-Brake®	16.5	558.1
480 minute winter	Depth/Area 1	Infiltration	19.3	

Appendix G

Attenuation Capacity Checks (Catchments A3 & A4)

Project :	Church Fields A3 & Church Field East
WM Ref:	20-074
Title:	Paved Area Factors
Date:	Apr-23

Church Fields A3 & Church Field East
Element
Catchment

Roofs(m²)	3961.899
Roads (m²)	6180.095
Permeable paving (m²)	1790.415
Grass (m²)	11650.046
Total Drained Area of New Development (m²)	**23582.455**

Paved Area Factors (PIMP Factors)

Roofs(m²)	0.95
Roads (m²)	0.95
Permeable paving (m²)	0.95
Grass (m²)	0.05

Paved Area Factors (m²)

Roofs(m²)	3763.80405
Roads (m²)	5871.09025
Permeable paving (m²)	1700.89425
Grass (m²)	582.5023

PIMP factor for Site 4

Element	
Roofs	16.0%
Roads	24.9%
Permeable paving	7.2%
Grass	2.5%
Average PIMP Factor Per site	**50.5388%**
Impermeable Area ha	**1.19183** ha

Greenfield Outflow

Total Allowed based on 3.7litres/second/hectare

Site Area (Ha)	2.36
QBar formula	3.7x (Site area Ha)
Qbar allowed ouflow for Total Area (l/s)	8.73 (+ 16.8 Sector 4)
	25.50 l/s

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	0.200
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	1.192			78.650		3.021	60.201	2.453
1		4.00	16.8	78.980	1200	4.619	59.181	1.500

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	Depth/Area 1	1.896	0.600	77.480	76.197	1.283	1.5	100	4.00	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	6.415	50.4	16.8	1.400	2.353	0.000	16.8	39	5.755

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	1.896	1.5	100	Circular	78.980	77.480	1.400	78.650	76.197	2.353

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Node Type
1.000	1	1200	Manhole	Adoptable	Depth/Area 1	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Depth/Area 1	3.021	60.201	78.650	2.453		1	1.000	76.197	100
1	4.619	59.181	78.980	1.500	1200	0	1.000	77.480	100

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.800	Drain Down Time (mins)	240
Ratio-R	0.270	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	76.197	Product Number	CTL-SHE-0214-2550-1500-2550
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	25.5	Min Node Diameter (mm)	1800

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	76.197
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.40	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1200.0	0.0	1.450	1200.0	0.0	1.451	0.0	0.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Depth/Area 1	690	77.560	1.363	67.3	667.4916	0.0000	OK
720 minute winter	1	690	77.777	0.297	16.8	0.3362	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	Depth/Area 1	Hydro-Brake®		25.5				1269.1
720 minute winter	1	1.000	Depth/Area 1	16.8	6.145	0.334	0.0148	

User Inputs

Chamber Model:	SC-740
Outlet Control Structure:	Yes
Project Name:	Church Fields A3
Engineer:	Noel Mahon
Project Location:	
Measurement Type:	Metric
Required Storage Volume:	623.01 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	351 mm.
Stone Above Chambers:	300 mm.
Average Cover Over Chambers:	458 mm.
Design Constraint Dimensions:	(26.00 m. x 33.01 m.)

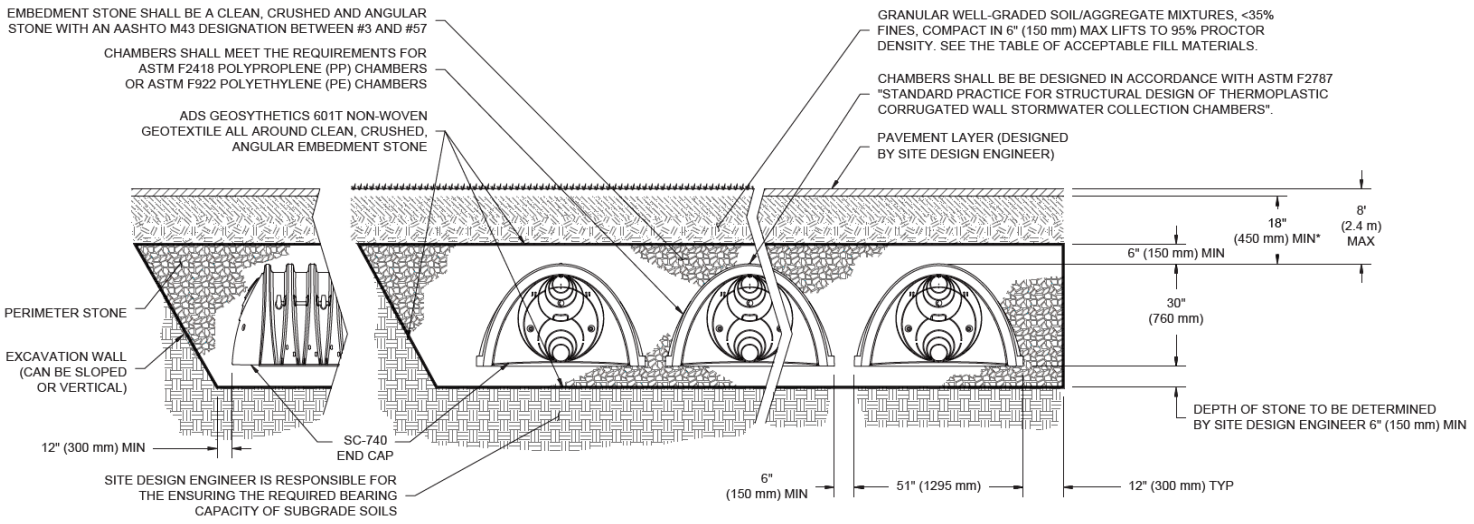
Results

System Volume and Bed Size

Installed Storage Volume:	638.26 cubic meters.
Storage Volume Per Chamber:	1.30 cubic meters.
Number Of Chambers Required:	234
Number Of End Caps Required:	34
Chamber Rows:	17
Maximum Length:	32.84 m.
Maximum Width:	25.26 m.
Approx. Bed Size Required:	806.97 square meters.

System Components

Amount Of Stone Required:	836 cubic meters
Volume Of Excavation (Not Including Fill):	1140 cubic meters
Total Non-woven Geotextile Required:	2138 square meters
Woven Geotextile Required (excluding Isolator Row):	67 square meters
Woven Geotextile Required (Isolator Row):	57 square meters
Total Woven Geotextile Required:	123 square meters
Impervious Liner Required:	0 square meters



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

Project :	Church Fields A4 & Church Field East
WM Ref:	20-074
Title:	Paved Area Factors
Date:	Apr-23

Church Fields A4 & Church Field East

Element	
Linear park (m²)	10841.23
Catchment	
Roofs, Roads and Permiable paving (m²)	8876.825
Grass (m²)	5405.438
Total Drained Area of New Development (m²)	**14282.263**
Total Drained Area of New Development including linear park (m²)	**25123.493**

Paved Area Factors (PIMP Factors)

Roofs, Roads and Permiable paving	0.95
Grass	0.05

Paved Area Factors (m²)

Roofs, Roads and Permiable paving (m²)	8432.98
Grass (m²)	270.27
Linear park (m²)	4040

PIMP factor for Site 4

Element		
Roofs, Roads and Permiable paving	33.6%	
Grass	1.1%	
Linear park	16.1%	
Average PIMP Factor Per site	**50.722%**	
Impermeable Area ha	**1.27433**	ha

Greenfield Outflow

Total Allowed based on 3.7litres/second/hectare

Site Area (Ha)	2.51
QBar formula	3.7x(Site area Ha)
Qbar allowed ouflow for Total Area (l/s)	**9.30**

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	0.600
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	1.273	76.000	3.021	60.201	2.115

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.800	Drain Down Time (mins)	240
Ratio-R	0.270	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	73.885	Product Number	CTL-SHE-0131-9300-1690-9300
Design Depth (m)	1.690	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	9.3	Min Node Diameter (mm)	1200

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	73.885
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.40	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	928.0	0.0	1.690	928.0	0.0	1.691	0.0	0.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	Depth/Area 1	570	75.507	1.622	61.1	621.4820	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
600 minute winter	Depth/Area 1	Hydro-Brake®	9.3	386.4

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	Church Fields A4
Engineer:	Noel Mahon
Project Location:	
Measurement Type:	Metric
Required Storage Volume:	621.01 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	229 mm.
Stone Above Chambers:	305 mm.
Average Cover Over Chambers:	458 mm.
Design Constraint Dimensions:	(50.00 m. x 27.50 m.)

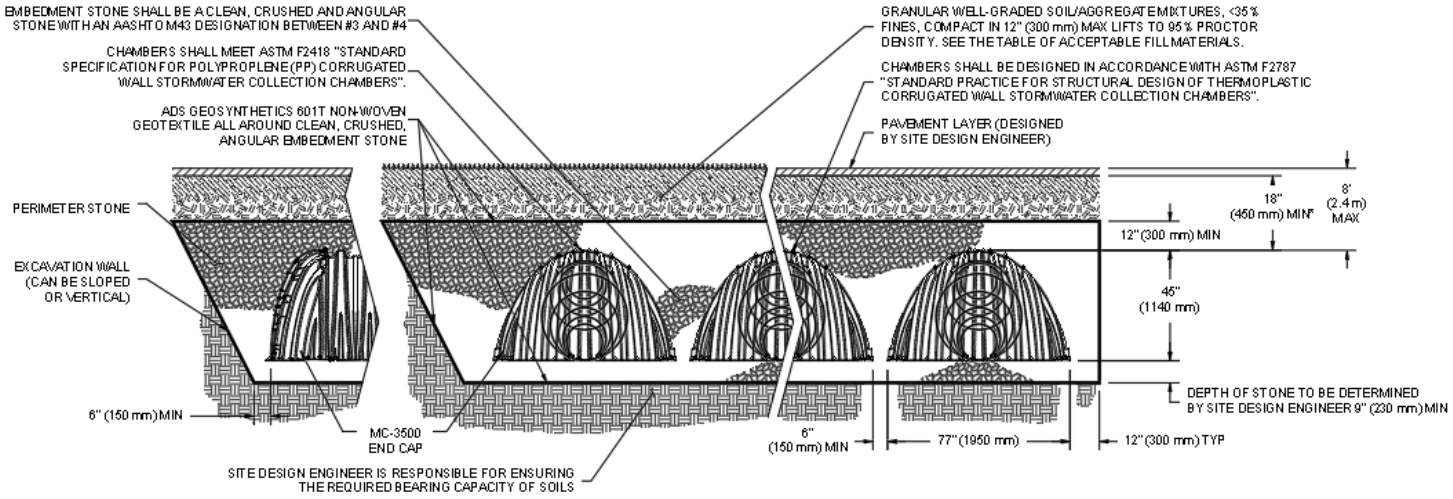
Results

System Volume and Bed Size

Installed Storage Volume:	640.79 cubic meters.
Storage Volume Per Chamber:	3.12 cubic meters.
Number Of Chambers Required:	117
Number Of End Caps Required:	22
Chamber Rows:	11
Maximum Length:	27.05 m.
Maximum Width:	23.84 m.
Approx. Bed Size Required:	621.51 square meters.

System Components

Amount Of Stone Required:	669 cubic meters
Volume Of Excavation (Not Including Fill):	1042 cubic meters
Total Non-woven Geotextile Required:	1702 square meters
Woven Geotextile Required (excluding Isolator Row):	98 square meters
Woven Geotextile Required (Isolator Row):	81 square meters
Total Woven Geotextile Required:	179 square meters
Impervious Liner Required:	0 square meters



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24"

UK and Ireland Office Locations