BARRETT **MAHONY**
CIVIL & STRUCTURAL
CONSULTING ENGINEERS

Infrastructure Planning Report

Project:
Holy Cross College SHD

Job No.
19.253

DOCUMENT CONTROL

Project:	Lands at Holy Cross College, Clonliffe Road, Dublin 3 and Drumcondra Road Lower, Drumcondra, Dublin 9.
Project No:	19.253
Document Title:	Infrastructure Planning Report
Document No:	19.253.IR.01

DOCUMENT STATUS

Issue	Date	Description	Orig.	PE	Issue Check
P01	09/10/2020	Issue for Comment	MH	MH	Michael Hughes
P02	04/11/2020	Issue for PAC	MH	MH	Michael Hughes
P03	30/05/2021	Update draft	MH	MH	Michael Hughes

Prepared by:

BMCE

52-54 Lower Sandwith Street

Dublin 2

D02WR26

Prepared for:

CWTC Multi Family ICAV acting on behalf of its sub fund DBTR DR1 Fund

Block 2, First Floor

Clanwilliam House, Clanwilliam Place

Dublin 2

BARRETT MAHONY CONSULTING ENGINEERS CIVIL & STRUCTURAL www.bmce.ie

MEMBER OF ACEI

ISO 9001:2015 REGISTERED COMPANY

ISO 14001:2015 REGISTERED COMPANY

ENGINEERS IRELAND cpd ACCREDITED EMPLOYER

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 GENERAL DESCRIPTION

This report has been prepared as part of a planning application for a proposed residential development at Clonliffe Road, Drumcondra, on behalf of the applicant, CWTC Multi Family ICAV acting on behalf of its sub-fund DBTR DR1 Fund. This report describes the proposed civil engineering infrastructure for the development and how it connects to the public infrastructure serving the area.

The project involves the development of lands at Holy Cross College, Clonliffe Road, Dublin 3 and Drumcondra Road Lower, Drumcondra, Dublin 9. The lands encompass a site of 14.76ha, of which 7.74ha relates directly to the residential proposed development. The remaining 7.02ha (which is outside the scope of this application) is intended for use as a GAA sports facilities and, as well as a new hotel.

The lands are located within the grounds of the former Holy Cross College seminary. The site is bounded by Clonliffe Road to the south, the Archbishop of Dublin's residence and Lower Drumcondra Road to the West, residential and private lands to the east, and the Tolka River runs the full length of the northern boundary. The site is currently predominantly green space (with trees) with a number of existing structures which formed the seminary campus. Refer Figure 1.1 and Site Plan Layout drawing in Appendix I for a satellite and plan view of the site.

The development will consist of the construction of a Build To Rent residential development set out in 12 no. blocks, ranging in height from 3 to 18 storeys, to accommodate 1614 no. apartments (comprising 540 studios, 602 no. 1 bed units, 419 no. 2 bed units and 53 no. 3 bed units) including a retail unit, a café unit, a crèche, and residential tenant amenity spaces. The development will include a single level basement under Blocks B2, B3 & C1, a single level basement under Block D2 and a podium level and single level basement under Block A1 to accommodate car parking spaces, bicycle parking, storage, services and plant areas. To facilitate the proposed development the scheme will involve the demolition of a number of existing structures on the site.

The proposed development sits as part of a wider Site Masterplan for the entire Holy Cross College lands which includes a permitted hotel development and future proposed GAA pitches and clubhouse.

The site contains a number of Protected Structures including The Seminary Building, Holy Cross Chapel, South Link Building, The Assembly Hall and The Ambulatory. The application proposes the renovation and extension of the Seminary Building to accommodate residential units and the renovation of the existing Holy Cross Chapel and Assembly Hall buildings for use as residential tenant amenity. The wider Holy Cross College lands also includes Protected Structures including The Red House and the Archbishop's House (no works are proposed to these Structures).

The residential buildings are arranged around a number of proposed public open spaces and routes throughout the site with extensive landscaping and tree planting proposed. Communal amenity spaces will be located adjacent to residential buildings and at roof level throughout the scheme. To facilitate the proposed development the scheme will involve the removal of some existing trees on the site.

The site is proposed to be accessed by vehicles, cyclists and pedestrians from a widened entrance on Clonliffe Road, at the junction with Jones's Road and through the opening up of an unused

access point on Drumcondra Road Lower at the junction with Hollybank Rd. An additional cyclist and pedestrian access is proposed through an existing access point on Holy Cross Avenue. Access from the Clonliffe Road entrance will also facilitate vehicular access to future proposed GAA pitches and clubhouse to the north of the site and to a permitted hotel on Clonliffe Road.

The proposed application includes all site landscaping works, green roofs, boundary treatments, PV panels at roof level, ESB Substations, lighting, servicing and utilities, signage, and associated and ancillary works, including site development works above and below ground.

Figure 1.1 Site Location Map Data © 2020 Google

1.2 SCOPE OF THIS REPORT

This report describes the proposed civil engineering infrastructure for the development and how it connects to the public infrastructure serving the area. In particular proposed surface water drainage, foul drainage and water supply elements are addressed.

A Site Specific Flood Risk Assessment report (specifically focused on residential lands) has been prepared by Barrett Mahony Consulting Engineers (BMCE) and submitted as part of this application.

Furthermore, a Masterplan Area Flood Risk Assessment (specifically focused on the balance of the GAA owned masterplan lands) and a Construction Surface Water Management Plan have been prepared, as specifically requested by DCC Drainage Division.

Roads infrastructure, traffic engineering and mobility management plan are not within the remit of BMCE. These elements are covered elsewhere within the application documentation.

This report should be read in conjunction with BMCE drawings submitted with the planning application.

2.0 RESPONSE TO DCC DRAINAGE COMMENTS ON PAC SUBMISSION

DCC Drainage Division commented upon the surface water and flood risk aspects of the PAC submission, and this formed part of their submission to ABP at PAC stage.

BMCE have liaised with DCC Drainage in respect of their comments and we have submitted a technical memo (19.253.MO.002) to DCC on 2 April 2021. The memo is included in Appendix 8, and certain changes to the surface water design have been incorporated into the submitted drawings, arising from same.

3.0 EXISTING DRAINAGE SYSTEMS

3.1 EXISTING PUBLIC DRAINAGE SYSTEMS IN VICINITY OF SITE

The existing drainage systems on the site are mainly combined systems (carrying foul and surface water). There are connections from the site to the existing sewerage network on Clonliffe Road and also to the 675mm diameter combined sewer, which traverses the north east quadrant of the masterplan lands.

There is an existing 225mm combined sewer on Holy Cross Avenue which discharges in a southerly direction and connects to the 375mm diameter combined sewer on Clonliffe Road. This 375mm sewer on Clonliffe Road discharges in an easterly direction and connects into a 450mm diameter combined sewer downstream.

There also a 675mm diameter combined sewer in the north east quadrant of the masterplan lands, crossing the lower lying grassed area in a south easterly direction. The existing sewerage network in the vicinity of the site eventually discharges to the Poplar Row pumping station (to the east) and from there sewage is pumped to the municipal wastewater treatment at Ringsend. Refer to Appendix 4 for a copy of the Dublin City Council (DCC) and Irish Water drainage and watermain records.

3.2 EXISTING DRAINAGE SYSTEMS ON THE SUBJECT SITE

On site, there is a combination of combined drains and surface water drains.

There is an existing surface water system which collects run-off from the internal access roads, via road gullies, before discharging in a southerly direction into the 375mm diameter combined sewer on Clonliffe Road.

There is an existing combined system serving the cluster of Seminary Buildings, majority of which discharges in a southerly direction, into the 225mm combined sewer on Holy Cross Avenue, and from there into the 375mm combined sewer on Clonliffe Road. A small portion of the combined drainage system discharges in a northerly direction and into the 675mm diameter combined public. Refer to BMCE drawing CLA-BMD-00-ZZ-DR-C-1001 Sheets S1-S4 for a copy of the existing drainage site plan layouts.

As part of the discussions with Irish Water at Pre-connection Enquiry stage, a detailed assessment was carried out to calculate the surface water and foul drainage flows entering the Irish Water public system from the subject site, in the existing situation and in the proposed situation.

The location of the existing and proposed outfall locations is indicated in Fig 3.2.

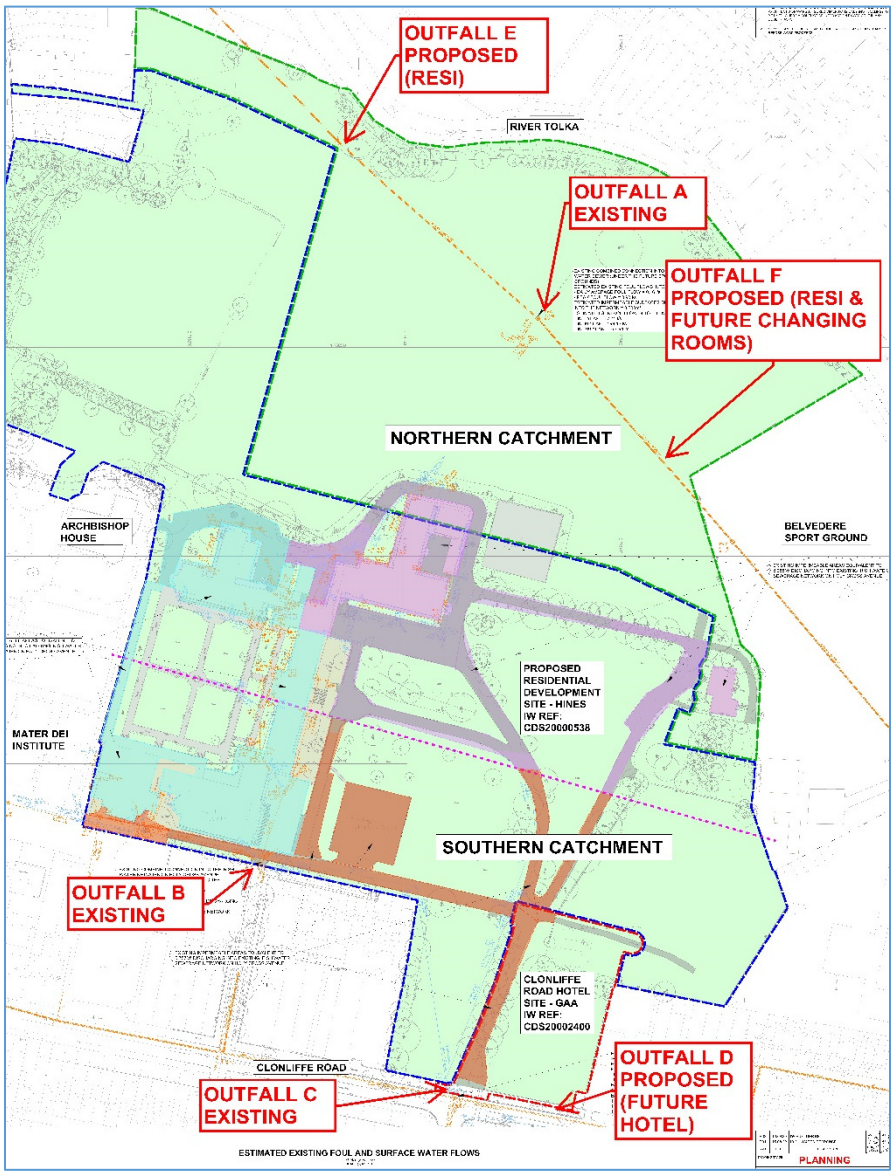


Figure 3.2 Drainage Outfall Locations

The existing and proposed flows are set out in Table 3.2.

The new development will comprise a separated drainage system, wherein the vast majority of surface water will not discharge into IW combined sewers, but rather will be attenuated to 2litres/sec/hectare (slowed down and temporarily stored) and discharged to the Tolka River. Due to this fact it is demonstrated that there is a significant reduction in overall discharge from the Holy Cross Lands into Irish Water sewers, during storm conditions, and this reduction ranges from 51% to 71%, depending on the storm event analysed.

Table 3.2 Existing and Proposed Drainage Flows

Drainage Flows For Existing Arrangements							
Outfall Ref	**Peak Foul flow l/sec**	**SW flow (1 in 1yr) l/sec**	**SW flow (1 in 30yr) l/sec**	**SW flow (1 in 100yr) l/sec**	**Scenario 1 (peak foul flow plus 1 in 1 year SW storm)**	**Scenario 2 (peak foul flow plus 1 in 30 year SW storm)**	**Scenario 1 (peak foul flow plus 1 in 100 year SW storm)**
A (at 675mm sewer)	0.93	67.75	199.12	277.94	0.93 + 67.75 = 68.68	0.93 + 199.12 = 200.05	0.93 + 277.94 = 278.87
B (at Holy Cross Ave)	3.74	71.84	211.13	294.70	3.74 + 71.84 = 75.58	3.74 + 211.13 = 214.87	3.74 + 294.70 = 298.44
C (at Junction Clonliffe Road and Jones Road)	0	47.08	138.35	193.11	47.08	138.35	193.11
Total discharge rates (foul and surface) into IW system for various scenarios					191.34	553.27	770.42
Drainage Flows For Proposed Arrangements							
Outfall Ref	**Peak Foul flow l/sec**	**SW flow (1 in 1yr) l/sec**	**SW flow (1 in 30yr) l/sec**	**SW flow (1 in 100yr) l/sec**	**Scenario 1 (peak foul flow plus 1 in 1 year SW storm)**	**Scenario 2 (peak foul flow plus 1 in 30 year SW storm)**	**Scenario 1 (peak foul flow plus 1 in 100 year SW storm)**
A (at 675mm sewer) This outfall point will be removed in the new arrangements	0	0	0	0	0	0	0
B (at Holy Cross Ave)	0	33.35	98	136.79	33.35	98	136.79
C (at Junction Clonliffe Road and Jones Road)	0	6.58	19.33	26.99	6.58	19.33	26.99
C1.0 (at Junction Clonliffe Road and Jones Road)	2.11	4.42	9.11	11.92	2.11 + 4.42 = 6.53	2.11 + 9.11 = 11.22	2.11 + 11.92 = 14.03
D (at Junction Clonliffe Road and Jones Road) serving new hotel only	5.21	2.0	2.0	2.0	7.21	7.21	7.21
E (into 675 sewer at NW corner of site)	14.39	0	0	0	14.39	14.39	14.39
F (into 675 sewer at NE corner of site)	26.15	0	0	0	26.15	26.15	26.15
Total discharge rates (foul and surface) into IW system for various scenarios					94.21	176.29	225.56
Percentage Reduction in overall discharge from Holy Cross Lands into IW sewers					51%	69%	71%

4.0 SURFACE WATER DRAINAGE SYSTEMS

Drainage from the proposed development will be drained on the basis of a completely separate system.

The foul system will connect to the Irish Water network at three locations including two connection points into the existing 675mm combined sewer and a third connection on Clonliffe Road (refer to Figure 3.2 above).

The surface water system will be attenuated prior to discharge into the River Tolka with the exception of Building C2 adjacent to Clonliffe Road which will discharge at a restricted flow, attenuated and into the Irish Water combined sewer on Clonliffe Road.

The drainage systems will be designed in accordance with Part H of the Building Regulations, EN 752 Drain and Sewer Systems outside Buildings, The Greater Dublin Regional Code of Practice for Drainage Works, Irish Water's Code of Practice for Wastewater and to DCC Drainage Division and Irish Water requirements.

4.1 PROPOSED SURFACE WATER DRAINAGE SYSTEM

Surface water run-off from the proposed development will drain by gravity and will be attenuated prior to discharge into the River Tolka with the exception of Building C2 adjacent to Clonliffe Road which will discharge at a restricted attenuated flow into the Irish Water combined sewer on Clonliffe Road. SuDS will be incorporated into the development and will include green roofs, permeable paving, filter drains, rain garden and shallow infiltration systems. Surface water run-off will go through a minimum of two-stage treatment prior to discharge by gravity into the receiving systems.

In response to DCC Drainage Division comments re sustainable drainage systems and the requirement for a minimum two-stage treatment train, the design team have reviewed the surface water strategy in detail, and have amended the surface water design in order to incorporate additional sustainable drainage measures where feasible. The amended design seeks to place greater emphasis on integrating increased opportunities for interception of surface water at source, through natural retention measures.

Please refer to BMCE drawings CLA-BMD-00-ZZ-DR-C-1005-S1 and CLA-BMD-00-ZZ-DR-C-1005-S2 showing the amended SuDS strategy layouts.

The proposed SuDs measures will reduce the quantity and improve the quality of water discharging into the receiving systems, see Section 4.3 for further information on the proposed sustainable measures.

The proposed surface water drainage system will be designed in accordance with DCC Drainage Division and Irish Water requirements. Refer to BMCE drawings CLA-BMD-00-ZZ-DR-C-1008 – Sheets S1-S8 for layout of the proposed surface water drainage.

4.1.1 Catchment Area

The site is divided into a number of surface water drainage catchments. The catchment areas have different SuDS measures which will have an influence on the runoff coefficient. The more porous the material, the lower the runoff coefficient. Materials in the area will consist of, but not limited

to, Permeable Paving, Green roof structures, solid roofs, impermeable areas, tree pits, filter strips, infiltration trenches and landscaped grass areas.

4.1.2 Catchment Strategy

The development will be served by 3no separated surface water drainage sub catchment areas, Each sub catchment will be served by a gravity drainage network, with run-off attenuated in each catchment prior to discharging to the Tolka river or the public network in Clonliffe road. The proposed catchment division is as follows:

1. Blocks A and surrounds (will drain by gravity towards the Tolka river)
2. Blocks B, C, D, E – with the exception of block C2, which will drain towards the Tolka river.
3. Block C2 – which will drain to the existing network in Clonliffe road.

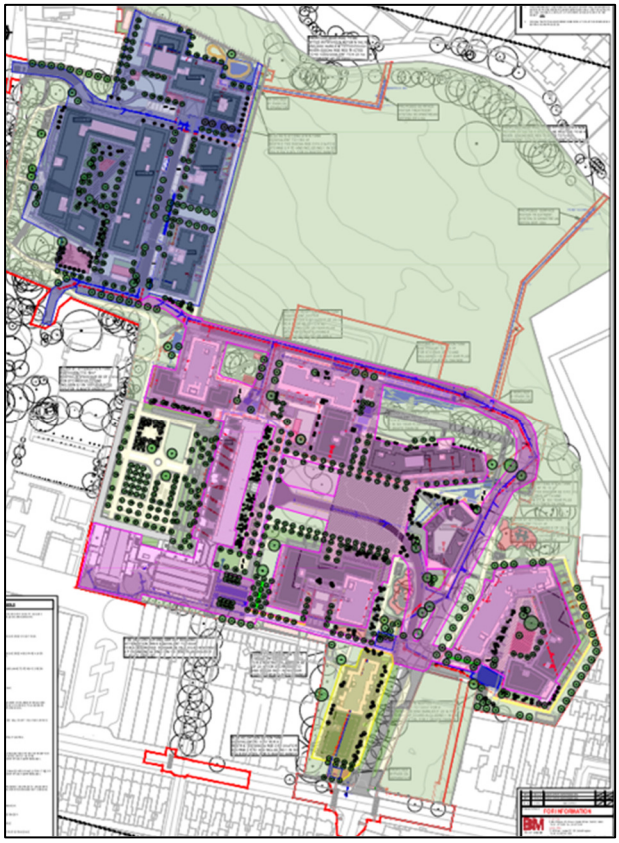


Figure 4.2.2 Catchment Strategy

4.1.2.1 Sub-Catchment 1: Blocks A and surrounds - North

The catchment area consists of various residential blocks with runoff directed to 2no. cellular attenuation storage tanks. The tanks has been designed to facilitate the 1 in 200 year flood evel from the Tolka river. The flood level of 5.40m was used as a invert (although the constructed invert will be 5.15m. The attenuation tank has been designed to cater for the unlikely event of a 1 in 200 year flood, having enough capacity to attenuate the surface runoff and the flooded river level. The hydrobrake flow control fitted to the tanks will be in line with the GDSDS requirements. A non-return valve will be fitted to the outlet to reduce any surcharge from outside the proposed development.

4.1.2.2 Sub-Catchment 2: Blocks B, C, D, E – Centre

The largest of the three sub-catchment areas will incorporate various SuDS and landscape elements to reduce the storm event runoff where possible. The existing church and library buildings will form part of the drainage strategy and the discharge will be limited to be in accordance with GDSDS requirements.

4.1.2.3 Sub-Catchment 3: Block C2 – South

The smallest of the three catchments will consist of a singular residential building with an attenuation tank, limiting any discharge. The existing entrance road and tree lane will be kept and no changes are proposed to the existing drainage strategy for the road in that area.

4.1.3 Estimation of greenfield runoff rate

In accordance with the IH124 method, the greenfield runoff for existing undeveloped sites measuring less than 50ha can be estimated using the following formula:
Qbar rural (in m^3 /s) = 0.00108 x (0.01 x AREA)0.89 x SAAR1.17 x SPR2.17
where:

- Qbar rural is the mean annual flood flow from a catchment
- AREA is the area of the catchment in ha.
- SAAR is the standard average annual rainfall for the period 1981-2010 Annual Average Rainfall Grid produced by Met Éireann.
- SPR is Standard Percentage Runoff coefficient for the SOIL category.

Rainfall data for the site was sourced from an Annual Average Rainfall (AAR) Grid (1981-2010) produced by Met Éireann (Available from: http://www.met.ie/climate/products03.asp). The rainfall data for the Irish Grid Coordinates closest to the site indicates a SAAR value of 721mm is appropriate. Irish Grids reference for this site area: 316388 (Easting) and 236473 (Northing).

Easting	Northing	Annual Average Rainfall (mm)
316000	233000	721
316000	234000	716
316000	235000	717
316000	236000	**721**
316000	237000	733
316000	238000	755
316000	239000	770

Table 4.2.3: Met Éireann Annual Average Rainfall (AAR) Grid (1981-2010) Extract

Therefore, $Qbar_{rural}$ for a 50ha site has been calculated as follows:

$Qbar_{rural}$ (for a50ha site) $= 0.00108 \times (0.01 \times 50)^{0.89} \times 721^{1.17} \times 0.40^{2.17}$

$Qbar_{rural}$ (for a 50ha site) $= 0.227385\ m^3/s$

$= 227.385\ l/s$

Interpolating linearly, this corresponds with a Qbar figure for the overall site (8.008ha) of 28.2 l/s. In accordance with GDSDS guidelines, a conservative value of 2l/s per hectare will be used.

Sub-Catchment 1 (2ha) = 4.0 l/s

Sub-Catchment 2 (5.75ha) = 11.5 l/s

Sub-Catchment 3 (smaller than 1ha) = 2.0 l/s

4.1.4 Flow Network Model input

In addition to the SAAR value given above, the Causeway Flow software requires inputs to accurately model the design rainfall events for the site. The following process is used to obtain the data;

- A request was submitted to Met Eireann for the Rainfall Return Period table relating to the Irish Grid Coordinates of the subject site.
- The value in the table that corresponded with 5 year return period and 60 minute storm duration was taken as the M5-60, which is 16.1 for the subject site.
- The value in the table that corresponded with 5 year return period and 2 day storm duration was taken as the M5-2D, which is 57.9 for the subject site.
- Dividing M5-60 by M5-2D, the Ratio-R was calculated as 0.278

4.2 Proposed Surface Water Management Plan

The proposed Surface Water Management Plan is in line with the key requirements of the Dublin City Council Drainage Division Planning & Development Control Section. The proposed surface water drainage system takes cognisance of the Dublin City Development Plan 2016 – 2022 with respect to SuDS Section 9.5.4. The proposed SuDS measures provide a minimum of two stage treatment train approach including interception and primary and secondary treatment of surface water run-off. This treatment approach is in line with The CIRIA SuDS Manual C753 and is outlined below.

The measures to be incorporated into the development and will include intensive and extensive green roofs, permeable paving, tree pits, gravel filter drains, rain gardens and shallow infiltration systems.

A Phasing Plan for the development (Refer to BMCE drawing CLA-BMD-00-ZZ-DR-C-3007) is provided showing the extent of development within each proposed phase. It should be noted that as part of the Phase 1 of the development, the Applicant commits to providing the requisite main surface water infrastructure needed to facilitate the adequate treatment of all surface water run-off from this Phase 1 of the development. By nature of the surface water strategy design for the overall development, some of this Phase 1 infrastructure contributes to the SuDS treatment train for subsequent phases. This, along with the phase-specific SuDS measures in each Phase of development, ensures that the full SuDS treatment train is implemented for each phase prior to any discharge entering the River Tolka to the north.

4.2.1 Proposed Surface Water Treatment Train

The proposed surface water system uses a number of SuDS components in series to provide a minimum of two-stage treatment prior to discharge into the receiving systems. A SuDs Management Train for the Development has been prepared – refer to Figure 4.3.1 The SuDS Management Train describes how rainfall falling on each surface is managed and treated prior discharge and clearly demonstrates a robust train of treatment, which in most cases exceeds the minimum two-stage requirement.

Rainfall run-off will be intercepted and treated at roof levels using intensive/extensive green roof where feasible. A multidisciplinary coordinated approach has been taken with regard to assigning the appropriate areas of roof level as intensive green roof, in an effort to accommodate other elements such as plant and photovoltaic panels. Furthermore, all podium areas (both hard and soft landscaping) over basement will be finished using an intensive green roof drainage board above the waterproofing, to ensure greater interception of rainwater and treatment through the substrate prior to entering the pipework system.

Owing to constraints on the site arising from the desire to retain existing mature trees and protection of these tree root zones (refer to constraints plan layout CLA-BMD-00-ZZ-DR-C-1010) pavement run-off will be intercepted and treated using a variety of SuDS components including gravel filter drains, permeable paving and rain gardens, which have been strategically selected and positioned where space permits.

The drainage of hardstanding has been re-examined and amended where feasible. The majority of pedestrianised areas and footpaths are proposed to be permeable paving or will be constructed such that the impermeable paths drain to a gravel trenches adjacent to the path, allowing for full interception and full infiltration of rainwater back to source.

Vehicular carriageways have proved challenging in terms of accommodating SuDS measures, given the existing tree constraints, but the design has now been amended to incorporate a far more robust approach to treatment of run-off from carriageways, ensure the risk of pollutants entering the Tolka River has been minimised significantly. Roads for the most part will either discharge to gravel filter drains along the verges, tree pits, or raingardens. Where adjacent to existing tree root protection zones, the run-off will discharge to trapped road gullies with sumps. Pipework from these will discharge into catchpit (silt trap) manholes followed by proprietary treatment systems such as Hydro International ‘Downstream Defender’ and bypass petrol interceptors which will remove any final silts and oils to discharge into the River Tolka.

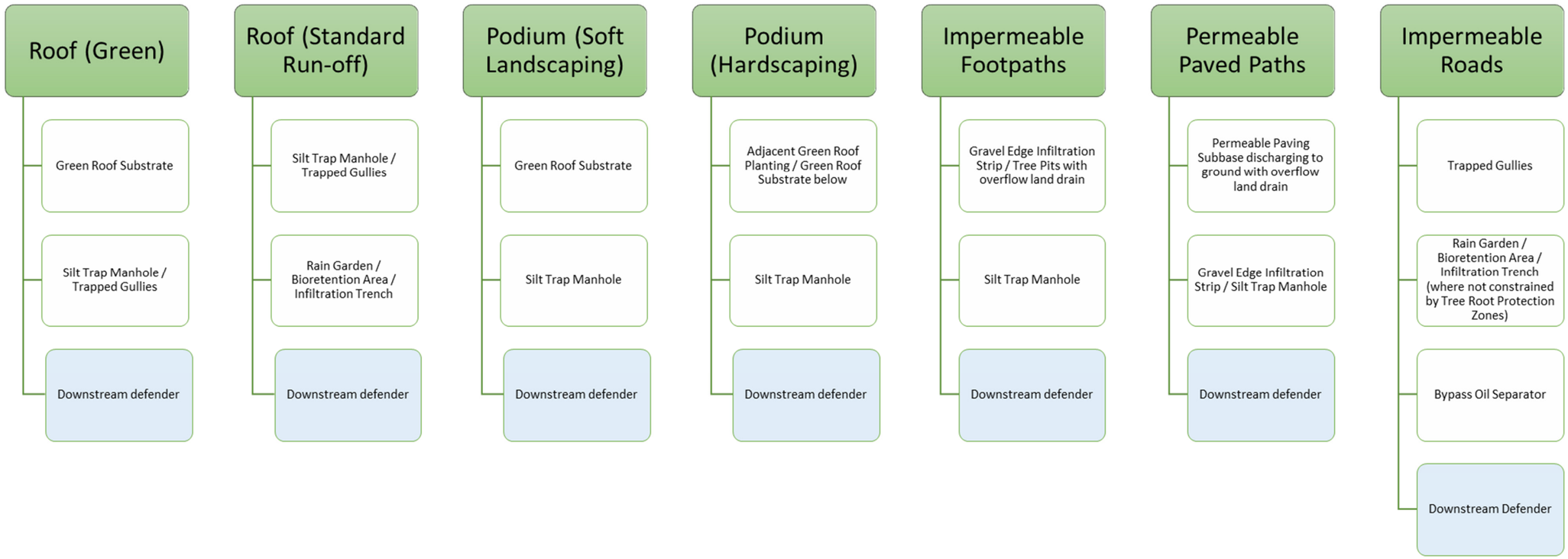


Figure 4.3.1 Surface Water Management Train

4.2.2 Proposed Surface Water Treatment SuDS Measures

Green Roofs

The proposed green roofs will consist of sedum roofing on maintenance only roofs, and intensive green roofing on rooftop amenity spaces. The proposed green roof coverage is summarised in Figure 4.3.2 below.

ROOF TYPE / BLOCK NO.	A1.1	A1.2	A2	A3	A4.1	A4.2	A4.3	B1	B2	B3	C1	C2	D1	D2	E2	E1	CH	L
INTENSIVE GREEN	1349	1416	460	476	306	407	180	510	609	375	1060	486	502	1380	520	0	0	0
EXTENSIVE GREEN	0	0	0	0	0	0	0	0	0	0	0	0	155	0	0	0	0	0
STANDARD ROOF	632	64	249	234	299	-	192	670	867	598	564	538	57	1359	172	998	752	474
TOTAL	1981	1480	709	710	605	407	372	1180	1476	973	1624	1024	714	2739	692	998	752	474
% of GREEN ROOF COVERAGE ACHIEVED	68	96	65	67	51	100	48	43	41	38	65	47	92	50	75	0	0	0

ROOF TYPE / BLOCK NO.	A1.1	A1.2	A2	A3	A4.1	A4.2	A4.3	B1	B2	B3	C1	C2	D1	D2	E2	E1	CH	L	CENTRAL BASEMENT
PODIUM AREAS (INTENSIVE GREEN ROOF)	1545		-	-	-	-	-	-	-	-	-	-	-	1198	-	-	-	-	3141

Figure 4.3.2 Green Roof Areas

The proposed green roofs will cover approx. 62% average cross new roof areas. The limitations in providing full green roof coverage is due to plant enclosures. The green roof will provide interception of rainfall, filtration through the medium, and storage within the voids facilitating evapotranspiration.

The green roofs will intercept and absorb the first 5 – 10mm of rainfall, thereby reducing the volume of run-off into the receiving systems. Rainfall run-off that is not absorbed by the green roof will filtrate through the substrate and geotextile filter fabric. A limited attenuation volume will be provided by the green roof crate layer system below the geotextile filter fabric, which will provide a time delay between the rainfall event and discharge into the system thereby reducing peak discharge rates. According to the leading green roof supplier/manufacturer Bauder, up to 40% of average annual rainfall can be absorbed and released back into the atmosphere by transpiration and evaporation.

Therefore, rainfall run-off from roof areas covered by the proposed green roofs will go through a two-stage treatment train including interception and primary treatment in line with SuDS Manual C753 Table 26.7.

Filter Drains

The proposed filter drains will be linear excavations filled with suitable granular material with a minimum void porosity of 30% and wrapped in a geotextile filter membrane. The filter drains will intercept pavement run-off at ground level. Catchpits will be provided downstream of the filter drains to offer additional surface water treatment including retention.

The proposed filter drains will provide interception and reduce peak run-off rates prior to discharge into the surface water drainage system. The granular material and geotextile filter material will provide interception and act as a secondary treatment in preventing ingress of fine material from paved areas prior to discharge into surface water drainage system.

Therefore, rainfall run-off that will discharge into the filter drains / catchpits will go through a three-stage treatment train including interception, primary and secondary treatment in line with SuDS Manual C753 Table 26.7

Permeable Pavements

The proposed permeable pavement will be located at parking bays throughout the development. The proposed permeable paving structures will be filled with suitable granular material with a minimum void porosity of 30% and wrapped in a geotextile filter membrane. The granular material will provide interception within the voids and by raising the invert of the outlet pipe to 150mm above the base. The geotextile filter material can offer secondary treatment of rainfall runoff by preventing ingress of fine material from paved areas through filtration prior to discharge into surface water drainage system.

Therefore, rainfall run-off from localised access road will go through a two-stage treatment train including interception and primary treatment in line with SuDS Manual C753 Table 26.7.

Rain Garden and Tree Pits

There are 2 areas of proposed rain garden, located to the southeast corner of Block C1 and to the northeast corner of Block A4. These will intercept and treat pavement run-off from the adjacent access roads and roof areas. The proposed rain-gardens will allow surface water run-off to pond temporarily before filtering through vegetation and underlaying soil before discharge into the system and therefore will serve as a bio-retention system providing interception as the water discharges through plants, shrubs and landscape medium. The planters will provide temporary retention for the 1 in 1 year event in the shallow depressions. Sand based material will be used to filter the water passing through. Further filtration will be provided by the geotextile filter membrane prior to discharge into the surface water system.

Therefore, rainfall run-off from the adjacent access roads. will go through a three-stage treatment train including interception, primary and secondary treatment in line with SuDS Manual C753 Table 26.7

Proprietary Surface Water Treatment Systems

Due to existing site constraints including mature trees adjacent to existing roads, the construction of many forms of sustainable drainage systems is not easily achievable. At suitable locations, a break will be introduced in the proposed kerbs to allow run-off to infiltrate to ground and into tree pits. Where this option is not available, it is the design intent to install proprietary surface water treatment systems prior to discharge into the river. The surface water treatment systems include catchpits, oil separators and sediments remover such as a ‘Downstream Defender’ or similar.

4.2.3 The Greater Dublin Strategic Drainage Study

The Greater Dublin Strategic Drainage Study (GDSDS) addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimize the impact of urbanisation, by replicating the run-off characteristics of the greenfield site. The criteria provide a consistent approach to addressing the increase in both rate and volume of run-off, as well as ensuring the environment is protected from any pollution from roads and buildings. These drainage design criteria are as set out in Table 4.3.3.a:

Table 4.3.3.a GDSDS Drainage Criteria

GDSDS Criteria		Aims
Criterion 1	River Water Quality Protection	• To prevent pollution • To maintain base flows in streams • To recharge groundwater
Criterion 2	River Regime Protection	• To prevent river scour due to flash flooding
Criterion 3	Flood Risk Assessment	• To prevent site flooding for the 30yr storm and manage overland flows if site flooding occurs for the 100yr storm
Criterion 4	River Flood Protection	• To prevent river flooding

The overarching principle of SuDS design is that surface water runoff should be managed for maximum benefit. The types of benefits that can be achieved by SuDS will be dependent on the site, but fit broadly into four categories – The Four Pillars of SuDS – as described in the CIRIA SuDS Manual C753 and set out in Table 4.3.3.b;

Table 4.3.3.b The Four Pillars of SuDS

SuDS Category	Benefit
Water Quantity	• Maintain and protect the natural water cycle • Support the management of flood risk
Water Quality	• Manage the quality of run-off to prevent pollution
Biodiversity	• To create and sustain better places for nature
Amenity	• To create and sustain better places for people

Compliance with four GDSDS criteria and the four pillars of SuDS as described in the CIRIA SuDS Manual C753, requires a robust strategy that employs at source and site wide SuDS control measures. The SuDS strategy for the development has been developed in conjunction with the Landscape Architects, and strives to achieves the aims and benefits outlined above, despite being somewhat restricted by the available green space, and in particular the necessity to retain existing mature trees on the subject site.

4.2.3.1 Criterion 1 GDSDS – River Water Quality Protection

Run-off from natural greenfield areas contributes very little pollution and sediment to rivers and for most rainfall events direct run-off from greenfield sites to rivers does not take place as rainfall percolates into the ground. By contrast, urban run-off, when drained by pipe systems, results in run-off from virtually every rainfall event with high levels of pollution, particularly in the first phase of run-off, with little rainfall percolating to the ground. To prevent this happening, Criterion 1 requires that interception storage and/or treatment storage is provided, thereby replicating the run-off characteristics of the pre-development greenfield site.

In the context of the proposed development, it is proposed that all surface water run-off will go through a two stage treatment train via green roofs, permeable paving, filter drains and rain garden before discharging at a controlled rate into the receiving systems.

4.2.4 Interception Storage

The GDSDS requires that Interception storage, where provided, should ensure that at a minimum the first 5mm and preferably the first 10mm of rainfall is intercepted on site and does not directly pass to the receiving watercourse.

Interception storage can be attained using SuDS features which allow the rainwater to infiltrate into the ground, evaporate into the atmosphere or transpire through vegetation. Soft landscaping and planted areas are conservatively taken as providing natural interception storage of 15mm.

Interception storage volumes for each Sub-catchment areas shown below

4.2.4.1 Interception Storage - Catchment 1

Interception storage required m^3 = Total drained area (m^2) x minimum rainfall (mm)

Interception storage required = 23,259m^2 x 10mm = 232.59m^3

Type of areas	Areas (m^2)	Storage (l/m^2)	Capacity (m^3)
Landscaping (Grass / Soft)	6091	15	91.41
Intensive Podium	1545	12	18.54
Green Roof	4414	12	52.97
Permeable Paving	1828	40	73.12
Impermeable Paving	1847	0	0.0
Standard Roof (impermeable)	1670	0	0.0
Total	-	-	**236.04**

Table 4-1 – Interception Storage Catchment 1

The proposed Interception storage meets the preferred 10mm storage criteria

4.2.4.2 Interception Storage - Catchment 2

Interception storage required m^3 = Total area (m^2) x minimum rainfall (mm)

Interception storage required = 51,831m^2 x 10mm = 518.31m^3

Type of areas	Areas (m^2)	Storage (l/m^2)	Capacity (m^3)
Landscaping (Grass / Soft)	13823	15	207.34
Intensive Podium	1198	12	14.38
Green Roof	4382	12	52.58
Permeable Paving	6140	40	245.6
Impermeable Paving	3415	0	0.0
Standard Roof (impermeable)	6511	0	0.0
Total	-	-	**519.90**

Table 4-2 – Interception Storage Catchment 2

The proposed Interception storage meets the preferred 10mm storage criteria.

4.2.4.3 Interception Storage - Catchment 3

Interception storage required m^3 = Total area (m^2) x minimum rainfall (mm)

Interception storage required = 4,213m^2 x 10mm = 42.13m^3

Type of areas	Areas (m^2)	Storage (l/m^2)	Capacity (m^3)
Landscaping (Grass / Soft)	1176	15	17.64
Green Roof	486	12	5.83
Permeable Paving	580	40	23.2
Impermeable Paving	539	0	0.0
Standard Roof (impermeable)	538	0	0.0
Total	-	-	**46.67**

Table 4-5 – Interception Storage Catchment 3

The proposed Interception storage meets the preferred 10mm storage criteria.

4.2.4.4 Treatment Storage

In accordance with the GDSDS, interception storage & treatment storage are interchangeable. Since full interception storage has been provided, treatment storage is not required.

4.2.5 Criterion 2 GDSDS – River Regime Protection

Regardless of the rainfall event, unchecked run-off from a developed site through traditional pipe networks will discharge into receiving waters at rates that are an order of magnitude greater than that prior to development. This can cause flash flow in the outfall river / stream that can cause scour and erosion. Attenuation storage is provided to prevent this occurring by limiting the rate of run-off to that which took place from the pre-development greenfield site.

In the context of the subject site, peak run -off discharge from the proposed development will be restricted to a peak rate of 15.5 l/s into the River Tolka in line with GDSDS requirement of 2.0 l/s/ha. Attenuation facilities will be provided throughout the site for storm events up to and including the 1 in 100 year plus 20% for climate change.

Therefore, GDSDS Criterion 2 is complied with.

4.2.6 Criterion 3 GDSDS – Level of Service For the Site

The GDSDS requires that no flooding should occur on site for storms up to and including the 1 in 30 year event. The pipe network and the attenuation storage volumes should, therefore, be checked for such storms to ensure that no site flooding occurs although partial surcharging of the system is allowed as long as it does not threaten to flood.

For the 1 in 100 year event, the pipe network can fully surcharge and cause site flooding, but the top water level due to any such flooding must be at least 500mm below any vulnerable internal floor levels, and the flood waters should be contained within the site. In addition, the top water level in any attenuation device during the 100 year storm must be at least 500mm below any vulnerable internal floor levels.

Refer to Appendix 3 for Causeway Flow simulations demonstrating a level of service as described above and ensures no surface water flooding for storms up to and including the 1 in 100 year with 20% extra for climate change. Therefore, GDSDS Criterion 3 is complied with.

4.2.7 Criterion 4 GDSDS – River Flood Protection

Criterion 4 is intended to prevent flooding of the receiving system / watercourse by either limiting the volume of run-off to the pre-development greenfield volume using 'long-term storage' (Option 1) or by limiting the rate of run-off for the 1 in 100 year storm to QBAR or 2.0l/s/ha without applying growth factors using 'extended attenuation storage' (Option 2).

Option 2 is complied with as the proposed development will limit discharge rate to 15.5 l/s in line with GDSDS requirement of 2.0 l/s/ha.

4.3 Summary of SuDS Measures

The proposed Surface Water Management Plan for the development is in line with the key requirements of the Dublin City Drainage Division and the Dublin City Development Plan 2016-2022 with respect to Sustainable Drainage Systems.

Rainfall run-off from the proposed site development will go through at least a two-stage treatment train prior to discharge into the River Tolka. The proposed SuDS measures will reduce the quantity and improve the quality of water discharging into the receiving system.

4.4 Construction Surface Water Management Plan

DCC Drainage Division requested details of protections to the river from any site runoff or other forms of possible pollution from site activities during construction. In response, please refer to the separate document 19.253-RP-05 – Outline CSWMP.

5.0 FOUL DRAINAGE SYSTEM

5.1 PROPOSED FOUL DRAINAGE SYSTEM

There is an existing 375mm Foul Network Sewer on Clonliffe Road. There is an existing 675mm Foul Network Sewer which crosses the site at the northern corner heading in a south western direction.

Refer to Appendix 5 for existing drainage records & drawing set no. C1008 for additional information.

5.2 PROPOSED FOUL DRAINAGE SYSTEM

The proposed foul drainage system will be designed to take discharges from the new residential units. Drainage from kitchen/canteen facilities will discharge through a grease separator designed in accordance with IS EN 1825 Part 1 and Part 2 and / or to Irish Water requirements. The foul system will connect to the Irish Water network at three locations including two connection points into the existing 675mm combined sewer below the future Sports Grounds and a third connection on Clonliffe Road. Refer to BMCE drawings CLA-BMD-00-ZZ-DR-C-1008 – Sheets S1-S8 for layout of the proposed foul drainage.

It is calculated that the proposed development will have a total hydraulic loading of 719m^3 per day of foul effluent generated during the operational phase of the development. This equates to an average flow of 8.32 litres/second (over a 24-hour period) and a peak flow of 24.96 litres/second. A breakdown of the foul loading calculations is included in Appendix 1

A Pre-connection Enquiry application was submitted to Irish Water to confirm capacity in the receiving network and a confirmation of feasibility was obtained. See Appendix 6 for a copy of the Irish Water Confirmation of Feasibility letter and see Appendix 7 for a copy of the Statement of Design Acceptance.

5.2.1 Residential Flow – 1614 no. units

Dry Weather Flow (Daily)	= (Population)(Consumption/Capita) + (Infiltration)
Number of Residential Units	= 1614
Population Estimate	= 1614 x 2.7 = 4358 persons
Consumption/Capita	= 150 litres / person / day
Infiltration	= 10% (as per App C Section 1.2.4 of CoP for WW Infrastructure)
Average Flow (DWF)	= (1614 x 2.7 x 150 x 1.1) = 719,037 litres / day
	= 8.32 litres/second
Peak Flow	= (Average Flow) × (3) = 8.32 x 3
	= 24.96 litres/second

5.2.2 Foul Network Design

The proposed pipe network has been designed in accordance with the relevant requirements of the Irish Water Code of Practice for Wastewater Infrastructure.

The proposed foul drainage network comprises of a series of 225mm diameter pipes, designed for a minimum velocity of 0.75m/s (self-cleansing) and maximum velocity of 3.0m/s. A pipe friction coefficient of 1.5mm has been assumed.

Each residential block is serviced by 150mm diameter (SN8 uPVC) branch connections in accordance with the Irish Water Code of Practice for Wastewater Infrastructure. It is noted the proposed foul outfall pipe is 225mm diameter pipe at 1:100 minimum fall which has a capacity of approximately 47 l/s and is deemed adequate for the peak foul flows anticipated.

Refer to BMCE drawings CLA-BMD-00-ZZ-DR-C-1008 – Sheets S1-S8 for layout of the proposed foul drainage.

6.0 WATER SUPPLY

6.1 EXISTING WATERMAIN INFRASTRUCTURE

There are numerous Irish Water watermains in the vicinity of the site including:

- A 100mm, 150mm and 800mm diameter watermains, to the south of the proposed development, on Clonliffe Road.
- A 150mm watermain on Holy Cross Avenue, to the south west of the proposed development.
- A 600mm and a 225mm watermain on Drumcondra Road Lower, to the north west of the proposed development.

Refer to Appendix 5 for details of the IW / DCC drainage and watermain records for the area.

In addition, there is a network of existing on-site watermains serving the various existing buildings across the Holy Cross lands. Refer to drawing CLA-BMD-00-ZZ-DR-C-1001 Sheets 1-4 for details of the existing on site watermain layout. Such is the scale of the proposed development across the site (including the demolition of several buildings), virtually all of the existing watermains will be decommissioned and grubbed up.

6.2 PROPOSED WATERMAINS

The proposed water supply connection to the new development will be from the existing 600mm public main on Drumcondra Road Lower with a cross-connection to the existing 225mm public main on Drumcondra Road Lower, as directed by Irish Water.

In addition, it is proposed that the development will be serviced by a second connection to the 800mm diameter public main on Clonliffe Road.

The proposed watermain system through the site will be 250mm diameter. Refer to drawings CLA-BMD-00-ZZ-DR-C-1009 Sheets 1-8 for the layout of the proposed watermains.

All of the new apartment blocks will be sprinklered, with 5 sprinkler tanks located as follows – Block A1 basement, Existing Block E1 lower ground, new central basement, Block D1 ground floor and Block D2 basement.

It is the M&E Engineers proposal that not every block will have its own water break tank and pumped system. Certain of the blocks will be fed from the tanks/pumped systems in other blocks. Refer to Appendix 9 for schematic drawings from OCSC M&E (ref CLN-OSC-ZZ-ZZ-DR-ME-0001 and CLN-OSC-ZZ-ZZ-DR-ME-0002) which indicates the location and layout of tanks and how each block is fed.

We expect the peak flow demand during the operational phase of the development to be in the region of 47.3 litres/second, equivalent to an average daily demand of 818 m^3. The installation of low flow fittings and a rainwater harvesting system for the development will reduce the demand on the existing water supply network.

A Pre-connection Enquiry application was submitted to Irish Water to confirm capacity in the network and a confirmation of feasibility was obtained. See Appendix 6 for a copy of the Irish Water Confirmation of the Feasibility letter and see Appendix 7 for a copy of the Statement of Design Acceptance

6.2.1 Residential Demand – 1614 no. units

Average Daily Demand	= (Population)(Consumption/Capita)
Number of Residential Units	= 1614
Population Estimate	= 1614 x 2.7 = 4358 persons
Consumption/Capita	= 150 litres / person / day
Average Daily Demand	= 4358 x 150
	= 653,670 litres/day
Average Day/Peak Week Demand	= (Average Daily Demand) x 1.25
	= 817,088 litres/day
	= 9.45 litres/second
Peak Demand	= (Average Day/Peak Week Demand) x 5
	= 47.28 litres/second

6.2.2 Watermain Design

All proposed water ring mains will be HDPE 250 SDR17 in accordance with Irish Water Standards. Individual houses will have their own connections (25mm O.D. PE pipe MDPE 80 SDR11) to distribution water mains via service connections and meter / boundary boxes. Individual connections are to be installed in accordance with Irish Water Standard Details.

The proposed water main layout is arranged such that all buildings are a maximum of 46m from a hydrant in accordance with the Department of the Environment's Building Regulations "Technical Guidance Document Part B Fire Safety". Hydrants are to be installed in accordance with Irish Water's Code of Practice and Standard Details. Final positions of hydrants will be agreed as part of the Fire Safety Certificate requirements.

Sluice valves are provided at appropriate locations to facilitate isolation and purging of the system.

Individual houses will accommodate minimum 24-hour water storage (in accordance with the requirements of Irish Water's Code of Practice) and include provision of water conservation measures such as dual flush water cisterns and low flow taps.

7.0 TRAFFIC ENGINEERING

Separate reports and drawings outlining the traffic assessment, roads access, internal road network and mobility management matters have been prepared by Systra and are submitted with this planning application.

8.0 FLOOD RISK ASSESSMENT

Refer to the BMCE Site Specific Flood Risk Assessment submitted as part of this planning application, which relates specifically to the proposed residential development.

Refer also to the BMCE Masterplan Area Flood Risk Assessment submitted as part of this application, which relates specifically to the GAA owned balance of the Masterplan lands.

Appendix 1

Foul Load Calculations

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

Foul Loading & Water Demand Calculations

Date: **29 April 2021**

Subject: **Clonliffe Lands, Clonliffe Road, D3**
Masterplan Drainage & Water Supply

---

1. Proposed Discharge to Clonliffe Road Outfall (375mm Foul Sewer)

The proposed foul system collects foul discharges from Block C2 via a 150mm drain before discharging into the 375mm Irish Water combined sewer on Clonliffe Road. Refer to BMCE drawing CLA-BMD-00-ZZ-DR-C-1002 in Appendix I.

The foul effluent from the proposed Block C2 is calculated as per the Irish Water Code of Practice for Wastewater Infrastructure (April 2021) assuming dry weather flow of 150 l/head/day and using the Irish Water assumed average occupancy of 2.7 persons/unit. See Table 1.1 for foul discharge rates.

Table 1.1 Discharge Rates to Clonliffe Road Sewers

Proposed Discharge to Clonliffe Road Outfall (375mm Foul Sewer)									
Location	Category	Number of Units	Number of Persons per Units	Total Number of Persons	Infiltration 10% as per CoP	Flow Rates for Design (Litres / Persons / Day)	Average Daily Flow Rates (m^3/ Day)	Peaking Factor	Peak Flow Rates (Litres / Seconds)
Block C2	Residential	96	2.7	259	10%	150	42.8	6	2.70

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

2. Proposed Discharge to Sports Grounds Outfalls (675mm Foul Sewer)

The proposed foul system collects foul discharges from the rest of the proposed masterplan before discharging into the 675mm Irish Water combined sewer under the Future Sports Grounds. Refer to BMCE drawing CLA-BMD-00-ZZ-DR-C-1002 in Appendix I.

The foul effluent from the proposed development is calculated as per the Irish Water Code of Practice for Wastewater Infrastructure (April 2021) assuming dry weather flow of 150 l/head/day and using the Irish Water assumed average occupancy of 2.7 persons/unit. See **Error! Reference source not found.** for foul discharge rates.

Table 2.1 Discharge Rates to Sports Grounds Outfalls

Proposed Discharge to Sports Grounds Outfalls (675mm Foul Sewer)									
Location	Category	Number of Units	Number of Persons per Units	Total Number of Persons	Infiltration 10% as per CoP	Flow Rates for Design (Litres / Persons / Day)	Average Daily Flow Rates (m^3/ Day)	Peaking Factor per IW COP appendix B table 2.5	Peak Flow Rates (Litres / Seconds)
Block C1	Residential	146	2.7	394	10%	150	65.0		
Block D2	Residential	239	2.7	645	10%	150	106.5		
Block B1	Residential	92	2.7	248	10%	150	41.0		
Block B2	Residential	137	2.7	370	10%	150	61.0		
Block D1	Residential	151	2.7	408	10%	150	67.3		
Block B3	Residential	80	2.7	216	10%	150	35.6		
Block E1	Residential	56	2.7	151	10%	150	24.9		
Block E2	Residential	48	2.7	130	10%	150	21.4		
Blocks A1.1 & A1.2	Residential	305	2.7	824	10%	150	135.9		
Block A2	Residential	73	2.7	197	10%	150	32.5		
Block A3	Residential	87	2.7	235	10%	150	38.8		
Blocks A4.1_A4.2&A4.3	Residential	104	2.7	281	10%	150	46.3		
Total		1518		4099			676.3	3	23.48

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

3. Proposed Water Demand

The water demand for the proposed development has been calculated using the guidelines given in the Irish Water Code of Practice for Water Infrastructure (April 2021) Section 3.7.2 assuming a per-capita consumption of 150 l/head/day and using the Irish Water assumed average occupancy of 2.7 persons/unit. The average day/peak week demand is taken as 1.25 times the average daily domestic demand. The peak demand factor is taken as 5 times the average day/peak week demand. See Table 3.1 for foul discharge rates.

Table 3.1 Masterplan Water Demand Rates

Proposed Water Demand									
Location	Category	Number of Units	Number of Persons per Units	Total Number of Persons	Flow Rates for Design (Litres / Persons / Day)	Average Day Peak Factor	Average Day Water Demand (m^3/Day)	Peak Demand Factor	Peak Water Demand Rates (Litres/Seconds)
Site Wide	Residential	1614	2.7	4358	150	1.25	817.1	5.00	47.29

Appendix 2

Green Roof Areas

Proposed SuDS Green Roof Coverage

ROOF TYPE / BLOCK NO.	A1.1	A1.2	A2	A3	A4.1	A4.2	A4.3	B1	B2	B3	C1	C2	D1	D2	E2	E1	CH	L
INTENSIVE GREEN	1349	1416	460	476	306	407	180	510	609	375	1060	486	502	1380	520	0	0	0
EXTENSIVE GREEN	0	0	0	0	0	0	0	0	0	0	0	0	155	0	0	0	0	0
STANDARD ROOF	632	64	249	234	299	-	192	670	867	598	564	538	57	1359	172	998	752	474
TOTAL	1981	1480	709	710	605	407	372	1180	1476	973	1624	1024	714	2739	692	998	752	474
% of GREEN ROOF COVERAGE ACHIEVED	68	96	65	67	51	100	48	43	41	38	65	47	92	50	75	0	0	0

ROOF TYPE / BLOCK NO.	A1.1	A1.2	A2	A3	A4.1	A4.2	A4.3	B1	B2	B3	C1	C2	D1	D2	E2	E1	CH	L	CENTRAL BASEMENT
PODIUM AREAS (INTENSIVE GREEN ROOF)	1545		-	-	-	-	-	-	-	-	-	-	-	1198	-	-	-	-	3141

Figure 2 - Green Roof Areas

Appendix 3

Causeway Flow Simulations

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)	16.100	Minimum Backdrop Height (m)	0.200
Ratio-R	0.278	Preferred Cover Depth (m)	1.200
CV	1.000	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)
S17.0	0.019	4.00	12.585	1200	716151.426	736461.606	1.985
S17.1	0.027	4.00	10.000	1200	716187.842	736452.048	1.450
S17.2	0.010	4.00	9.660	1200	716191.413	736465.459	1.560
S17.3	0.101	4.00	8.300	1200	716198.775	736493.106	1.700
S17.4	0.023	4.00	7.689	1200	716206.014	736520.294	1.889
S18.0	0.023	4.00	7.850	1200	716153.249	736587.139	1.050
S18.1	0.011	4.00	7.560	1200	716160.318	736573.205	1.411
S18.2	0.022	4.00	7.560	1200	716193.811	736566.026	1.631
S17.5	0.545	4.00	7.500	1200	716216.604	736560.063	1.840
S17.6			7.675	1200	716250.172	736553.652	3.075
S16.0	0.147	4.00	7.985	1200	716258.000	736584.587	3.535
S16.2			7.650	1200	716259.191	736583.684	3.250
S16.3			5.355	1200	716338.674	736570.908	1.530
DSD1			5.295	1200	716340.332	736577.233	1.770

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	S17.0	S17.1	37.639	0.600	10.600	8.554	2.046	18.4	225	4.20	50.0
1.001	S17.1	S17.2	12.533	0.600	8.550	8.101	0.449	27.9	225	4.29	50.0
1.002	S17.2	S17.3	27.879	0.600	8.100	6.833	1.267	22.0	225	4.45	50.0
1.003	S17.3	S17.4	27.535	0.600	6.600	5.800	0.800	34.4	225	4.66	50.0
1.004	S17.4	S17.5	40.555	0.600	5.800	5.661	0.139	291.8	300	5.40	50.0
2	S18.0	S18.1	15.418	0.600	6.800	6.149	0.651	23.7	150	4.12	50.0
2.001	S18.1	S18.2	34.254	0.600	6.149	5.929	0.220	155.7	225	4.67	50.0
2.002	S18.2	S17.5	23.353	0.600	5.929	5.660	0.269	86.8	225	4.95	50.0
1.005	S17.5	S17.6	11.171	0.600	5.660	5.599	0.061	183.1	375	5.54	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)
1	3.064	121.8	3.4	1.760	1.221	0.019	0.0
1.001	2.486	98.9	8.3	1.225	1.334	0.046	0.0
1.002	2.801	111.4	10.1	1.335	1.242	0.056	0.0
1.003	2.238	89.0	28.4	1.475	1.664	0.157	0.0
1.004	0.915	64.7	32.5	1.589	1.539	0.180	0.0
2	2.077	36.7	4.2	0.900	1.261	0.023	0.0
2.001	1.045	41.6	6.1	1.186	1.406	0.034	0.0
2.002	1.404	55.8	10.1	1.406	1.615	0.056	0.0
1.005	1.335	147.5	141.1	1.465	1.701	0.781	0.0

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)
1.007	S17.6	S16.0	31.910	0.600	4.600	4.450	0.150	212.7	375	5.97	50.0
1.008	S16.0	S16.2	2.180	0.600	4.450	4.400	0.050	43.6	375	5.98	50.0
1.009	S16.2	S16.3	79.158	0.600	4.400	3.825	0.575	137.7	225	7.17	50.0
1.01	S16.3	DSD1	5.193	0.600	3.825	3.525	0.300	17.3	225	7.19	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)
1.007	1.238	136.8	141.1	2.700	3.160	0.781	0.0
1.008	2.750	303.7	167.7	3.160	2.875	0.928	0.0
1.009	1.112	44.2	167.7	3.025	1.305	0.928	0.0
1.01	3.161	125.7	167.7	1.305	1.545	0.928	0.0

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	37.639	18.4	225	Circular	12.585	10.600	1.760	10.000	8.554	1.221
1.001	12.533	27.9	225	Circular	10.000	8.550	1.225	9.660	8.101	1.334
1.002	27.879	22.0	225	Circular	9.660	8.100	1.335	8.300	6.833	1.242
1.003	27.535	34.4	225	Circular	8.300	6.600	1.475	7.689	5.800	1.664
1.004	40.555	291.8	300	Circular	7.689	5.800	1.589	7.500	5.661	1.539
2	15.418	23.7	150	Circular	7.850	6.800	0.900	7.560	6.149	1.261
2.001	34.254	155.7	225	Circular	7.560	6.149	1.186	7.560	5.929	1.406
2.002	23.353	86.8	225	Circular	7.560	5.929	1.406	7.500	5.660	1.615
1.005	11.171	183.1	375	Circular	7.500	5.660	1.465	7.675	5.599	1.701
1.007	31.910	212.7	375	Circular	7.675	4.600	2.700	7.985	4.450	3.160
1.008	2.180	43.6	375	Circular	7.985	4.450	3.160	7.650	4.400	2.875
1.009	79.158	137.7	225	Circular	7.650	4.400	3.025	5.355	3.825	1.305
1.01	5.193	17.3	225	Circular	5.355	3.825	1.305	5.295	3.525	1.545

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1	S17.0	1200	Manhole	Adoptable	S17.1	1200	Manhole	Adoptable
1.001	S17.1	1200	Manhole	Adoptable	S17.2	1200	Manhole	Adoptable
1.002	S17.2	1200	Manhole	Adoptable	S17.3	1200	Manhole	Adoptable
1.003	S17.3	1200	Manhole	Adoptable	S17.4	1200	Manhole	Adoptable
1.004	S17.4	1200	Manhole	Adoptable	S17.5	1200	Manhole	Adoptable
2	S18.0	1200	Manhole	Adoptable	S18.1	1200	Manhole	Adoptable
2.001	S18.1	1200	Manhole	Adoptable	S18.2	1200	Manhole	Adoptable
2.002	S18.2	1200	Manhole	Adoptable	S17.5	1200	Manhole	Adoptable
1.005	S17.5	1200	Manhole	Adoptable	S17.6	1200	Manhole	Adoptable
1.007	S17.6	1200	Manhole	Adoptable	S16.0	1200	Manhole	Adoptable
1.008	S16.0	1200	Manhole	Adoptable	S16.2	1200	Manhole	Adoptable
1.009	S16.2	1200	Manhole	Adoptable	S16.3	1200	Manhole	Adoptable
1.01	S16.3	1200	Manhole	Adoptable	DSD1	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S17.0	716151.426	736461.606	12.585	1.985	1200	0	1	10.600	225
S17.1	716187.842	736452.048	10.000	1.450	1200	1 0	1 1.001	8.554 8.550	225 225
S17.2	716191.413	736465.459	9.660	1.560	1200	1 0	1.001 1.002	8.101 8.100	225 225
S17.3	716198.775	736493.106	8.300	1.700	1200	1 0	1.002 1.003	6.833 6.600	225 225
S17.4	716206.014	736520.294	7.689	1.889	1200	1 0	1.003 1.004	5.800 5.800	225 300
S18.0	716153.249	736587.139	7.850	1.050	1200	0	2	6.800	150
S18.1	716160.318	736573.205	7.560	1.411	1200	1 0	2 2.001	6.149 6.149	150 225
S18.2	716193.811	736566.026	7.560	1.631	1200	1 0	2.001 2.002	5.929 5.929	225 225
S17.5	716216.604	736560.063	7.500	1.840	1200	1 2 0	2.002 1.004 1.005	5.660 5.661 5.660	225 300 375
S17.6	716250.172	736553.652	7.675	3.075	1200	1 0	1.005 1.007	5.599 4.600	375 375
S16.0	716258.000	736584.587	7.985	3.535	1200	1 0	1.007 1.008	4.450 4.450	375 375
S16.2	716259.191	736583.684	7.650	3.250	1200	1 0	1.008 1.009	4.400 4.400	375 225
S16.3	716338.674	736570.908	5.355	1.530	1200	1 0	1.009 1.01	3.825 3.825	225 225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
DSD1	716340.332	736577.233	5.295	1.770	1200	1	1.01	3.525	225

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	16.100	Additional Storage (m³/ha)	20.0
Ratio-R	0.278	Check Discharge Rate(s)	x
Summer CV	1.000	Check Discharge Volume	x
Analysis Speed	Detailed		

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
30	20	0	0
100	20	0	0

Node S16.2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	4.400	Product Number	CTL-SHE-0092-4000-1200-4000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.0	Min Node Diameter (mm)	1200

Node S17.6 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	450.0	0.0	1.350	450.0	0.0	1.351	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
5 year +20% CC 15 minute summer	157.431	44.548
5 year +20% CC 30 minute summer	107.107	30.308
5 year +20% CC 60 minute summer	75.139	19.857
5 year +20% CC 120 minute summer	48.030	12.693
5 year +20% CC 180 minute summer	37.937	9.762
5 year +20% CC 240 minute summer	30.619	8.092
5 year +20% CC 360 minute summer	24.099	6.201

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
5 year +20% CC 480 minute summer	19.415	5.131
5 year +20% CC 600 minute summer	16.189	4.428
5 year +20% CC 720 minute summer	14.646	3.925
5 year +20% CC 960 minute summer	12.322	3.245
5 year +20% CC 1440 minute summer	9.253	2.480
5 year +20% CC 2160 minute summer	6.857	1.895
5 year +20% CC 2880 minute summer	5.841	1.565
5 year +20% CC 4320 minute summer	4.573	1.196
5 year +20% CC 5760 minute summer	3.858	0.988
5 year +20% CC 7200 minute summer	3.338	0.852
5 year +20% CC 8640 minute summer	2.957	0.754
5 year +20% CC 10080 minute summer	2.669	0.681
30 year +20% CC 15 minute summer	230.533	65.233
30 year +20% CC 30 minute summer	158.330	44.802
30 year +20% CC 60 minute summer	110.655	29.243
30 year +20% CC 120 minute summer	70.393	18.603
30 year +20% CC 180 minute summer	55.084	14.175
30 year +20% CC 240 minute summer	44.150	11.667
30 year +20% CC 360 minute summer	34.380	8.847
30 year +20% CC 480 minute summer	27.479	7.262
30 year +20% CC 600 minute summer	22.768	6.227
30 year +20% CC 720 minute summer	20.489	5.491
30 year +20% CC 960 minute summer	17.093	4.501
30 year +20% CC 1440 minute summer	12.685	3.400
30 year +20% CC 2160 minute summer	9.288	2.567
30 year +20% CC 2880 minute summer	7.842	2.102
30 year +20% CC 4320 minute summer	6.059	1.584
30 year +20% CC 5760 minute summer	5.061	1.296
30 year +20% CC 7200 minute summer	4.344	1.108
30 year +20% CC 8640 minute summer	3.823	0.975
30 year +20% CC 10080 minute summer	3.432	0.875
100 year +20% CC 15 minute summer	298.703	84.523
100 year +20% CC 30 minute summer	206.626	58.468
100 year +20% CC 60 minute summer	143.868	38.020
100 year +20% CC 120 minute summer	90.806	23.997
100 year +20% CC 180 minute summer	70.639	18.178
100 year +20% CC 240 minute summer	56.367	14.896
100 year +20% CC 360 minute summer	43.598	11.219
100 year +20% CC 480 minute summer	34.671	9.163
100 year +20% CC 600 minute summer	28.612	7.826
100 year +20% CC 720 minute summer	25.663	6.878
100 year +20% CC 960 minute summer	21.295	5.608
100 year +20% CC 1440 minute summer	15.685	4.204
100 year +20% CC 2160 minute summer	11.399	3.150
100 year +20% CC 2880 minute summer	9.570	2.565
100 year +20% CC 4320 minute summer	7.332	1.917
100 year +20% CC 5760 minute summer	6.086	1.558
100 year +20% CC 7200 minute summer	5.198	1.326
100 year +20% CC 8640 minute summer	4.555	1.162
100 year +20% CC 10080 minute summer	4.075	1.039

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 98.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S17.0	10	10.632	0.032	5.4	0.0426	0.0000	OK
15 minute summer	S17.1	10	8.607	0.057	13.1	0.0863	0.0000	OK
15 minute summer	S17.2	10	8.159	0.059	16.0	0.0741	0.0000	OK
15 minute summer	S17.3	10	6.714	0.114	44.9	0.2651	0.0000	OK
15 minute summer	S17.4	10	6.253	0.453	51.0	0.6222	0.0000	SURCHARGED
15 minute summer	S18.0	10	6.843	0.043	6.6	0.0676	0.0000	OK
15 minute summer	S18.1	10	6.225	0.076	9.7	0.0982	0.0000	OK
15 minute summer	S18.2	10	6.210	0.281	19.3	0.3941	0.0000	SURCHARGED
15 minute summer	S17.5	10	6.172	0.512	221.7	3.6156	0.0000	SURCHARGED
960 minute summer	S17.6	720	5.986	1.386	27.3	252.3493	0.0000	SURCHARGED
960 minute summer	S16.0	720	5.986	1.536	6.7	3.0151	0.0000	SURCHARGED
960 minute summer	S16.2	720	5.986	1.586	15.3	1.7937	0.0000	SURCHARGED
960 minute summer	S16.3	720	3.856	0.031	4.6	0.0349	0.0000	OK
960 minute summer	DSD1	720	3.554	0.029	4.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S17.0	1	S17.1	5.4	1.029	0.044	0.2008	
15 minute summer	S17.1	1.001	S17.2	13.1	1.636	0.133	0.1004	
15 minute summer	S17.2	1.002	S17.3	16.0	1.973	0.143	0.2259	
15 minute summer	S17.3	1.003	S17.4	44.4	1.345	0.499	0.8263	
15 minute summer	S17.4	1.004	S17.5	50.2	0.713	0.776	2.8559	
15 minute summer	S18.0	2	S18.1	6.6	1.063	0.180	0.1016	
15 minute summer	S18.1	2.001	S18.2	8.9	0.702	0.215	0.8840	
15 minute summer	S18.2	2.002	S17.5	23.7	0.636	0.425	0.9288	
15 minute summer	S17.5	1.005	S17.6	213.5	1.938	1.447	1.1933	
960 minute summer	S17.6	1.007	S16.0	4.6	0.450	0.034	3.5196	
960 minute summer	S16.0	1.008	S16.2	15.3	0.513	0.050	0.2404	
960 minute summer	S16.2	Hydro-Brake®	S16.3	4.6				
960 minute summer	S16.3	1.01	DSD1	4.6	1.451	0.036	0.0163	290.9

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 98.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S17.0	10	10.639	0.039	8.0	0.0515	0.0000	OK
15 minute summer	S17.1	10	8.621	0.071	19.3	0.1069	0.0000	OK
15 minute summer	S17.2	10	8.170	0.070	23.5	0.0880	0.0000	OK
15 minute summer	S17.3	11	7.017	0.417	65.8	0.9659	0.0000	SURCHARGED
15 minute summer	S17.4	10	6.591	0.791	67.8	1.0872	0.0000	SURCHARGED
15 minute summer	S18.0	10	6.852	0.052	9.6	0.0822	0.0000	OK
15 minute summer	S18.1	10	6.537	0.388	22.8	0.4992	0.0000	SURCHARGED
15 minute summer	S18.2	10	6.484	0.555	27.0	0.7769	0.0000	SURCHARGED
15 minute summer	S17.5	10	6.424	0.764	313.7	5.3905	0.0000	SURCHARGED
720 minute summer	S17.6	675	6.332	1.732	46.2	400.6752	0.0000	SURCHARGED
720 minute summer	S16.0	705	6.334	1.884	8.4	3.6993	0.0000	SURCHARGED
720 minute summer	S16.2	630	6.334	1.934	10.6	2.1878	0.0000	SURCHARGED
720 minute summer	S16.3	675	3.857	0.032	5.0	0.0366	0.0000	OK
720 minute summer	DSD1	705	3.556	0.031	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S17.0	1	S17.1	8.0	1.123	0.066	0.2728	
15 minute summer	S17.1	1.001	S17.2	19.3	1.834	0.195	0.1317	
15 minute summer	S17.2	1.002	S17.3	23.5	2.142	0.211	0.6167	
15 minute summer	S17.3	1.003	S17.4	60.1	1.531	0.676	1.0951	
15 minute summer	S17.4	1.004	S17.5	70.0	0.994	1.082	2.8559	
15 minute summer	S18.0	2	S18.1	9.6	1.147	0.262	0.1779	
15 minute summer	S18.1	2.001	S18.2	17.8	0.676	0.429	1.3623	
15 minute summer	S18.2	2.002	S17.5	30.6	0.776	0.548	0.9288	
15 minute summer	S17.5	1.005	S17.6	306.1	2.775	2.075	1.2197	
720 minute summer	S17.6	1.007	S16.0	5.1	0.242	0.037	3.5196	
720 minute summer	S16.0	1.008	S16.2	10.6	0.218	0.035	0.2404	
720 minute summer	S16.2	Hydro-Brake®	S16.3	5.0				
720 minute summer	S16.3	1.01	DSD1	5.0	1.487	0.040	0.0174	254.2

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 98.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S17.0	10	10.644	0.044	10.3	0.0583	0.0000	OK
15 minute summer	S17.1	10	8.632	0.082	24.9	0.1233	0.0000	OK
15 minute summer	S17.2	10	8.180	0.080	30.3	0.1005	0.0000	OK
15 minute summer	S17.3	11	7.618	1.018	85.1	2.3608	0.0000	SURCHARGED
15 minute summer	S17.4	11	6.945	1.145	84.0	1.5728	0.0000	SURCHARGED
15 minute summer	S18.0	11	6.881	0.081	12.5	0.1274	0.0000	OK
15 minute summer	S18.1	11	6.808	0.659	18.1	0.8479	0.0000	SURCHARGED
15 minute summer	S18.2	10	6.755	0.826	33.6	1.1573	0.0000	SURCHARGED
15 minute summer	S17.5	10	6.698	1.038	394.3	7.3262	0.0000	SURCHARGED
960 minute summer	S17.6	870	6.663	2.063	48.1	542.6556	0.0000	SURCHARGED
960 minute summer	S16.0	870	6.663	2.213	11.1	4.3445	0.0000	SURCHARGED
960 minute summer	S16.2	870	6.663	2.263	8.7	2.5596	0.0000	SURCHARGED
960 minute summer	S16.3	870	3.859	0.034	5.4	0.0380	0.0000	OK
960 minute summer	DSD1	870	3.557	0.032	5.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S17.0	1	S17.1	10.3	1.186	0.085	0.3327	
15 minute summer	S17.1	1.001	S17.2	24.9	1.957	0.252	0.1595	
15 minute summer	S17.2	1.002	S17.3	30.3	2.108	0.272	0.7299	
15 minute summer	S17.3	1.003	S17.4	74.0	1.860	0.831	1.0951	
15 minute summer	S17.4	1.004	S17.5	88.3	1.254	1.365	2.8559	
15 minute summer	S18.0	2	S18.1	12.1	1.233	0.329	0.2107	
15 minute summer	S18.1	2.001	S18.2	20.9	0.710	0.503	1.3623	
15 minute summer	S18.2	2.002	S17.5	34.9	0.879	0.626	0.9288	
15 minute summer	S17.5	1.005	S17.6	386.2	3.501	2.618	1.2197	
960 minute summer	S17.6	1.007	S16.0	5.3	0.224	0.039	3.5196	
960 minute summer	S16.0	1.008	S16.2	8.7	-0.167	0.028	0.2404	
960 minute summer	S16.2	Hydro-Brake®	S16.3	5.4				
960 minute summer	S16.3	1.01	DSD1	5.4	1.518	0.043	0.0184	334.6

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)	16.100	Minimum Backdrop Height (m)	0.200
Ratio-R	0.278	Preferred Cover Depth (m)	1.200
CV	1.000	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)
S2.0	0.317	4.00	12.150	1200	716191.760	736268.112	1.650
S2.1			11.000	1200	716234.233	736258.158	1.500
S3.0		4.00	11.000	1200	716252.640	736260.436	2.985
S2.2			11.000	1200	716250.845	736254.505	3.000
EX.MH206		4.00	11.000	1200	716252.316	736252.919	2.160
S2.3			11.000	1200	716263.268	736251.875	3.126
S2.4			8.960	1200	716331.487	736233.962	1.793
S5.0		4.00	8.830	1200	716335.029	736235.666	1.080
S5.1			8.800	1200	716346.229	736232.666	1.784
S7.0	0.207	4.00	8.600	1200	716345.586	736236.966	1.615
S5.2			8.782	1200	716347.592	736236.177	1.802
S6.1	0.328	4.00	7.900	1200	716403.155	736215.771	1.950
S6.2			8.250	1200	716372.468	736223.883	2.450
S6.3	0.025	4.00	8.775	1200	716356.607	736232.530	3.067
S6.4			8.750	1200	716355.993	736237.267	3.164
S6.5			8.750	1200	716354.587	736248.098	3.222
S8.0	0.075	4.00	8.800	1500	716368.511	736269.364	1.600
S6.8			8.490	1500	716381.760	736264.124	3.204
S9.1	0.121	4.00	9.500	1200	716357.208	736306.870	1.230
S9.2	0.121	4.00	9.130	1200	716378.588	736329.645	1.168
S10.0	0.074	4.00	8.750	1200	716398.321	736325.508	2.000
S11.0	0.099	4.00	8.554	1200	716407.842	736333.911	2.054
S9.3			8.500	1200	716408.785	736332.377	2.050
S6.9			8.476	1200	716413.829	736329.919	3.483
S6.10	0.023	4.00	8.417	1500	716437.332	736351.764	3.552
S6.11	0.018	4.00	7.380	1200	716426.597	736375.294	2.621
S19.0	0.005	4.00	11.525	1200	716264.729	736298.456	1.075
S19.1	0.006	4.00	10.755	1200	716281.810	736363.609	1.148
S19.2	0.010	4.00	10.920	1200	716269.667	736372.927	1.472
S19.3	0.150	4.00	11.655	1200	716252.864	736379.325	2.392
S12.0			10.380	1200	716260.441	736386.128	1.780
S15.0	0.007	4.00	9.850	1200	716204.618	736448.137	1.450
S20.0	0.113	4.00	11.150	1200	716215.725	736429.309	2.650
S15.1	0.011	4.00	9.585	1200	716219.746	736438.535	1.881
S15.2	0.030	4.00	9.330	1200	716270.735	736424.594	2.330
S15.3	0.022	4.00	7.750	1200	716311.467	736413.683	1.750
S13.1	0.176	4.00	10.150	1200	716335.929	736381.964	4.350
S13.0			7.215	1200	716341.324	736399.374	1.565
S15.4	0.019	4.00	7.275	1200	716343.131	736405.203	1.725
S15.5	0.011	4.00	7.090	1200	716362.476	736400.459	1.790
S15.6	0.019	4.00	6.766	1200	716392.541	736390.421	2.066

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S14.0		4.00	7.201	1200	716385.349	736383.865	2.511
S6.12	0.022	4.00	6.790	1500	716408.826	736383.203	2.334
S6.13			5.380	1200	716429.891	736460.955	1.830
S6.14			4.855	1200	716462.796	736494.860	1.840
DSD2			4.720	1200	716466.877	736499.692	2.005

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	S2.0	S2.1	43.624	0.600	10.500	9.500	1.000	43.6	225	4.37	50.0
1.001	S2.1	S2.2	17.009	0.600	9.500	9.000	0.500	34.0	225	4.49	50.0
2	S3.0	S2.2	6.197	0.600	8.015	8.000	0.015	413.1	225	4.16	50.0
1.002	S2.2	S2.3	12.698	0.600	8.000	7.874	0.126	100.8	225	4.65	50.0
3	EX.MH206	S2.3	11.002	0.600	8.840	8.600	0.240	45.8	225	4.09	50.0
1.003	S2.3	S2.4	70.532	0.600	7.874	7.167	0.707	99.8	225	5.55	50.0
1.004	S2.4	S5.1	14.799	0.600	7.167	7.016	0.151	98.0	225	5.74	50.0
4	S5.0	S5.1	11.595	0.600	7.750	7.650	0.100	115.9	225	4.16	50.0
1.005	S5.1	S5.2	3.766	0.600	7.016	6.980	0.036	104.6	225	5.79	50.0
5	S7.0	S5.2	2.156	0.600	6.985	6.980	0.005	431.1	225	4.06	50.0
1.006	S5.2	S6.4	8.471	0.600	6.980	6.890	0.090	94.1	225	5.89	50.0
6	S6.1	S6.2	31.741	0.600	5.950	5.800	0.150	211.6	225	4.59	50.0
6.001	S6.2	S6.3	18.065	0.600	5.800	5.708	0.092	196.4	225	4.92	50.0
6.002	S6.3	S6.4	4.777	0.600	5.708	5.586	0.122	39.2	225	4.95	50.0
1.007	S6.4	S6.5	10.922	0.600	5.586	5.528	0.058	188.3	300	6.05	50.0
1.008	S6.5	S6.8	31.547	0.600	5.528	5.286	0.242	130.4	300	6.44	50.0
7	S8.0	S6.8	14.248	0.600	7.200	7.000	0.200	71.2	225	4.15	50.0
1.009	S6.8	S6.9	73.194	0.600	5.286	4.993	0.293	249.8	375	7.50	50.0
8	S9.1	S9.2	31.238	0.600	8.270	7.962	0.308	101.4	225	4.40	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)
1	1.986	79.0	57.3	1.425	1.275	0.317	0.0
1.001	2.250	89.5	57.3	1.275	1.775	0.317	0.0
2	0.637	25.3	0.0	2.760	2.775	0.000	0.0
1.002	1.302	51.8	57.3	2.775	2.901	0.317	0.0
3	1.937	77.0	0.0	1.935	2.175	0.000	0.0
1.003	1.309	52.0	57.3	2.901	1.568	0.317	0.0
1.004	1.321	52.5	57.3	1.568	1.559	0.317	0.0
4	1.213	48.2	0.0	0.855	0.925	0.000	0.0
1.005	1.278	50.8	57.3	1.559	1.577	0.317	0.0
5	0.623	24.8	37.4	1.390	1.577	0.207	0.0
1.006	1.348	53.6	94.7	1.577	1.635	0.524	0.0
6	0.895	35.6	59.3	1.725	2.225	0.328	0.0
6.001	0.929	36.9	59.3	2.225	2.842	0.328	0.0
6.002	2.097	83.4	63.8	2.842	2.939	0.353	0.0
1.007	1.142	80.7	158.5	2.864	2.922	0.877	0.0
1.008	1.375	97.2	158.5	2.922	2.904	0.877	0.0
7	1.551	61.7	13.6	1.375	1.265	0.075	0.0
1.009	1.142	126.1	177.6	2.829	3.108	0.983	0.0
8	1.298	51.6	21.9	1.005	0.943	0.121	0.0

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)
8.001	S9.2	S9.3	30.320	0.600	7.962	7.250	0.712	42.6	225	4.65	50.0
9	S10.0	S9.3	12.517	0.600	6.750	6.450	0.300	41.7	225	4.10	50.0
10	S11.0	S9.3	1.801	0.600	6.500	6.450	0.050	36.0	225	4.01	50.0
8.002	S9.3	S6.9	5.611	0.600	6.450	6.400	0.050	112.2	225	4.73	50.0
1.01	S6.9	S6.10	32.087	0.600	4.993	4.865	0.128	250.7	375	7.97	50.0
1.011	S6.10	S6.11	25.863	0.600	4.865	4.759	0.106	244.0	375	8.35	49.2
1.012	S6.11	S6.12	19.451	0.600	4.759	4.606	0.153	127.1	375	8.55	48.7
11	S19.0	S19.1	67.355	0.600	10.450	9.607	0.843	79.9	150	5.00	50.0
11.001	S19.1	S19.2	15.306	0.600	9.607	9.448	0.159	96.3	150	5.25	50.0
11.002	S19.2	S19.3	17.980	0.600	9.448	9.263	0.185	97.2	150	5.54	50.0
11.003	S19.3	S12.0	10.183	0.600	9.263	9.250	0.013	783.3	225	5.91	50.0
11.005	S12.0	S15.2	39.820	0.600	8.600	7.300	1.300	30.6	150	6.27	50.0
14	S15.0	S15.1	17.918	0.600	8.400	8.100	0.300	59.7	225	4.18	50.0
15	S20.0	S15.1	10.064	0.600	8.500	7.704	0.796	12.6	150	4.06	50.0
14.001	S15.1	S15.2	52.860	0.600	7.704	7.000	0.704	75.1	300	4.66	50.0
11.006	S15.2	S15.3	42.168	0.600	7.000	6.000	1.000	42.2	300	6.56	50.0
11.007	S15.3	S15.4	32.780	0.600	6.000	5.550	0.450	72.8	300	6.86	50.0
13	S13.1	S13.0	18.227	0.600	5.800	5.650	0.150	121.5	225	4.26	50.0
13.001	S13.0	S15.4	6.103	0.600	5.650	5.550	0.100	61.0	225	4.32	50.0
11.008	S15.4	S15.5	19.918	0.600	5.550	5.300	0.250	79.7	300	7.05	50.0
11.009	S15.5	S15.6	31.696	0.600	5.300	5.000	0.300	105.7	300	7.39	50.0
11.01	S15.6	S6.12	17.813	0.600	4.700	4.606	0.094	189.5	300	7.65	50.0
12	S14.0	S6.12	23.486	0.600	4.690	4.603	0.087	270.0	375	4.36	50.0
1.013	S6.12	S6.13	80.555	0.600	4.456	3.550	0.906	88.9	225	9.52	46.4

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
8.001	2.010	79.9	43.7	0.943	1.025	0.242	0.0
9	2.031	80.7	13.4	1.775	1.825	0.074	0.0
10	2.187	86.9	17.9	1.829	1.825	0.099	0.0
8.002	1.233	49.0	75.0	1.825	1.851	0.415	0.0
1.01	1.140	125.9	252.6	3.108	3.177	1.398	0.0
1.011	1.155	127.6	252.8	3.177	2.246	1.421	0.0
1.012	1.605	177.3	253.3	2.246	1.809	1.439	0.0
11	1.125	19.9	0.9	0.925	0.998	0.005	0.0
11.001	1.024	18.1	2.0	0.998	1.322	0.011	0.0
11.002	1.019	18.0	3.8	1.322	2.242	0.021	0.0
11.003	0.459	18.3	30.9	2.167	0.905	0.171	0.0
11.005	1.825	32.3	30.9	1.630	1.880	0.171	0.0
14	1.695	67.4	1.3	1.225	1.260	0.007	0.0
15	2.848	50.3	20.4	2.500	1.731	0.113	0.0
14.001	1.816	128.4	23.7	1.581	2.030	0.131	0.0
11.006	2.428	171.6	60.0	2.030	1.450	0.332	0.0
11.007	1.844	130.3	64.0	1.450	1.425	0.354	0.0
13	1.185	47.1	31.8	4.125	1.340	0.176	0.0
13.001	1.677	66.7	31.8	1.340	1.500	0.176	0.0
11.008	1.763	124.6	99.2	1.425	1.490	0.549	0.0
11.009	1.529	108.1	101.2	1.490	1.466	0.560	0.0
11.01	1.138	80.5	104.6	1.766	1.884	0.579	0.0
12	1.098	121.2	0.0	2.136	1.812	0.000	0.0
1.013	1.387	55.1	342.0	2.109	1.605	2.040	0.0

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)
1.014	S6.13	S6.14	47.247	0.600	3.550	3.015	0.535	88.3	225	10.08	45.2
1.015	S6.14	DSD2	6.325	0.600	3.015	2.715	0.300	21.1	225	10.12	45.1

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.014	1.392	55.3	333.0	1.605	1.615	2.040	0.0
1.015	2.862	113.8	332.4	1.615	1.780	2.040	0.0

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	43.624	43.6	225	Circular	12.150	10.500	1.425	11.000	9.500	1.275
1.001	17.009	34.0	225	Circular	11.000	9.500	1.275	11.000	9.000	1.775
2	6.197	413.1	225	Circular	11.000	8.015	2.760	11.000	8.000	2.775
1.002	12.698	100.8	225	Circular	11.000	8.000	2.775	11.000	7.874	2.901
3	11.002	45.8	225	Circular	11.000	8.840	1.935	11.000	8.600	2.175
1.003	70.532	99.8	225	Circular	11.000	7.874	2.901	8.960	7.167	1.568
1.004	14.799	98.0	225	Circular	8.960	7.167	1.568	8.800	7.016	1.559
4	11.595	115.9	225	Circular	8.830	7.750	0.855	8.800	7.650	0.925
1.005	3.766	104.6	225	Circular	8.800	7.016	1.559	8.782	6.980	1.577
5	2.156	431.1	225	Circular	8.600	6.985	1.390	8.782	6.980	1.577
1.006	8.471	94.1	225	Circular	8.782	6.980	1.577	8.750	6.890	1.635
6	31.741	211.6	225	Circular	7.900	5.950	1.725	8.250	5.800	2.225
6.001	18.065	196.4	225	Circular	8.250	5.800	2.225	8.775	5.708	2.842
6.002	4.777	39.2	225	Circular	8.775	5.708	2.842	8.750	5.586	2.939
1.007	10.922	188.3	300	Circular	8.750	5.586	2.864	8.750	5.528	2.922
1.008	31.547	130.4	300	Circular	8.750	5.528	2.922	8.490	5.286	2.904
7	14.248	71.2	225	Circular	8.800	7.200	1.375	8.490	7.000	1.265
1.009	73.194	249.8	375	Circular	8.490	5.286	2.829	8.476	4.993	3.108

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1	S2.0	1200	Manhole	Adoptable	S2.1	1200	Manhole	Adoptable
1.001	S2.1	1200	Manhole	Adoptable	S2.2	1200	Manhole	Adoptable
2	S3.0	1200	Manhole	Adoptable	S2.2	1200	Manhole	Adoptable
1.002	S2.2	1200	Manhole	Adoptable	S2.3	1200	Manhole	Adoptable
3	EX.MH206	1200	Manhole	Adoptable	S2.3	1200	Manhole	Adoptable
1.003	S2.3	1200	Manhole	Adoptable	S2.4	1200	Manhole	Adoptable
1.004	S2.4	1200	Manhole	Adoptable	S5.1	1200	Manhole	Adoptable
4	S5.0	1200	Manhole	Adoptable	S5.1	1200	Manhole	Adoptable
1.005	S5.1	1200	Manhole	Adoptable	S5.2	1200	Manhole	Adoptable
5	S7.0	1200	Manhole	Adoptable	S5.2	1200	Manhole	Adoptable
1.006	S5.2	1200	Manhole	Adoptable	S6.4	1200	Manhole	Adoptable
6	S6.1	1200	Manhole	Adoptable	S6.2	1200	Manhole	Adoptable
6.001	S6.2	1200	Manhole	Adoptable	S6.3	1200	Manhole	Adoptable
6.002	S6.3	1200	Manhole	Adoptable	S6.4	1200	Manhole	Adoptable
1.007	S6.4	1200	Manhole	Adoptable	S6.5	1200	Manhole	Adoptable
1.008	S6.5	1200	Manhole	Adoptable	S6.8	1500	Manhole	Adoptable
7	S8.0	1500	Manhole	Adoptable	S6.8	1500	Manhole	Adoptable
1.009	S6.8	1500	Manhole	Adoptable	S6.9	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)
8	31.238	101.4	225	Circular	9.500	8.270	1.005	9.130	7.962	0.943
8.001	30.320	42.6	225	Circular	9.130	7.962	0.943	8.500	7.250	1.025
9	12.517	41.7	225	Circular	8.750	6.750	1.775	8.500	6.450	1.825
10	1.801	36.0	225	Circular	8.554	6.500	1.829	8.500	6.450	1.825
8.002	5.611	112.2	225	Circular	8.500	6.450	1.825	8.476	6.400	1.851
1.01	32.087	250.7	375	Circular	8.476	4.993	3.108	8.417	4.865	3.177
1.011	25.863	244.0	375	Circular	8.417	4.865	3.177	7.380	4.759	2.246
1.012	19.451	127.1	375	Circular	7.380	4.759	2.246	6.790	4.606	1.809
11	67.355	79.9	150	Circular	11.525	10.450	0.925	10.755	9.607	0.998
11.001	15.306	96.3	150	Circular	10.755	9.607	0.998	10.920	9.448	1.322
11.002	17.980	97.2	150	Circular	10.920	9.448	1.322	11.655	9.263	2.242
11.003	10.183	783.3	225	Circular	11.655	9.263	2.167	10.380	9.250	0.905
11.005	39.820	30.6	150	Circular	10.380	8.600	1.630	9.330	7.300	1.880
14	17.918	59.7	225	Circular	9.850	8.400	1.225	9.585	8.100	1.260
15	10.064	12.6	150	Circular	11.150	8.500	2.500	9.585	7.704	1.731
14.001	52.860	75.1	300	Circular	9.585	7.704	1.581	9.330	7.000	2.030
11.006	42.168	42.2	300	Circular	9.330	7.000	2.030	7.750	6.000	1.450
11.007	32.780	72.8	300	Circular	7.750	6.000	1.450	7.275	5.550	1.425
13	18.227	121.5	225	Circular	10.150	5.800	4.125	7.215	5.650	1.340
13.001	6.103	61.0	225	Circular	7.215	5.650	1.340	7.275	5.550	1.500
11.008	19.918	79.7	300	Circular	7.275	5.550	1.425	7.090	5.300	1.490
11.009	31.696	105.7	300	Circular	7.090	5.300	1.490	6.766	5.000	1.466
11.01	17.813	189.5	300	Circular	6.766	4.700	1.766	6.790	4.606	1.884
12	23.486	270.0	375	Circular	7.201	4.690	2.136	6.790	4.603	1.812
1.013	80.555	88.9	225	Circular	6.790	4.456	2.109	5.380	3.550	1.605

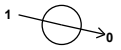
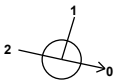
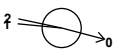
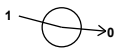
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
8	S9.1	1200	Manhole	Adoptable	S9.2	1200	Manhole	Adoptable
8.001	S9.2	1200	Manhole	Adoptable	S9.3	1200	Manhole	Adoptable
9	S10.0	1200	Manhole	Adoptable	S9.3	1200	Manhole	Adoptable
10	S11.0	1200	Manhole	Adoptable	S9.3	1200	Manhole	Adoptable
8.002	S9.3	1200	Manhole	Adoptable	S6.9	1200	Manhole	Adoptable
1.01	S6.9	1200	Manhole	Adoptable	S6.10	1500	Manhole	Adoptable
1.011	S6.10	1500	Manhole	Adoptable	S6.11	1200	Manhole	Adoptable
1.012	S6.11	1200	Manhole	Adoptable	S6.12	1500	Manhole	Adoptable
11	S19.0	1200	Manhole	Adoptable	S19.1	1200	Manhole	Adoptable
11.001	S19.1	1200	Manhole	Adoptable	S19.2	1200	Manhole	Adoptable
11.002	S19.2	1200	Manhole	Adoptable	S19.3	1200	Manhole	Adoptable
11.003	S19.3	1200	Manhole	Adoptable	S12.0	1200	Manhole	Adoptable
11.005	S12.0	1200	Manhole	Adoptable	S15.2	1200	Manhole	Adoptable
14	S15.0	1200	Manhole	Adoptable	S15.1	1200	Manhole	Adoptable
15	S20.0	1200	Manhole	Adoptable	S15.1	1200	Manhole	Adoptable
14.001	S15.1	1200	Manhole	Adoptable	S15.2	1200	Manhole	Adoptable
11.006	S15.2	1200	Manhole	Adoptable	S15.3	1200	Manhole	Adoptable
11.007	S15.3	1200	Manhole	Adoptable	S15.4	1200	Manhole	Adoptable
13	S13.1	1200	Manhole	Adoptable	S13.0	1200	Manhole	Adoptable
13.001	S13.0	1200	Manhole	Adoptable	S15.4	1200	Manhole	Adoptable
11.008	S15.4	1200	Manhole	Adoptable	S15.5	1200	Manhole	Adoptable
11.009	S15.5	1200	Manhole	Adoptable	S15.6	1200	Manhole	Adoptable
11.01	S15.6	1200	Manhole	Adoptable	S6.12	1500	Manhole	Adoptable
12	S14.0	1200	Manhole	Adoptable	S6.12	1500	Manhole	Adoptable
1.013	S6.12	1500	Manhole	Adoptable	S6.13	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	47.247	88.3	225	Circular	5.380	3.550	1.605	4.855	3.015	1.615
1.015	6.325	21.1	225	Circular	4.855	3.015	1.615	4.720	2.715	1.780

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.014	S6.13	1200	Manhole	Adoptable	S6.14	1200	Manhole	Adoptable
1.015	S6.14	1200	Manhole	Adoptable	DSD2	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S2.0	716191.760	736268.112	12.150	1.650	1200				
						0	1	10.500	225
S2.1	716234.233	736258.158	11.000	1.500	1200	1	1	9.500	225
									
						0	1.001	9.500	225
S3.0	716252.640	736260.436	11.000	2.985	1200				
						0	2	8.015	225
S2.2	716250.845	736254.505	11.000	3.000	1200		1	2	8.000	225
							2	1.001	9.000	225
						0	1.002	8.000	225
EX.MH206	716252.316	736252.919	11.000	2.160	1200				
						0	3	8.840	225
S2.3	716263.268	736251.875	11.000	3.126	1200	1	3	8.600	225
							2	1.002	7.874	225
						0	1.003	7.874	225
S2.4	716331.487	736233.962	8.960	1.793	1200	1	1.003	7.167	225
									
						0	1.004	7.167	225
S5.0	716335.029	736235.666	8.830	1.080	1200				
						0	4	7.750	225
S5.1	716346.229	736232.666	8.800	1.784	1200		1	4	7.650	225
							2	1.004	7.016	225
						0	1.005	7.016	225
S7.0	716345.586	736236.966	8.600	1.615	1200				
						0	5	6.985	225

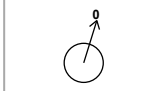
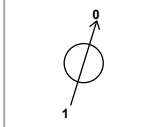
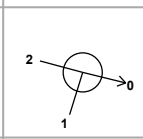
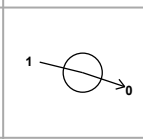
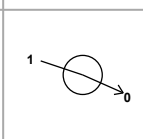
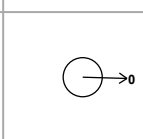
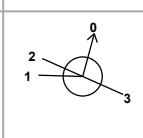
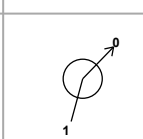
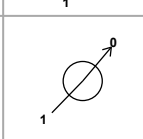
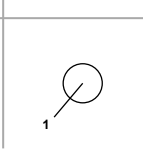
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S5.2	716347.592	736236.177	8.782	1.802	1200	1	5	6.980	225
						2	1.005	6.980	225
						0	1.006	6.980	225
S6.1	716403.155	736215.771	7.900	1.950	1200	0	6	5.950	225
S6.2	716372.468	736223.883	8.250	2.450	1200	1	6	5.800	225
						0	6.001	5.800	225
S6.3	716356.607	736232.530	8.775	3.067	1200	1	6.001	5.708	225
						0	6.002	5.708	225
S6.4	716355.993	736237.267	8.750	3.164	1200	1	6.002	5.586	225
						2	1.006	6.890	225
						0	1.007	5.586	300
S6.5	716354.587	736248.098	8.750	3.222	1200	1	1.007	5.528	300
						0	1.008	5.528	300
S8.0	716368.511	736269.364	8.800	1.600	1500	0	7	7.200	225
S6.8	716381.760	736264.124	8.490	3.204	1500	1	7	7.000	225
						2	1.008	5.286	300
						0	1.009	5.286	375
S9.1	716357.208	736306.870	9.500	1.230	1200	0	8	8.270	225
S9.2	716378.588	736329.645	9.130	1.168	1200	1	8	7.962	225
						0	8.001	7.962	225
S10.0	716398.321	736325.508	8.750	2.000	1200	0	9	6.750	225
S11.0	716407.842	736333.911	8.554	2.054	1200	0	10	6.500	225
S9.3	716408.785	736332.377	8.500	2.050	1200	1	10	6.450	225
						2	9	6.450	225
						3	8.001	7.250	225
						0	8.002	6.450	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S6.9	716413.829	736329.919	8.476	3.483	1200	1	8.002	6.400	225
						2	1.009	4.993	375
						0	1.01	4.993	375
S6.10	716437.332	736351.764	8.417	3.552	1500	1	1.01	4.865	375
						0	1.011	4.865	375
S6.11	716426.597	736375.294	7.380	2.621	1200	1	1.011	4.759	375
						0	1.012	4.759	375
S19.0	716264.729	736298.456	11.525	1.075	1200	0	11	10.450	150
S19.1	716281.810	736363.609	10.755	1.148	1200	1	11	9.607	150
						0	11.001	9.607	150
S19.2	716269.667	736372.927	10.920	1.472	1200	1	11.001	9.448	150
						0	11.002	9.448	150
S19.3	716252.864	736379.325	11.655	2.392	1200	1	11.002	9.263	150
						0	11.003	9.263	225
S12.0	716260.441	736386.128	10.380	1.780	1200	1	11.003	9.250	225
						0	11.005	8.600	150
S15.0	716204.618	736448.137	9.850	1.450	1200	0	14	8.400	225
S20.0	716215.725	736429.309	11.150	2.650	1200	0	15	8.500	150
S15.1	716219.746	736438.535	9.585	1.881	1200	1	15	7.704	150
						2	14	8.100	225
						0	14.001	7.704	300
S15.2	716270.735	736424.594	9.330	2.330	1200	1	14.001	7.000	300
						2	11.005	7.300	150
						0	11.006	7.000	300
S15.3	716311.467	736413.683	7.750	1.750	1200	1	11.006	6.000	300
						0	11.007	6.000	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S13.1	716335.929	736381.964	10.150	4.350	1200				
						0	13	5.800	225
S13.0	716341.324	736399.374	7.215	1.565	1200		1	13	5.650	225
							0	13.001	5.650	225
S15.4	716343.131	736405.203	7.275	1.725	1200		1	13.001	5.550	225
							2	11.007	5.550	300
							0	11.008	5.550	300
S15.5	716362.476	736400.459	7.090	1.790	1200		1	11.008	5.300	300
							0	11.009	5.300	300
S15.6	716392.541	736390.421	6.766	2.066	1200		1	11.009	5.000	300
							0	11.01	4.700	300
S14.0	716385.349	736383.865	7.201	2.511	1200					
						0	12	4.690	375
S6.12	716408.826	736383.203	6.790	2.334	1500		1	12	4.603	375
							2	11.01	4.606	300
							3	1.012	4.606	375
							0	1.013	4.456	225
S6.13	716429.891	736460.955	5.380	1.830	1200		1	1.013	3.550	225
							0	1.014	3.550	225
S6.14	716462.796	736494.860	4.855	1.840	1200		1	1.014	3.015	225
							0	1.015	3.015	225
DSD2	716466.877	736499.692	4.720	2.005	1200		1	1.015	2.715	225

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	16.100	Additional Storage (m³/ha)	20.0
Ratio-R	0.278	Check Discharge Rate(s)	x
Summer CV	1.000	Check Discharge Volume	x
Analysis Speed	Detailed		

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
30	20	0	0
100	20	0	0

Node S6.1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	5.950	Product Number	CTL-SHE-0064-2000-1200-2000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S2.0 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	10.500	Product Number	CTL-SHE-0064-2000-1200-2000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S7.0 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	6.985	Product Number	CTL-SHE-0064-2000-1200-2000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S10.0 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	6.750	Product Number	CTL-SHE-0064-2000-1200-2000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S11.0 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	6.500	Product Number	CTL-SHE-0061-2000-1500-2000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S6.12 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	4.456	Product Number	CTL-SHE-0140-1150-2000-1150
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	11.5	Min Node Diameter (mm)	1500

Node S20.0 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	8.500	Product Number	CTL-SHE-0061-2000-1500-2000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S12.0 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	8.600	Product Number	CTL-SHE-0061-2000-1500-2000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S13.0 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	5.650	Product Number	CTL-SHE-0067-2000-1000-2000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S6.1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.950
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	180.0	0.0	1.200	180.0	0.0	1.201	0.0	0.0

Node S2.0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	10.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	168.3	0.0	1.200	168.3	0.0	1.201	0.0	0.0

Node S7.0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	6.985
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	103.5	0.0	1.200	103.5	0.0	1.201	0.0	0.0

Node S10.0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	6.750
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	140

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	28.0	0.0	1.200	28.0	0.0	1.201	0.0	0.0

Node S11.0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	6.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	320

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	30.0	0.0	1.200	30.0	0.0	1.201	0.0	0.0

Node S14.0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	4.690
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	469.1	0.0	1.200	469.1	0.0	1.201	0.0	0.0

Node S20.0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	8.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	288

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	45.0	0.0	1.200	45.0	0.0	1.201	0.0	0.0

Node S12.0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	8.600
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	74.1	0.0	1.200	74.1	0.0	1.201	0.0	0.0

Node S13.0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.650
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	116.0	0.0	0.800	116.0	0.0	0.801	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
5 year +20% CC 15 minute summer	157.431	44.548
5 year +20% CC 30 minute summer	107.107	30.308
5 year +20% CC 60 minute summer	75.139	19.857
5 year +20% CC 120 minute summer	48.030	12.693
5 year +20% CC 180 minute summer	37.937	9.762
5 year +20% CC 240 minute summer	30.619	8.092
5 year +20% CC 360 minute summer	24.099	6.201
5 year +20% CC 480 minute summer	19.415	5.131
5 year +20% CC 600 minute summer	16.189	4.428
5 year +20% CC 720 minute summer	14.646	3.925
5 year +20% CC 960 minute summer	12.322	3.245
5 year +20% CC 1440 minute summer	9.253	2.480
5 year +20% CC 2160 minute summer	6.857	1.895
5 year +20% CC 2880 minute summer	5.841	1.565
5 year +20% CC 4320 minute summer	4.573	1.196
5 year +20% CC 5760 minute summer	3.858	0.988
5 year +20% CC 7200 minute summer	3.338	0.852
5 year +20% CC 8640 minute summer	2.957	0.754
5 year +20% CC 10080 minute summer	2.669	0.681
30 year +20% CC 15 minute summer	230.533	65.233
30 year +20% CC 30 minute summer	158.330	44.802
30 year +20% CC 60 minute summer	110.655	29.243
30 year +20% CC 120 minute summer	70.393	18.603
30 year +20% CC 180 minute summer	55.084	14.175
30 year +20% CC 240 minute summer	44.150	11.667
30 year +20% CC 360 minute summer	34.380	8.847
30 year +20% CC 480 minute summer	27.479	7.262
30 year +20% CC 600 minute summer	22.768	6.227
30 year +20% CC 720 minute summer	20.489	5.491
30 year +20% CC 960 minute summer	17.093	4.501
30 year +20% CC 1440 minute summer	12.685	3.400
30 year +20% CC 2160 minute summer	9.288	2.567
30 year +20% CC 2880 minute summer	7.842	2.102
30 year +20% CC 4320 minute summer	6.059	1.584
30 year +20% CC 5760 minute summer	5.061	1.296
30 year +20% CC 7200 minute summer	4.344	1.108
30 year +20% CC 8640 minute summer	3.823	0.975
30 year +20% CC 10080 minute summer	3.432	0.875
100 year +20% CC 15 minute summer	298.703	84.523
100 year +20% CC 30 minute summer	206.626	58.468
100 year +20% CC 60 minute summer	143.868	38.020
100 year +20% CC 120 minute summer	90.806	23.997
100 year +20% CC 180 minute summer	70.639	18.178
100 year +20% CC 240 minute summer	56.367	14.896
100 year +20% CC 360 minute summer	43.598	11.219
100 year +20% CC 480 minute summer	34.671	9.163
100 year +20% CC 600 minute summer	28.612	7.826
100 year +20% CC 720 minute summer	25.663	6.878
100 year +20% CC 960 minute summer	21.295	5.608
100 year +20% CC 1440 minute summer	15.685	4.204
100 year +20% CC 2160 minute summer	11.399	3.150
100 year +20% CC 2880 minute summer	9.570	2.565

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 4320 minute summer	7.332	1.917
100 year +20% CC 5760 minute summer	6.086	1.558
100 year +20% CC 7200 minute summer	5.198	1.326
100 year +20% CC 8640 minute summer	4.555	1.162
100 year +20% CC 10080 minute summer	4.075	1.039

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	S2.0	735	11.063	0.563	10.9	97.5021	0.0000	SURCHARGED
60 minute summer	S2.1	142	9.522	0.022	1.8	0.0251	0.0000	OK
120 minute summer	S3.0	330	8.029	0.014	0.0	0.0159	0.0000	OK
120 minute summer	S2.2	330	8.029	0.029	1.8	0.0328	0.0000	OK
15 minute summer	EX.MH206	1	8.840	0.000	0.0	0.0000	0.0000	OK
7200 minute summer	S2.3	4260	7.902	0.028	1.8	0.0322	0.0000	OK
960 minute summer	S2.4	480	7.195	0.028	1.8	0.0322	0.0000	OK
15 minute summer	S5.0	1	7.750	0.000	0.0	0.0000	0.0000	OK
7200 minute summer	S5.1	4260	7.047	0.031	1.8	0.0348	0.0000	OK
600 minute summer	S7.0	435	7.511	0.526	9.3	53.6297	0.0000	SURCHARGED
60 minute summer	S5.2	44	7.021	0.041	3.5	0.0461	0.0000	OK
960 minute summer	S6.1	750	6.536	0.586	11.2	102.8600	0.0000	SURCHARGED
60 minute summer	S6.2	156	5.835	0.035	1.8	0.0399	0.0000	OK
15 minute summer	S6.3	10	5.760	0.052	8.6	0.0676	0.0000	OK
15 minute summer	S6.4	13	5.774	0.188	10.0	0.2124	0.0000	OK
15 minute summer	S6.5	13	5.714	0.186	14.8	0.2106	0.0000	OK
15 minute summer	S8.0	10	7.298	0.098	21.4	0.2639	0.0000	OK
15 minute summer	S6.8	13	5.731	0.445	66.5	0.7857	0.0000	SURCHARGED
15 minute summer	1.009:50%	12	5.728	0.588	42.1	2.5876	0.0000	SURCHARGED
15 minute summer	S9.1	10	8.410	0.140	34.6	0.4340	0.0000	OK
15 minute summer	S9.2	10	8.135	0.173	69.3	0.5545	0.0000	OK
120 minute summer	S10.0	86	7.136	0.386	9.9	10.9837	0.0000	SURCHARGED
180 minute summer	S11.0	144	7.089	0.589	10.4	18.0163	0.0000	SURCHARGED
15 minute summer	S9.3	10	6.792	0.342	70.2	0.3872	0.0000	SURCHARGED
15 minute summer	S6.9	12	5.688	0.695	87.6	0.7862	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute summer	S2.0	Hydro-Brake®	S2.1	1.8				
60 minute summer	S2.1	1.001	S2.2	1.8	0.887	0.020	0.0340	
120 minute summer	S3.0	2	S2.2	0.0	-0.023	-0.001	0.0124	
120 minute summer	S2.2	1.002	S2.3	1.8	0.604	0.034	0.0373	
15 minute summer	EX.MH206	3	S2.3	0.0	0.000	0.000	0.0000	
7200 minute summer	S2.3	1.003	S2.4	1.8	0.613	0.034	0.2041	
960 minute summer	S2.4	1.004	S5.1	1.8	0.586	0.034	0.0448	
15 minute summer	S5.0	4	S5.1	0.0	0.000	0.000	0.0000	
7200 minute summer	S5.1	1.005	S5.2	1.8	0.515	0.035	0.0149	
600 minute summer	S7.0	Hydro-Brake®	S5.2	1.8				
60 minute summer	S5.2	1.006	S6.4	3.5	0.748	0.066	0.0401	
960 minute summer	S6.1	Hydro-Brake®	S6.2	1.8				
60 minute summer	S6.2	6.001	S6.3	1.8	0.596	0.048	0.0824	
15 minute summer	S6.3	6.002	S6.4	8.6	0.942	0.103	0.0986	
15 minute summer	S6.4	1.007	S6.5	14.8	0.821	0.183	0.5042	
15 minute summer	S6.5	1.008	S6.8	23.7	0.688	0.244	1.8354	
15 minute summer	S8.0	7	S6.8	21.4	1.360	0.347	0.2243	
15 minute summer	S6.8	1.009	1.009:50%	40.2	0.856	0.319	4.0365	
15 minute summer	S6.8	1.009	S6.9	65.1	0.704	0.516	4.0365	
15 minute summer	S9.1	8	S9.2	34.7	1.176	0.672	0.9179	
15 minute summer	S9.2	8.001	S9.3	68.6	2.184	0.859	0.9520	
120 minute summer	S10.0	Hydro-Brake®	S9.3	1.8				
180 minute summer	S11.0	Hydro-Brake®	S9.3	1.6				
15 minute summer	S9.3	8.002	S6.9	68.7	1.727	1.401	0.2194	
15 minute summer	S6.9	1.01	S6.10	93.6	1.097	0.744	3.5391	

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S6.10	12	5.641	0.776	94.4	1.4721	0.0000	SURCHARGED
15 minute summer	S6.11	12	5.595	0.836	98.4	1.0605	0.0000	SURCHARGED
15 minute summer	S19.0	10	10.476	0.026	1.4	0.0320	0.0000	OK
15 minute summer	S19.1	11	9.647	0.040	3.0	0.0493	0.0000	OK
15 minute summer	S19.2	10	9.574	0.126	5.6	0.1601	0.0000	OK
15 minute summer	S19.3	10	9.560	0.297	47.7	0.7090	0.0000	SURCHARGED
480 minute summer	S12.0	360	9.146	0.546	9.2	41.0427	0.0000	SURCHARGED
15 minute summer	S15.0	10	8.427	0.027	2.0	0.0330	0.0000	OK
360 minute summer	S20.0	248	8.967	0.467	7.6	21.9322	0.0000	SURCHARGED
15 minute summer	S15.1	10	7.749	0.045	6.6	0.0567	0.0000	OK
15 minute summer	S15.2	10	7.062	0.062	16.4	0.0855	0.0000	OK
15 minute summer	S15.3	10	6.083	0.083	22.4	0.1143	0.0000	OK
15 minute summer	S13.1	10	6.038	0.238	50.3	0.4616	0.0000	SURCHARGED
480 minute summer	S13.0	328	5.999	0.349	9.5	38.8655	0.0000	SURCHARGED
15 minute summer	S15.4	10	5.651	0.101	28.8	0.1368	0.0000	OK
15 minute summer	S15.5	12	5.634	0.334	31.1	0.4194	0.0000	SURCHARGED
15 minute summer	S15.6	12	5.584	0.884	37.9	1.1624	0.0000	SURCHARGED
2160 minute summer	S14.0	1560	5.206	0.516	11.5	242.8291	0.0000	SURCHARGED
15 minute summer	S6.12	12	5.566	1.110	126.2	2.1703	0.0000	SURCHARGED
15 minute summer	S6.13	17	3.624	0.074	11.5	0.0834	0.0000	OK
240 minute summer	S6.14	264	3.067	0.052	11.5	0.0590	0.0000	OK
240 minute summer	DSD2	264	2.763	0.048	11.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S6.10	1.011	S6.11	98.0	1.113	0.768	2.8526	
15 minute summer	S6.11	1.012	S6.12	107.6	0.980	0.607	2.1454	
15 minute summer	S19.0	11	S19.1	1.3	0.464	0.066	0.1944	
15 minute summer	S19.1	11.001	S19.2	2.8	0.520	0.155	0.1493	
15 minute summer	S19.2	11.002	S19.3	7.7	0.525	0.427	0.3006	
15 minute summer	S19.3	11.003	S12.0	46.9	1.202	2.570	0.3766	
480 minute summer	S12.0	Hydro-Brake®	S15.2	1.6				
15 minute summer	S15.0	14	S15.1	2.0	0.754	0.030	0.0473	
360 minute summer	S20.0	Hydro-Brake®	S15.1	1.6				
15 minute summer	S15.1	14.001	S15.2	6.5	0.761	0.050	0.4516	
15 minute summer	S15.2	11.006	S15.3	16.1	1.236	0.094	0.5517	
15 minute summer	S15.3	11.007	S15.4	21.8	1.222	0.168	0.6009	
15 minute summer	S13.1	13	S13.0	50.4	1.883	1.069	0.4985	
480 minute summer	S13.0	Hydro-Brake®	S15.4	2.0				
15 minute summer	S15.4	11.008	S15.5	28.5	1.287	0.228	0.8888	
15 minute summer	S15.5	11.009	S15.6	32.3	1.151	0.299	2.2320	
15 minute summer	S15.6	11.01	S6.12	37.1	0.594	0.461	1.2544	
2160 minute summer	S14.0	12	S6.12	-11.5	-0.253	-0.095	2.5904	
15 minute summer	S6.12	Hydro-Brake®	S6.13	11.5				
15 minute summer	S6.13	1.014	S6.14	11.5	1.268	0.208	0.4310	
240 minute summer	S6.14	1.015	DSD2	11.5	1.748	0.101	0.0416	306.7

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	S2.0	795	11.367	0.867	15.1	150.1690	0.0000	SURCHARGED
15 minute summer	S2.1	18	9.522	0.022	1.8	0.0251	0.0000	OK
30 minute summer	S3.0	20	8.029	0.014	0.1	0.0158	0.0000	OK
15 minute summer	S2.2	16	8.029	0.029	1.8	0.0328	0.0000	OK
15 minute summer	EX.MH206	1	8.840	0.000	0.0	0.0000	0.0000	OK
15 minute summer	S2.3	14	7.902	0.028	1.8	0.0322	0.0000	OK
15 minute summer	S2.4	17	7.195	0.028	1.8	0.0322	0.0000	OK
15 minute summer	S5.0	1	7.750	0.000	0.0	0.0000	0.0000	OK
10080 minute summer	S5.1	6420	7.047	0.031	1.8	0.0345	0.0000	OK
720 minute summer	S7.0	540	7.812	0.827	11.8	84.3250	0.0000	SURCHARGED
15 minute summer	S5.2	18	7.021	0.041	3.5	0.0461	0.0000	OK
1440 minute summer	S6.1	1080	6.846	0.896	11.6	157.2680	0.0000	SURCHARGED
15 minute summer	S6.2	12	6.121	0.321	1.8	0.3627	0.0000	SURCHARGED
15 minute summer	S6.3	12	6.132	0.424	21.2	0.5492	0.0000	SURCHARGED
15 minute summer	S6.4	12	6.128	0.542	26.0	0.6135	0.0000	SURCHARGED
15 minute summer	S6.5	12	6.130	0.602	40.9	0.6808	0.0000	SURCHARGED
15 minute summer	S8.0	10	7.323	0.123	31.4	0.3338	0.0000	OK
15 minute summer	S6.8	13	6.100	0.814	111.6	1.4383	0.0000	SURCHARGED
15 minute summer	1.009:50%	13	6.102	0.963	65.5	6.9315	0.0000	SURCHARGED
15 minute summer	S9.1	11	8.707	0.437	50.6	1.3552	0.0000	SURCHARGED
15 minute summer	S9.2	11	8.444	0.482	96.3	1.5427	0.0000	SURCHARGED
180 minute summer	S10.0	140	7.406	0.656	11.3	18.6904	0.0000	SURCHARGED
240 minute summer	S11.0	188	7.444	0.944	12.1	28.8733	0.0000	SURCHARGED
15 minute summer	S9.3	11	6.913	0.463	89.2	0.5240	0.0000	SURCHARGED
15 minute summer	S6.9	13	6.056	1.063	106.2	1.2023	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute summer	S2.0	Hydro-Brake®	S2.1	1.8				
15 minute summer	S2.1	1.001	S2.2	1.8	0.887	0.020	0.0340	
30 minute summer	S3.0	2	S2.2	-0.1	-0.064	-0.003	0.0124	
15 minute summer	S2.2	1.002	S2.3	1.8	0.625	0.034	0.0373	
15 minute summer	EX.MH206	3	S2.3	0.0	0.000	0.000	0.0000	
15 minute summer	S2.3	1.003	S2.4	1.8	0.660	0.034	0.2043	
15 minute summer	S2.4	1.004	S5.1	1.8	0.589	0.034	0.0448	
15 minute summer	S5.0	4	S5.1	0.0	0.000	0.000	0.0000	
10080 minute summer	S5.1	1.005	S5.2	1.8	0.523	0.035	0.0150	
720 minute summer	S7.0	Hydro-Brake®	S5.2	1.8				
15 minute summer	S5.2	1.006	S6.4	3.5	0.749	0.066	0.0401	
1440 minute summer	S6.1	Hydro-Brake®	S6.2	1.8				
15 minute summer	S6.2	6.001	S6.3	8.7	0.596	0.235	0.7185	
15 minute summer	S6.3	6.002	S6.4	22.5	1.031	0.270	0.1900	
15 minute summer	S6.4	1.007	S6.5	30.6	0.893	0.379	0.7691	
15 minute summer	S6.5	1.008	S6.8	42.1	0.718	0.433	2.2215	
15 minute summer	S8.0	7	S6.8	31.4	1.489	0.509	0.3006	
15 minute summer	S6.8	1.009	1.009:50%	-66.7	0.903	-0.529	4.0365	
15 minute summer	S6.8	1.009	S6.9	85.4	0.856	0.677	4.0365	
15 minute summer	S9.1	8	S9.2	45.8	1.201	0.887	1.2424	
15 minute summer	S9.2	8.001	S9.3	87.6	2.245	1.096	1.2058	
180 minute summer	S10.0	Hydro-Brake®	S9.3	1.8				
240 minute summer	S11.0	Hydro-Brake®	S9.3	1.6				
15 minute summer	S9.3	8.002	S6.9	88.8	2.233	1.811	0.2209	
15 minute summer	S6.9	1.01	S6.10	113.1	1.081	0.899	3.5391	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S6.10	13	5.946	1.081	113.8	2.0499	0.0000	SURCHARGED
15 minute summer	S6.11	12	5.875	1.116	119.8	1.4151	0.0000	SURCHARGED
15 minute summer	S19.0	10	10.482	0.032	2.1	0.0393	0.0000	OK
15 minute summer	S19.1	11	9.725	0.118	5.1	0.1461	0.0000	OK
15 minute summer	S19.2	11	9.711	0.263	10.3	0.3333	0.0000	SURCHARGED
15 minute summer	S19.3	10	9.686	0.423	66.6	1.0084	0.0000	SURCHARGED
480 minute summer	S12.0	392	9.450	0.850	13.1	63.9089	0.0000	SURCHARGED
15 minute summer	S15.0	10	8.432	0.032	2.9	0.0396	0.0000	OK
360 minute summer	S20.0	272	9.264	0.764	10.8	35.9034	0.0000	SURCHARGED
15 minute summer	S15.1	10	7.757	0.053	9.0	0.0665	0.0000	OK
15 minute summer	S15.2	10	7.073	0.073	23.1	0.1017	0.0000	OK
15 minute summer	S15.3	10	6.101	0.101	31.9	0.1391	0.0000	OK
15 minute summer	S13.1	10	6.326	0.526	73.7	1.0197	0.0000	SURCHARGED
480 minute summer	S13.0	384	6.214	0.564	13.1	62.7581	0.0000	SURCHARGED
15 minute summer	S15.4	12	5.907	0.357	41.5	0.4818	0.0000	SURCHARGED
15 minute summer	S15.5	12	5.881	0.581	39.4	0.7285	0.0000	SURCHARGED
15 minute summer	S15.6	12	5.846	1.146	52.4	1.5074	0.0000	SURCHARGED
2160 minute summer	S14.0	1980	5.556	0.866	15.3	407.1048	0.0000	SURCHARGED
15 minute summer	S6.12	12	5.819	1.363	177.2	2.6666	0.0000	SURCHARGED
15 minute summer	S6.13	17	3.624	0.074	11.5	0.0834	0.0000	OK
15 minute summer	S6.14	18	3.067	0.052	11.5	0.0590	0.0000	OK
15 minute summer	DSD2	18	2.763	0.048	11.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S6.10	1.011	S6.11	119.0	1.104	0.932	2.8526	
15 minute summer	S6.11	1.012	S6.12	124.5	1.129	0.702	2.1454	
15 minute summer	S19.0	11	S19.1	2.0	0.462	0.100	0.5907	
15 minute summer	S19.1	11.001	S19.2	8.2	0.540	0.451	0.2487	
15 minute summer	S19.2	11.002	S19.3	12.0	0.697	0.667	0.3165	
15 minute summer	S19.3	11.003	S12.0	64.7	1.628	3.543	0.3958	
480 minute summer	S12.0	Hydro-Brake®	S15.2	1.6				
15 minute summer	S15.0	14	S15.1	2.9	0.842	0.043	0.0616	
360 minute summer	S20.0	Hydro-Brake®	S15.1	1.6				
15 minute summer	S15.1	14.001	S15.2	9.0	0.830	0.070	0.5742	
15 minute summer	S15.2	11.006	S15.3	22.7	1.345	0.133	0.7169	
15 minute summer	S15.3	11.007	S15.4	32.2	1.252	0.247	1.4625	
15 minute summer	S13.1	13	S13.0	73.5	2.069	1.560	0.6703	
480 minute summer	S13.0	Hydro-Brake®	S15.4	2.0				
15 minute summer	S15.4	11.008	S15.5	38.4	1.348	0.308	1.4026	
15 minute summer	S15.5	11.009	S15.6	44.7	1.128	0.414	2.2320	
15 minute summer	S15.6	11.01	S6.12	53.5	0.759	0.664	1.2544	
2160 minute summer	S14.0	12	S6.12	-15.3	-0.246	-0.126	2.5904	
15 minute summer	S6.12	Hydro-Brake®	S6.13	11.5				
15 minute summer	S6.13	1.014	S6.14	11.5	1.268	0.208	0.4311	
15 minute summer	S6.14	1.015	DSD2	11.5	1.748	0.101	0.0416	168.5

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	S2.0	840	11.627	1.127	18.8	195.3214	0.0000	SURCHARGED
960 minute summer	S2.1	840	9.523	0.023	1.9	0.0263	0.0000	OK
960 minute summer	S3.0	840	8.030	0.015	0.0	0.0174	0.0000	OK
960 minute summer	S2.2	840	8.030	0.030	1.9	0.0343	0.0000	OK
15 minute summer	EX.MH206	1	8.840	0.000	0.0	0.0000	0.0000	OK
1440 minute summer	S2.3	1110	7.904	0.030	1.9	0.0337	0.0000	OK
960 minute summer	S2.4	825	7.197	0.030	1.9	0.0336	0.0000	OK
15 minute summer	S5.0	1	7.750	0.000	0.0	0.0000	0.0000	OK
1440 minute summer	S5.1	1140	7.048	0.032	1.9	0.0361	0.0000	OK
720 minute summer	S7.0	570	8.075	1.090	14.8	111.1587	0.0000	SURCHARGED
960 minute summer	S5.2	750	7.022	0.042	3.8	0.0479	0.0000	OK
1440 minute summer	S6.1	1110	7.116	1.166	14.3	204.6271	0.0000	SURCHARGED
15 minute summer	S6.2	13	6.444	0.644	6.3	0.7288	0.0000	SURCHARGED
15 minute summer	S6.3	13	6.414	0.706	17.3	0.9140	0.0000	SURCHARGED
15 minute summer	S6.4	13	6.422	0.836	75.4	0.9457	0.0000	SURCHARGED
15 minute summer	S6.5	13	6.414	0.886	27.0	1.0025	0.0000	SURCHARGED
15 minute summer	S8.0	10	7.347	0.147	40.7	0.3975	0.0000	OK
15 minute summer	S6.8	12	6.420	1.134	57.7	2.0030	0.0000	SURCHARGED
15 minute summer	1.009:50%	13	6.388	1.249	105.6	11.6606	0.0000	SURCHARGED
15 minute summer	S9.1	11	9.315	1.045	65.6	3.2371	0.0000	FLOOD RISK
15 minute summer	S9.2	11	8.927	0.965	115.1	3.0906	0.0000	FLOOD RISK
240 minute summer	S10.0	176	7.653	0.903	11.6	25.7032	0.0000	SURCHARGED
360 minute summer	S11.0	248	8.531	2.031	12.0	38.4694	0.0000	FLOOD RISK
15 minute summer	S9.3	11	7.049	0.599	108.2	0.6778	0.0000	SURCHARGED
15 minute summer	S6.9	13	6.357	1.364	144.3	1.5429	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute summer	S2.0	Hydro-Brake®	S2.1	1.9				
960 minute summer	S2.1	1.001	S2.2	1.9	0.912	0.022	0.0363	
960 minute summer	S3.0	2	S2.2	0.0	-0.006	0.000	0.0135	
960 minute summer	S2.2	1.002	S2.3	1.9	0.621	0.038	0.0399	
15 minute summer	EX.MH206	3	S2.3	0.0	0.000	0.000	0.0000	
1440 minute summer	S2.3	1.003	S2.4	1.9	0.630	0.037	0.2179	
960 minute summer	S2.4	1.004	S5.1	1.9	0.599	0.037	0.0481	
15 minute summer	S5.0	4	S5.1	0.0	0.000	0.000	0.0000	
1440 minute summer	S5.1	1.005	S5.2	1.9	0.460	0.038	0.0161	
720 minute summer	S7.0	Hydro-Brake®	S5.2	1.9				
960 minute summer	S5.2	1.006	S6.4	3.8	0.764	0.071	0.0424	
1440 minute summer	S6.1	Hydro-Brake®	S6.2	2.0				
15 minute summer	S6.2	6.001	S6.3	10.0	0.596	0.270	0.7185	
15 minute summer	S6.3	6.002	S6.4	19.1	1.092	0.229	0.1900	
15 minute summer	S6.4	1.007	S6.5	-57.8	0.941	-0.716	0.7691	
15 minute summer	S6.5	1.008	S6.8	53.3	0.824	0.548	2.2215	
15 minute summer	S8.0	7	S6.8	40.7	1.573	0.660	0.3685	
15 minute summer	S6.8	1.009	1.009:50%	73.6	0.881	0.584	4.0365	
15 minute summer	S6.8	1.009	S6.9	101.9	0.933	0.808	4.0365	
15 minute summer	S9.1	8	S9.2	53.0	1.333	1.027	1.2424	
15 minute summer	S9.2	8.001	S9.3	106.9	2.688	1.338	1.1980	
240 minute summer	S10.0	Hydro-Brake®	S9.3	1.8				
360 minute summer	S11.0	Hydro-Brake®	S9.3	2.3				
15 minute summer	S9.3	8.002	S6.9	107.0	2.690	2.182	0.2209	
15 minute summer	S6.9	1.01	S6.10	148.6	1.348	1.181	3.5391	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	S6.10	1440	6.240	1.375	24.5	2.6091	0.0000	SURCHARGED
1440 minute summer	S6.11	1440	6.240	1.481	24.7	1.8777	0.0000	SURCHARGED
15 minute summer	S19.0	10	10.487	0.037	2.7	0.0448	0.0000	OK
15 minute summer	S19.1	11	9.912	0.305	12.7	0.3769	0.0000	SURCHARGED
15 minute summer	S19.2	11	9.890	0.442	12.2	0.5594	0.0000	SURCHARGED
15 minute summer	S19.3	10	9.829	0.566	84.9	1.3504	0.0000	SURCHARGED
480 minute summer	S12.0	424	9.709	1.109	16.5	83.4621	0.0000	SURCHARGED
15 minute summer	S15.0	10	8.437	0.037	3.8	0.0453	0.0000	OK
360 minute summer	S20.0	288	9.530	1.030	13.7	48.4030	0.0000	SURCHARGED
15 minute summer	S15.1	10	7.764	0.060	11.4	0.0744	0.0000	OK
15 minute summer	S15.2	10	7.083	0.083	29.1	0.1146	0.0000	OK
1440 minute summer	S15.3	1440	6.240	0.240	6.0	0.3318	0.0000	OK
15 minute summer	S13.1	10	6.636	0.836	95.3	1.6211	0.0000	SURCHARGED
480 minute summer	S13.0	416	6.417	0.767	16.7	85.4133	0.0000	SURCHARGED
1440 minute summer	S15.4	1440	6.240	0.690	8.7	0.9320	0.0000	SURCHARGED
1440 minute summer	S15.5	1440	6.240	0.940	9.2	1.1784	0.0000	SURCHARGED
1440 minute summer	S15.6	1440	6.239	1.539	10.0	2.0244	0.0000	SURCHARGED
1440 minute summer	S14.0	1440	6.239	1.549	23.6	564.9069	0.0000	SURCHARGED
1440 minute summer	S6.12	1440	6.239	1.783	35.1	3.4882	0.0000	SURCHARGED
15 minute summer	S6.13	18	3.624	0.074	11.5	0.0834	0.0000	OK
480 minute summer	S6.14	240	3.067	0.052	11.5	0.0590	0.0000	OK
480 minute summer	DSD2	240	2.763	0.048	11.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute summer	S6.10	1.011	S6.11	23.9	0.865	0.188	2.8526	
1440 minute summer	S6.11	1.012	S6.12	24.7	0.770	0.139	2.1454	
15 minute summer	S19.0	11	S19.1	2.6	0.508	0.131	0.7047	
15 minute summer	S19.1	11.001	S19.2	10.6	0.600	0.584	0.2695	
15 minute summer	S19.2	11.002	S19.3	14.7	0.836	0.817	0.3165	
15 minute summer	S19.3	11.003	S12.0	81.3	2.043	4.448	0.4009	
480 minute summer	S12.0	Hydro-Brake®	S15.2	1.7				
15 minute summer	S15.0	14	S15.1	3.8	0.911	0.056	0.0746	
360 minute summer	S20.0	Hydro-Brake®	S15.1	1.7				
15 minute summer	S15.1	14.001	S15.2	11.3	0.886	0.088	0.6780	
15 minute summer	S15.2	11.006	S15.3	28.8	1.444	0.168	0.9493	
1440 minute summer	S15.3	11.007	S15.4	6.0	0.803	0.046	2.1448	
15 minute summer	S13.1	13	S13.0	94.3	2.471	2.001	0.7249	
480 minute summer	S13.0	Hydro-Brake®	S15.4	2.0				
1440 minute summer	S15.4	11.008	S15.5	8.7	0.950	0.070	1.4026	
1440 minute summer	S15.5	11.009	S15.6	9.2	0.920	0.085	2.2320	
1440 minute summer	S15.6	11.01	S6.12	9.7	0.536	0.121	1.2544	
1440 minute summer	S14.0	12	S6.12	-23.6	-0.246	-0.195	2.5904	
1440 minute summer	S6.12	Hydro-Brake®	S6.13	11.5				
15 minute summer	S6.13	1.014	S6.14	11.5	1.268	0.208	0.4311	
480 minute summer	S6.14	1.015	DSD2	11.5	1.748	0.101	0.0416	430.7

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)	16.100	Minimum Backdrop Height (m)	0.200
Ratio-R	0.278	Preferred Cover Depth (m)	1.200
CV	1.000	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)
S4.0	0.105	4.00	7.130	1200	716316.972	736159.308	1.958
S4.3		4.00	6.840	1200	716323.555	736157.740	1.300
S4.1			6.800	1200	716320.081	736148.111	1.700
S4.2			6.560	1200	716318.587	736140.664	1.560

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)
1.001	S4.0	S4.1	8.348	0.600	5.172	5.100	0.072	116.3	225	4.11	50.0
1.002	S4.1	S4.2	7.595	0.600	5.100	5.000	0.100	75.9	150	4.22	50.0
2.001	S4.3	S4.1	10.237	0.600	5.540	5.150	0.390	26.2	100	4.11	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)
1.001	1.211	48.2	19.0	1.733	1.475	0.105	0.0	98	1.141
1.002	1.155	20.4	19.0	1.550	1.410	0.105	0.0	115	1.308
2.001	1.512	11.9	0.0	1.200	1.550	0.000	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)
1.001	8.348	116.3	225	Circular	7.130	5.172	1.733	6.800	5.100	1.475
1.002	7.595	75.9	150	Circular	6.800	5.100	1.550	6.560	5.000	1.410
2.001	10.237	26.2	100	Circular	6.840	5.540	1.200	6.800	5.150	1.550

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	S4.0	1200	Manhole	Adoptable	S4.1	1200	Manhole	Adoptable
1.002	S4.1	1200	Manhole	Adoptable	S4.2	1200	Manhole	Adoptable
2.001	S4.3	1200	Manhole	Adoptable	S4.1	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S4.0	716316.972	736159.308	7.130	1.958	1200	 0	1.001	5.172	225
S4.3	716323.555	736157.740	6.840	1.300	1200	 0	2.001	5.540	100
S4.1	716320.081	736148.111	6.800	1.700	1200	 1	2.001	5.150	100
						2	1.001	5.100	225
						0	1.002	5.100	150
S4.2	716318.587	736140.664	6.560	1.560	1200	 1	1.002	5.000	150

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	16.100	Additional Storage (m³/ha)	20.0
Ratio-R	0.278	Check Discharge Rate(s)	x
Summer CV	1.000	Check Discharge Volume	x
Analysis Speed	Detailed		

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
30	20	0	0
100	20	0	0

Node S4.0 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	5.172	Product Number	CTL-SHE-0061-2000-1500-2000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S4.0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.172
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	296

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	36.0	0.0	1.200	36.0	0.0	1.201	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
5 year +20% CC 15 minute summer	157.431	44.548
5 year +20% CC 30 minute summer	107.107	30.308
5 year +20% CC 60 minute summer	75.139	19.857
5 year +20% CC 120 minute summer	48.030	12.693
5 year +20% CC 180 minute summer	37.937	9.762
5 year +20% CC 240 minute summer	30.619	8.092
5 year +20% CC 360 minute summer	24.099	6.201
5 year +20% CC 480 minute summer	19.415	5.131
5 year +20% CC 600 minute summer	16.189	4.428
5 year +20% CC 720 minute summer	14.646	3.925
5 year +20% CC 960 minute summer	12.322	3.245
5 year +20% CC 1440 minute summer	9.253	2.480
5 year +20% CC 2160 minute summer	6.857	1.895
5 year +20% CC 2880 minute summer	5.841	1.565
5 year +20% CC 4320 minute summer	4.573	1.196
5 year +20% CC 5760 minute summer	3.858	0.988
5 year +20% CC 7200 minute summer	3.338	0.852
5 year +20% CC 8640 minute summer	2.957	0.754
5 year +20% CC 10080 minute summer	2.669	0.681
30 year +20% CC 15 minute summer	230.533	65.233
30 year +20% CC 30 minute summer	158.330	44.802
30 year +20% CC 60 minute summer	110.655	29.243
30 year +20% CC 120 minute summer	70.393	18.603
30 year +20% CC 180 minute summer	55.084	14.175
30 year +20% CC 240 minute summer	44.150	11.667
30 year +20% CC 360 minute summer	34.380	8.847
30 year +20% CC 480 minute summer	27.479	7.262
30 year +20% CC 600 minute summer	22.768	6.227
30 year +20% CC 720 minute summer	20.489	5.491
30 year +20% CC 960 minute summer	17.093	4.501
30 year +20% CC 1440 minute summer	12.685	3.400
30 year +20% CC 2160 minute summer	9.288	2.567
30 year +20% CC 2880 minute summer	7.842	2.102
30 year +20% CC 4320 minute summer	6.059	1.584
30 year +20% CC 5760 minute summer	5.061	1.296
30 year +20% CC 7200 minute summer	4.344	1.108
30 year +20% CC 8640 minute summer	3.823	0.975
30 year +20% CC 10080 minute summer	3.432	0.875
100 year +20% CC 15 minute summer	298.703	84.523
100 year +20% CC 30 minute summer	206.626	58.468
100 year +20% CC 60 minute summer	143.868	38.020
100 year +20% CC 120 minute summer	90.806	23.997
100 year +20% CC 180 minute summer	70.639	18.178
100 year +20% CC 240 minute summer	56.367	14.896
100 year +20% CC 360 minute summer	43.598	11.219
100 year +20% CC 480 minute summer	34.671	9.163
100 year +20% CC 600 minute summer	28.612	7.826
100 year +20% CC 720 minute summer	25.663	6.878
100 year +20% CC 960 minute summer	21.295	5.608
100 year +20% CC 1440 minute summer	15.685	4.204
100 year +20% CC 2160 minute summer	11.399	3.150
100 year +20% CC 2880 minute summer	9.570	2.565

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 4320 minute summer	7.332	1.917
100 year +20% CC 5760 minute summer	6.086	1.558
100 year +20% CC 7200 minute summer	5.198	1.326
100 year +20% CC 8640 minute summer	4.555	1.162
100 year +20% CC 10080 minute summer	4.075	1.039

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	S4.0	180	5.710	0.538	8.9	19.5904	0.0000	SURCHARGED
15 minute summer	S4.3	1	5.540	0.000	0.0	0.0000	0.0000	OK
15 minute summer	S4.1	14	5.129	0.029	1.6	0.0328	0.0000	OK
15 minute summer	S4.2	24	5.028	0.028	1.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute summer	S4.0	Hydro-Brake®	S4.1	1.6				
15 minute summer	S4.3	2.001	S4.1	0.0	0.000	0.000	0.0000	
15 minute summer	S4.1	1.002	S4.2	1.6	0.671	0.076	0.0177	11.3

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	S4.0	192	6.042	0.870	12.9	31.6547	0.0000	SURCHARGED
15 minute summer	S4.3	1	5.540	0.000	0.0	0.0000	0.0000	OK
240 minute summer	S4.1	192	5.129	0.029	1.6	0.0328	0.0000	OK
240 minute summer	S4.2	192	5.028	0.028	1.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute summer	S4.0	Hydro-Brake®	S4.1	1.6				
15 minute summer	S4.3	2.001	S4.1	0.0	0.000	0.000	0.0000	
240 minute summer	S4.1	1.002	S4.2	1.6	0.672	0.077	0.0177	38.6

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	S4.0	272	6.347	1.175	12.7	42.7622	0.0000	SURCHARGED
15 minute summer	S4.3	1	5.540	0.000	0.0	0.0000	0.0000	OK
360 minute summer	S4.1	272	5.131	0.031	1.8	0.0352	0.0000	OK
360 minute summer	S4.2	272	5.030	0.030	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute summer	S4.0	Hydro-Brake®	S4.1	1.8				
15 minute summer	S4.3	2.001	S4.1	0.0	0.000	0.000	0.0000	
360 minute summer	S4.1	1.002	S4.2	1.8	0.698	0.088	0.0195	51.5

Appendix 4

Soakaway Test Results

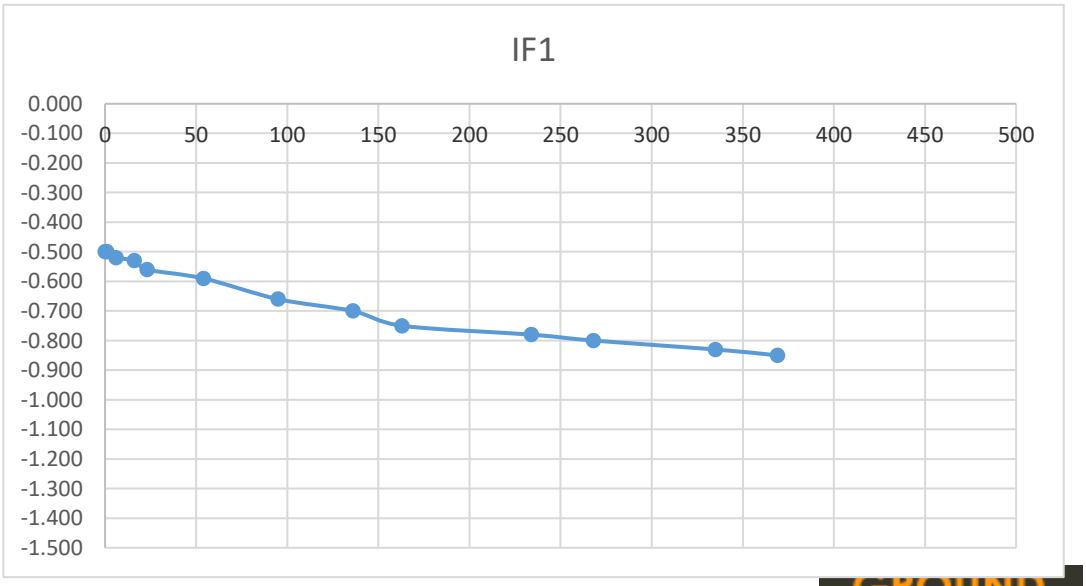
IF1

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.70m x 0.40m 1.50m (L x W x D)

Date	Time	Water level (m bgl)
18/05/2020	0	-0.500
18/05/2020	1	-0.500
18/05/2020	6	-0.520
18/05/2020	16	-0.530
18/05/2020	23	-0.560
18/05/2020	54	-0.590
18/05/2020	95	-0.660
18/05/2020	136	-0.700
18/05/2020	163	-0.750
18/05/2020	234	-0.780
18/05/2020	268	-0.800
18/05/2020	335	-0.830
18/05/2020	369	-0.850

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.50	1.500	1.000	0.75	1.25



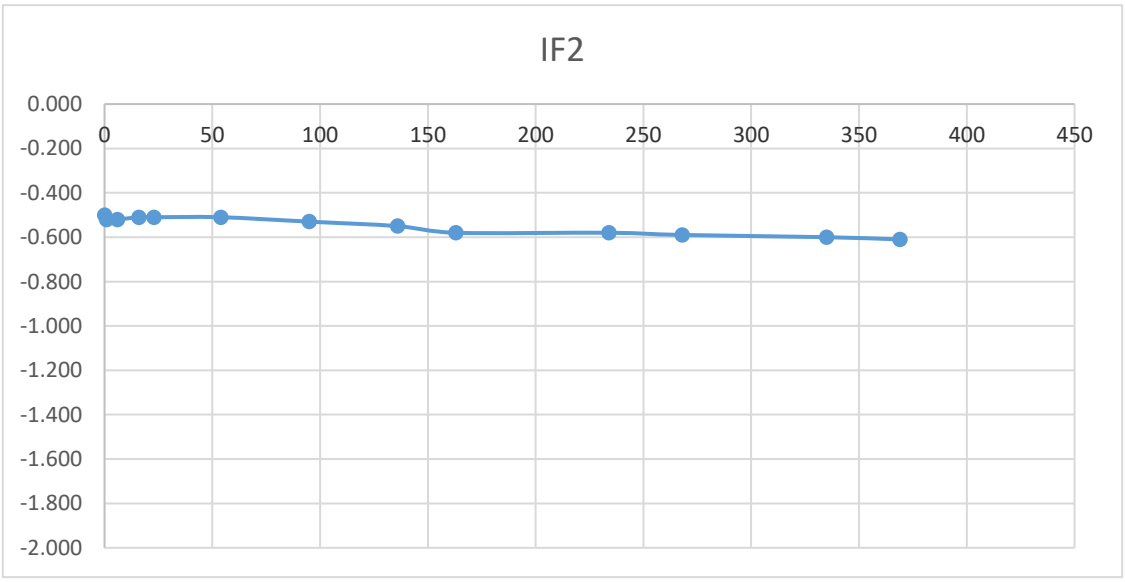
IF2

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.7m x 0.40m 1.50m (L x W x D)

Date	Time	Water level (m bgl)
18/05/2020	0	-0.500
18/05/2020	1	-0.520
18/05/2020	6	-0.520
18/05/2020	16	-0.510
18/05/2020	23	-0.510
18/05/2020	54	-0.510
18/05/2020	95	-0.530
18/05/2020	136	-0.550
18/05/2020	163	-0.580
18/05/2020	234	-0.580
18/05/2020	268	-0.590
18/05/2020	335	-0.600
18/05/2020	369	-0.610

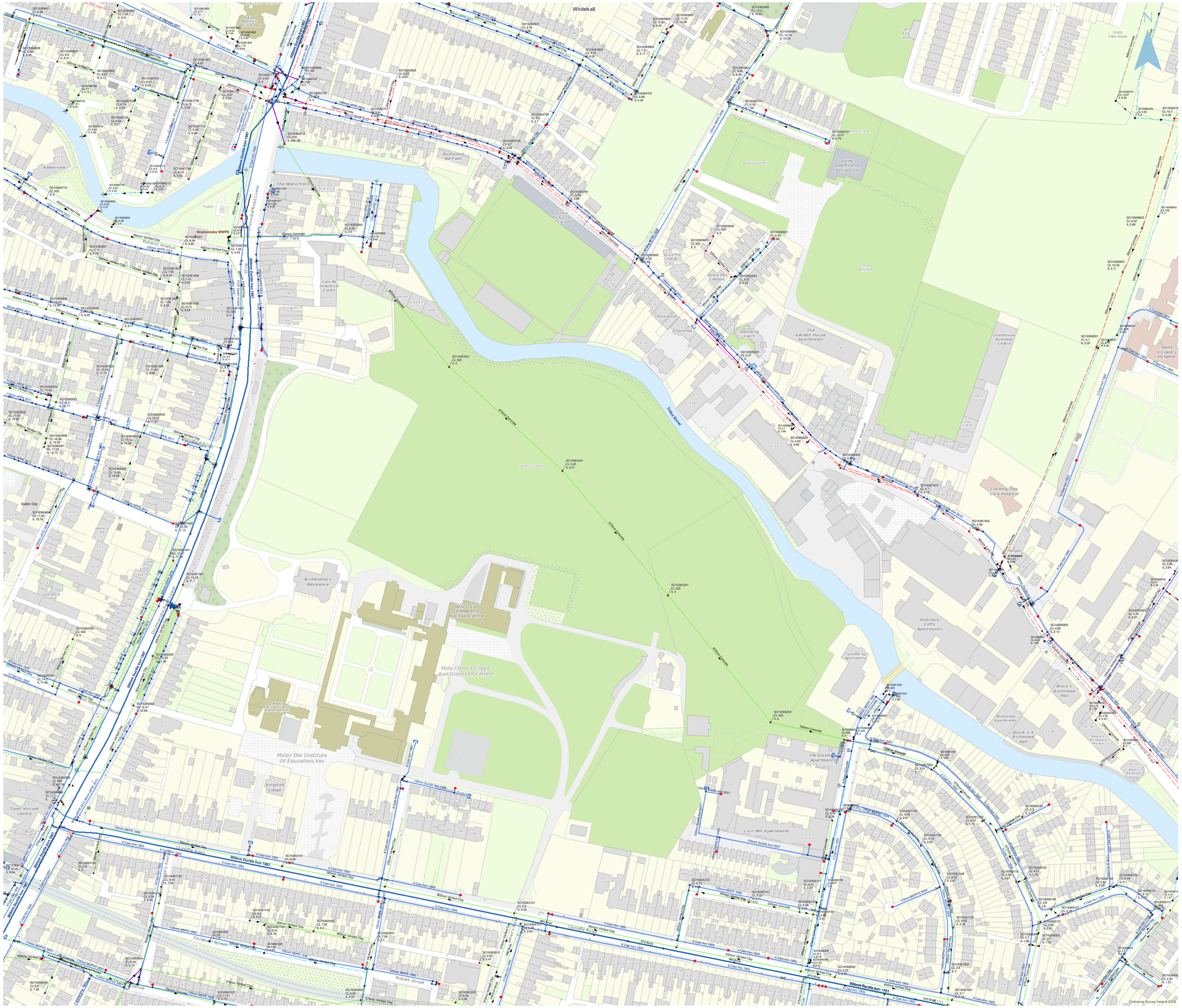
***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.50	1.500	1.000	0.75	1.25



Appendix 5

DCC / IW Drainage & Watermain Records



Legend

- Boundary Meter
- Unknown Meter; Other Meter
- PRV
- Sluice Valve Open
- Sluice Valve Closed
- Sluice Valve Closed
- Double Air Control Valve

Water Hydrants

Hydrant Function

- Fire Hydrant
- Telemetry Kiosk
- Cap
- Other Fittings

Water Distribution Mains

Owned By

- Irish Water
- Irish Water
- Irish Water
- Water Abandoned Lines

Sewer Manholes

Manhole Type

- Standard
- Lamphole
- Other; Unknown

Sewer Discharge Points

Discharge Type

- Other; Unknown
- Pump Station

Sewer Inlets

Inlet Type

- Catchpit
- Other; Unknown
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow

Storm Manholes

Manhole Type

- Standard

Storm Discharge Points

Discharge Type

- Outfall
- Surface Gravity Mains
- Surface Gravity Mains Private

Storm Inlets

Inlet Type

- Gully

Surface Fittings

Fitting Type

- Other; Unknown

1:1,000 at A0

Last edited: 08/02/2019

Metres

0 25 50 100

Appendix 6

Irish Water Confirmation of Feasibility Letter

Michael Hughes

Sandwith House,
52-54 LWR Sandwith Street,
Dublin 2
D02WR26

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 September 2020

Re: CDS20000538 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 1,800 units at Holy Cross Lands, Clonliffe Road, Dublin 3

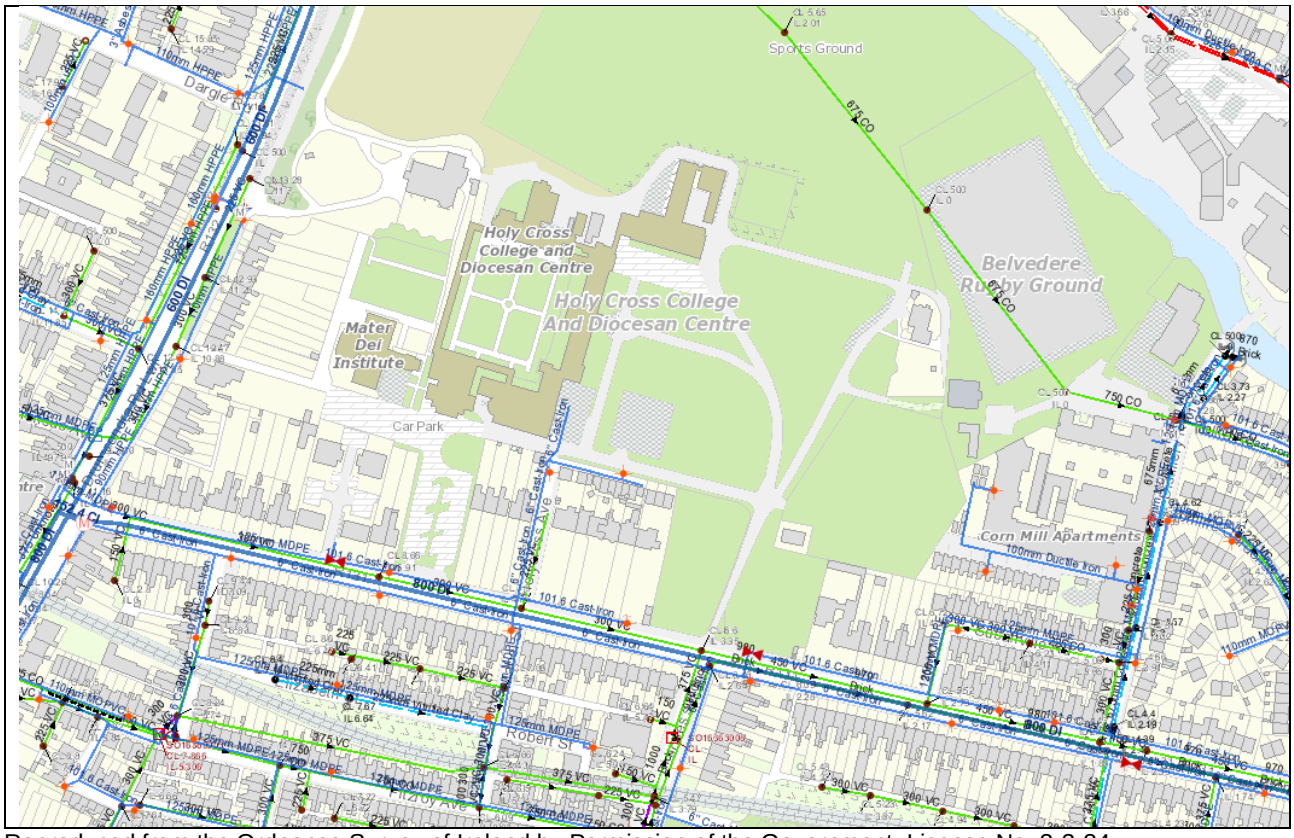
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Holy Cross Lands, Clonliffe Road, Dublin 3 (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	The Development can be supplied from existing 600mm DI in Drumcondra Road Lower via a new 250mm ID connecting pipe with installation of a PRV controller, a bulk/DMA meter and associated telemetry system. Secondary connection should be provided for the Development from existing 225mm HPPE water main in Drumcondra Road Lower via a new 250mm ID connecting pipe with installation of a control valve (to be closed during normal operation).
Wastewater Connection	Separate storm and foul water connection services have to be provided for the Development. Storm water from the Development must be discharged only into storm water network that does not discharge into an Irish Water combined/foul

	sewer. The storm water connection arrangement should be agreed with the Local Authority Drainage Division. Storm water from the Site, currently discharging into Irish Water combined network, must be removed from the network where possible prior the connection.
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

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



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

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

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

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

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

Appendix 7

Irish Water State of Design Acceptance

Michael Hughes
Sandwith Hse
52-54 Sandwith Street
Dublin 2
Dublin
D02 WR2

2 June 2021

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

Re: Design Submission for Holy Cross Lands, Clonliffe Road, Dublin 3 (the "Development")
(the "Design Submission") / Connection Reference No: CDS20000538

Dear Michael Hughes,

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: Dario Alvarez
Email: dalvarez@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- [CLN-BMCE-50-ZZ-DR-C-1008-S1 -PL3- Watermain Layout]
- [CLN-BMCE-50-ZZ-DR-C-1008-S2 -PL3- Watermain Layout]
- [CLN-BMCE-50-ZZ-DR-C-1008-S3 -PL3- Watermain Layout]
- [CLN-BMCE-50-ZZ-DR-C-1008-S4 -PL3- Watermain Layout]
- [CLN-BMCE-50-ZZ-DR-C-1008-S5 -PL3- Watermain Layout]
- [CLN-BMCE-50-ZZ-DR-C-1008-S6 -PL3- Watermain Layout]
- [CLN-BMCE-50-ZZ-DR-C-1008-S7 -PL3- Watermain Layout]
- [CLN-BMCE-50-ZZ-DR-C-1008-S8 -PL3- Watermain Layout]
- [CLN-BMCE-50-ZZ-DR-C-1009-S1 -PL4- Foul Sewer Layout]
- [CLN-BMCE-50-ZZ-DR-C-1009-S2 -PL4- Foul Sewer Layout]
- [CLN-BMCE-50-ZZ-DR-C-1009-S3 -PL4- Foul Sewer Layout]
- [CLN-BMCE-50-ZZ-DR-C-1009-S4 -PL4- Foul Sewer Layout]
- [CLN-BMCE-50-ZZ-DR-C-1009-S5 -PL4- Foul Sewer Layout]
- [CLN-BMCE-50-ZZ-DR-C-1009-S6 -PL4- Foul Sewer Layout]
- [CLN-BMCE-50-ZZ-DR-C-1009-S7 -PL4- Foul Sewer Layout]
- [CLN-BMCE-50-ZZ-DR-C-1009-S8 -PL4- Foul Sewer Layout]
- [CLN-BMCE-50-ZZ-DR-C-1160-S1-PL2 Foul Sewer Long Sections]
- [CLN-BMCE-50-ZZ-DR-C-1161-S2 -PL2 Foul Sewer Long Sections]
- [CLN-BMCE-50-ZZ-DR-C-1162-S3 – PL1 Foul Sewer Long Sections]
- [CLN-BMCE-50-ZZ-DR-C-1163-S4 – PL1 Foul Sewer Long Sections]

Standard Details/Code of Practice Exemption:

*Statement of Design Acceptance on condition that Foul Sewer line and watermain within the site will be privately managed, Irish water will not take them in charge.

*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 8

BMCE Memo Response to DCC Drainage Comments on PAC Submission

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

MEMORANDUM

To: **Maria Treacy (DCC Drainage Division)**

From: **Michael Hughes (Barrett Mahony Consulting Engineers)**

Date: **02 April 2021**

Subject: **ABPSHDPAC0033/20 – SHD Application for Lands at Holycross College, Clonliffe Road, Dublin 3 and Drumcondra Road Lower, Drumcondra, Dublin 9.**

Dear Maria,

We write in relation to the above SHD application which we are due to submit to An Bord Pleanala shortly. We acknowledge the comments received by DCC Drainage Division on the PAC submission, noted below in italics and wish to outline our responses to the comments raised in relation to the proposed surface water drainage strategy and flood risk for the development.

DCC DRAINAGE DIVISION COMMENTS RECEIVED ON THE PAC SUBMISSION TO ABP:

Masterplan

Further consideration shall be given to the overall surface water management strategy in terms of increased use of natural water retentions measures to ensure an appropriate level of treatment prior to discharge to the River Tolka and in keeping with the existing environment.

The Developer shall submit a flood risk assessment for the masterplan lands, ensuring an appropriate level of assessment with reference and implementation of the recommendations as set out in the Strategic Flood Risk Assessment that forms part of the current Development Plan 2016- 2022.

Detail of the findings of the report and how it influenced the layout of the proposed development shall be provided, ensuring there shall be no development in Flood Zones A or B.

The impact of global warming in relation to increased river flows shall also be assessed in accommodating the possible extension of Flood Zone B within the Masterplan lands. No development shall be located in areas that would reduce natural storage of the existing site.

The Masterplan shall be developed further to outline the proposed sustainable surface water management strategy that will be implemented for the entire Masterplan lands in order to mitigate against any increase

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

in flood risk or further deterioration of the water quality in the river Tolka in accordance with the Water Framework Directive and Flood Directive. In particular, detail of the proposed development on the GAA site and associated flood risk/flood storage and surface water management plan shall be provided.

Proposed Development Residential Site

The site-specific flood risk assessment shall be developed further to include references and implement any recommendations as set out in the Strategic Flood Risk Assessment that forms part of the current Development Plan 2016- 2022, for the proposed development.

Evidence to be provided of appropriate treatment of surface water discharges to the River Tolka in order to confirm compliance with the objectives of the Water Framework Directive and Flood Directive.

The development shall incorporate Sustainable Drainage Systems in the management of surface water, with a minimum requirement of a 2-stage treatment approach. Full details of these shall be agreed in writing with Drainage Division prior to submission of revised proposals.

The main surface water infrastructure shall be implemented as part of the first Phase 1 of the overall proposed development to facilitate adequate treatment of surface water prior to discharge to the River Tolka and to ensure that the flood risk is appropriately managed both during and when the overall development is constructed.

The Infrastructure Report, Document No 19.253-IR-01 shall be developed further to

- *Indicate the treatment train for each hardstanding area proposed in the new development.*
- *Provide detail of phasing of proposed surface water drainage and green infrastructure.*
- *Provide detail of protections to the river from any site runoff or other forms of possible pollution from site activities during construction.*

Clarification on the proposal to drain lands from proposed Building C2 to the public combined sewer at Clonliffe Road as this proposal does not reflect the terms in the Letter of confirmation of Feasibility from Irish Water.

BMCE RESPONSE TO DCC DRAINAGE DIVISION COMMENTS RECEIVED:

In response to the comments on the masterplan area flood risk assessment, refer to the attached document Report 19.253-IR-03 - Masterplan Flood Risk Assessment.

In response to the comments on the management and control of the construction stage surface water, refer to the attached document Report 19.253-RP-05 - Outline Construction Surface Water Management Plan

We outline below our responses to the DCC comments relating to the "Proposed Residential Site" and specifically the Sustainable Drainage Measures which are proposed to ensure appropriate management and treatment of surface water run-off generated by the new development.

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

INTRODUCTION

Surface water run-off from the proposed development will drain via gravity and ultimately discharge to the River Tolka, with the exception of Building C2 adjacent to Clonliffe Road which will discharge at a restricted flow, to the Irish Water combined sewer on Clonliffe Road. This has been agreed in principle with Irish Water and shall be reflected in the Statement of Design Acceptance issued with the submission to An Bord Pleanala. Furthermore, it is noted that any discharge to the combined sewer will, of course, be subject to the Applicant entering into a Connection Agreement with Irish Water prior to construction.

In response to DCC Drainage Division comments re sustainable drainage systems and the requirement for a minimum two-stage treatment train, the design team have reviewed the surface water strategy in detail, and have amended the surface water design in order to incorporate additional sustainable drainage measures where feasible. The amended design seeks to place greater emphasis on integrating increased opportunities for interception of surface water at source, through natural retention measures. Please refer to revised BMCE drawings CLA-BMD-00-ZZ-DR-C-1005-S1 and CLA-BMD-00-ZZ-DR-C-1005-S2 showing the amended SuDS strategy layouts.

A SuDS Treatment Train for the various sources of run-off generated within the new development has been designed to achieve adherence with the DCC Drainage Division requirement for a minimum two-stage treatment approach and ultimately achieve a greater diversity of SuDS measures in order to improve water quality.

A Phasing Plan for the development (Refer to BMCE drawing CLA-BMD-00-ZZ-DR-C-3007 enclosed) is now provided showing the extent of development within each proposed phase. It should be noted that as part of the Phase 1 of the development, the Applicant commits to providing the requisite main surface water infrastructure needed to facilitate the adequate treatment of all surface water run-off from this Phase 1 of the development. By nature of the surface water strategy design for the overall development, some of this Phase 1 infrastructure contributes to the SuDS treatment train for subsequent phases. This, along with the phase-specific SuDS measures in each Phase of development, ensures that the full SuDS treatment train is implemented for each phase prior to any discharge entering the River Tolka to the north.

PROPOSED SURFACE WATER MANAGEMENT PLAN

The proposed Surface Water Management Plan is in line with the key requirements of the Dublin City Council Drainage Division Planning & Development Control Section. The proposed surface water drainage system takes cognisance of the Dublin City Development Plan 2016 – 2022 with respect to SuDS Section 9.5.4. The amended proposals provide a minimum of two-stage treatment, including interception and primary and secondary treatment of surface water run-off. This treatment approach is in line with The CIRIA SuDS Manual C753 and is outlined below. The measures to be incorporated into the development and will include intensive and extensive green roofs, permeable paving, tree pits, gravel filter drains, rain gardens and shallow infiltration systems.

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

Proposed Surface Water Treatment Train

The proposed surface water system uses a number of SuDS components in series to provide a minimum of two-stage treatment prior to discharge into the receiving systems. A SuDs Management Train for the Development has been prepared – refer to Figure 1. The SuDS Management Train describes how rainfall falling on each surface is managed and treated prior discharge and clearly demonstrates a robust train of treatment, which in most cases exceeds the minimum two-stage requirement.

Rainfall run-off will be intercepted and treated at roof levels using intensive/extensive green roof where feasible. A multidisciplinary coordinated approach has been taken with regard to assigning the appropriate areas of roof level as intensive green roof, in an effort to accommodate other elements such as plant and photovoltaic panels. Furthermore, all podium areas (both hard and soft landscaping) over basement will be finished using an intensive green roof drainage board above the waterproofing, to ensure greater interception of rainwater and treatment through the substrate prior to entering the pipework system. Where roof areas are not covered by green roof

Owing to constraints on the site arising from the desire to retain existing mature trees and protection of these tree root zones (refer to constraints plan layout CLA-BMD-00-ZZ-DR-C-1010) pavement run-off will be intercepted and treated using a variety of SuDS components including gravel filter drains, permeable paving and rain gardens, which have been strategically selected and positioned where space permits.

The drainage of hardstanding has been re-examined and amended where feasible. The majority of pedestrianised areas and footpaths will now be constructed using permeable paving or will be constructed such that the impermeable paths drain to a gravel trenches adjacent to the path, allowing for full interception and full infiltration of rainwater back to source.

Vehicular carriageways have proved challenging in terms of accommodating SuDS measures, given the existing tree constraints, but the design has now been amended to incorporate a far more robust approach to treatment of run-off from carriageways, ensure the risk of pollutants entering the Tolka River has been minimised significantly. Roads for the most part will either discharge to gravel filter drains along the verges, tree pits, or raingardens. Where adjacent to existing tree root protection zones, the run-off will discharge to trapped road gullies with sumps. Pipework from these will discharge into catchpit (silt trap) manholes followed by proprietary treatment systems such as Hydro International ‘Downstream Defender’ and bypass petrol interceptors which will remove any final silts and oils to discharge into the River Tolka.

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

Proposed Surface Water Treatment SuDS Measures

Green roof

The proposed green roofs will consist of intensive/extensive green roofing on specific areas of rooftop, away from plant and photovoltaic panels. The proposed green roof coverage is summarised in the enclosed Green Roof Coverage Summary Table – refer Figure 2. It should be noted that areas may be subject to further minor amendments prior to lodging the full application to An Bord Pleanala.

The green roof will provide interception of rainfall, filtration through the medium, and storage within the voids facilitating evapotranspiration.

The green roofs will intercept and absorb the first 5 – 10mm of rainfall, thereby reducing the volume of run-off into the receiving systems. Rainfall run-off that is not absorbed by the green roof will filtrate through the substrate and geotextile filter fabric. A limited attenuation volume will be provided by the green roof crate layer system below the geotextile filter fabric, which will provide a time delay between the rainfall event and discharge into the system thereby reducing peak discharge rates. According to the leading green roof supplier/manufacturer Bauder, up to 40% of average annual rainfall can be absorbed and released back into the atmosphere by transpiration and evaporation.

Therefore, rainfall run-off from roof areas covered by the proposed green roofs will go through a minimum two-stage treatment train including interception and primary treatment in line with SuDS Manual C753 Table 26.7

Filter Drains

The proposed filter drains will be linear excavations filled with suitable granular material with a minimum void porosity of 30% and wrapped in a geotextile filter membrane. The filter drains will intercept pavement run-off at ground level. Catchpits will be provided downstream of the filter drains to offer additional surface water treatment including retention.

The proposed filter drains will provide interception and reduce peak run-off rates prior to discharge into the surface water drainage system. The granular material and geotextile filter material will provide interception and act as a secondary treatment in preventing ingress of fine material from paved areas prior to discharge into surface water drainage system.

Therefore, rainfall run-off that will discharge into the filter drains / catchpits will go through a three-stage treatment train including interception, primary and secondary treatment in line with SuDS Manual C753 Table 26.7, replicated in

Permeable Pavement

The proposed permeable pavement will be located at parking bays throughout the development. The proposed permeable paving structures will be filled with suitable granular material with a minimum void porosity of 30% and wrapped in a geotextile filter membrane. The granular material will provide interception within the voids and by raising the invert of the outlet pipe to 150mm above the base. The geotextile filter

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

material can offer secondary treatment of rainfall runoff by preventing ingress of fine material from paved areas through filtration prior to discharge into surface water drainage system.

Therefore, rainfall run-off from localised access road will go through a two-stage treatment train including interception and primary treatment in line with SuDS Manual C753 Table 26.7.

Raingarden & Tree Pits

A proposed raingarden will be located between Block D2 and Block C1. It will intercept and treat pavement run-off from the adjacent access roads. Furthermore, additional raingardens have been added to the area at the north west of the development close to the "A" blocks. The proposed raingardens will allow surface water run-off from paved areas to pond temporarily before filtering through vegetation and underlaying soil before discharge into the system and therefore will serve as a bio-retention system providing interception as the water discharges through plants, shrubs and landscape medium. The planters will provide temporary retention for the 1 in 1 year event in the shallow depressions. Sand based material will be used to filter the water passing through. Further filtration will be provided by the geotextile filter membrane prior to discharge into the surface water system.

Therefore, rainfall run-off from the adjacent access roads or standard roofs, will go through a three-stage treatment train including interception, primary and secondary treatment in line with SuDS Manual C753 Table 26.7

Proprietary Surface Water Treatment Systems

Due to existing site constraints including mature trees adjacent to existing roads the construction of many forms of sustainable drainage systems is not easily achievable. At suitable locations, a break will be introduced on the proposed kerbs to allow run-off to infiltrate to ground and into tree pits, gravel infiltration strips, but where this option is not available, it is the design intent to install proprietary surface water treatment systems prior to discharge into the river. The surface water treatment systems include catchpits, oil separators and sediments remover such as a 'Downstream Defender' or similar.

COMPLIANCE WITH THE PRINCIPLES OF SUSTAINABLE DRAINAGE SYSTEMS

The Greater Dublin Strategic Drainage Study (GDSDS) addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimize the impact of urbanisation, by replicating the run-off characteristics of the greenfield site. The criteria provide a consistent approach to addressing the increase in both rate and volume of run-off, as well as ensuring the environment is protected from any pollution from roads and buildings. These drainage design criteria are as follows:

GDSDS Criteria		**Aims**
Criterion 1	River Water Quality Protection	• To prevent pollution • To maintain base flows in streams • To recharge groundwater
Criterion 2	River Regime Protection	• To prevent river scour due to flash flooding

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

Criterion 3	Flood Risk Assessment	• To prevent site flooding for the 30yr storm and manage overland flows if site flooding occurs for the 100yr storm
Criterion 4	River Flood Protection	• To prevent river flooding

The overarching principle of SuDS design is that surface water runoff should be managed for maximum benefit. The types of benefits that can be achieved by SuDS will be dependent on the site, but fit broadly into four categories – The Four Pillars of SuDS – as described in the CIRIA SuDS Manual C753.

SuDS Category	**Benefit**
Water Quantity	• Maintain and protect the natural water cycle • Support the management of flood risk
Water Quality	• Manage the quality of run-off to prevent pollution
Biodiversity	• To create and sustain better places for nature
Amenity	• To create and sustain better places for people

Compliance with four GDSDS criteria and the four pillars of SuDS as described in the CIRIA SuDS Manual C753, requires a robust strategy that employs at source and site wide SuDS control measures. The SuDS strategy for the development has been developed in conjunction with the Landscape Architects, and strives to achieves the aims and benefits outlined above, despite being somewhat restricted by the available green space, and in particular the necessity to retain existing mature trees on the subject site.

Criterion 1 GDSDS – River Water Quality Protection

Run-off from natural greenfield areas contributes very little pollution and sediment to rivers and for most rainfall events direct run-off from greenfield sites to rivers does not take place as rainfall percolates into the ground. By contrast, urban run-off, when drained by pipe systems, results in run-off from virtually every rainfall event with high levels of pollution, particularly in the first phase of run-off, with little rainfall percolating to the ground. To prevent this happening, Criterion 1 requires that interception storage and/or treatment storage is provided, thereby replicating the run-off characteristics of the pre-development greenfield site.

In the context of the proposed development, it is proposed that all surface water run-off will go through a two-stage treatment train via green roofs, permeable paving, filter drains and rain garden before discharging at a controlled rate into the receiving systems. R

Interception Storage

Interception storage where required, should ensure that at least, the first 5mm of rainfall runoff is intercepted on site and does not find its way to the receiving water, in line with the GDSDS.

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

The required volume of interception is 178m^3 and the proposed design will easily accommodate this requirement following the introduction of additional SuDS measures. Further detailed calculations demonstrating this will be provided in the amended Infrastructure Report for Planning, and to demonstrate compliance with GDSDS Criterion 1.

Treatment Storage

In accordance with the GDSDS, interception storage & treatment storage are interchangeable. Since full interception storage has been provided, treatment storage is not required.

Criterion 2 GDSDS – River Regime Protection

Regardless of the rainfall event, unchecked run-off from a developed site through traditional pipe networks will discharge into receiving waters at rates that are an order of magnitude greater than that prior to development. This can cause flash flow in the outfall river / stream that can cause scour and erosion. Attenuation storage is provided to prevent this occurring by limiting the rate of run-off to that which took place from the pre-development greenfield site.

In the context of the subject site, peak run -off discharge from the proposed development will be restricted to a peak rate of 15.5 l/s into the River Tolka in line with GDSDS requirement of 2.0 l/s/ha. Attenuation facilities will be provided throughout the site for storm events up to and including the 1 in 100 year plus 20% for climate change. Therefore, GDSDS Criterion 2 is complied with.

Criterion 3 GDSDS – Level of Service For the Site

The GDSDS requires that no flooding should occur on site for storms up to and including the 1 in 30 year event. The pipe network and the attenuation storage volumes should, therefore, be checked for such storms to ensure that no site flooding occurs although partial surcharging of the system is allowed as long as it does not threaten to flood.

For the 1 in 100 year event, the pipe network can fully surcharge and cause site flooding, but the top water level due to any such flooding must be at least 500mm below any vulnerable internal floor levels, and the flood waters should be contained within the site. In addition, the top water level in any attenuation device during the 100 year storm must be at least 500mm below any vulnerable internal floor levels.

MicroDrainage simulations will be provided demonstrating a level of service as described above and ensures no surface water flooding for storms up to and including the 1 in 100 year with 20% extra for climate change, and ultimately to demonstrate GDSDS Criterion 3 is complied with.

Criterion 4 GDSDS – River Flood Protection

Criterion 4 is intended to prevent flooding of the receiving system / watercourse by either limiting the volume of run-off to the pre-development greenfield volume using ‘long-term storage’ (Option 1) or by limiting the rate of run-off for the 1 in 100 year storm to QBAR or 2.0l/s/ha without applying growth factors using ‘extended attenuation storage’ (Option 2).

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

Option 2 is complied with as the proposed development will limit discharge rate to 15.5 l/s in line with GDSDS requirement of 2.0 l/s/ha.

SUMMARY

The proposed Surface Water Management Plan for the development is in line with the key requirements of the Dublin City Drainage Division and the Dublin City Development Plan 2016-2022 with respect to Sustainable Drainage Systems.

Rainfall run-off from the proposed site development will go through at least a two-stage treatment train prior to discharge into the River Tolka and the Irish Water sewerage network on Clonliffe Road. The proposed SuDS measures will reduce the quantity and improve the quality of water discharging into the receiving system.**Error! Reference source not found.**

Attachments:

Report 19.253-IR-03 - Masterplan Flood Risk Assessment.

Report 19.253-RP-05 - Outline Construction Surface Water Management Plan

Drawings:

C-1005 S1 Proposed SuDS Scheme Site Plan Layout Sheet 1 of 2

C-1005 S2 Proposed SuDS Scheme Site Plan Layout Sheet 2 of 2

C-1008 S1 Proposed Drainage Site Plan Layout Sheet 1 of 8

C-1008 S2 Proposed Drainage Site Plan Layout Sheet 2 of 8

C-1008 S3 Proposed Drainage Site Plan Layout Sheet 3 of 8

C-1008 S4 Proposed Drainage Site Plan Layout Sheet 4 of 8

C-1008 S5 Proposed Drainage Site Plan Layout Sheet 5 of 8

C-1008 S6 Proposed Drainage Site Plan Layout Sheet 6 of 8

C-1008 S7 Proposed Drainage Site Plan Layout Sheet 7 of 8

C-1008 S8 Proposed Drainage Site Plan Layout Sheet 8 of 8

C-1010 Constraints Site Plan Layout

C-1150 S1 Surface Water Outfall No.1

C-1150 S2 Surface Water Outfall No.2

C-1162 S1 Longitudinal Sections For Proposed Surface Water Drainage Sheet 1 of 3

C-1163 S2 Longitudinal Sections For Proposed Surface Water Drainage Sheet 2 of 3

C-1164 S3 Longitudinal Sections For Proposed Surface Water Drainage Sheet 3 of 3

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

C-1210 Typical SuDS Details Sheet 1

C-1211 Typical SuDS Details Sheet 2

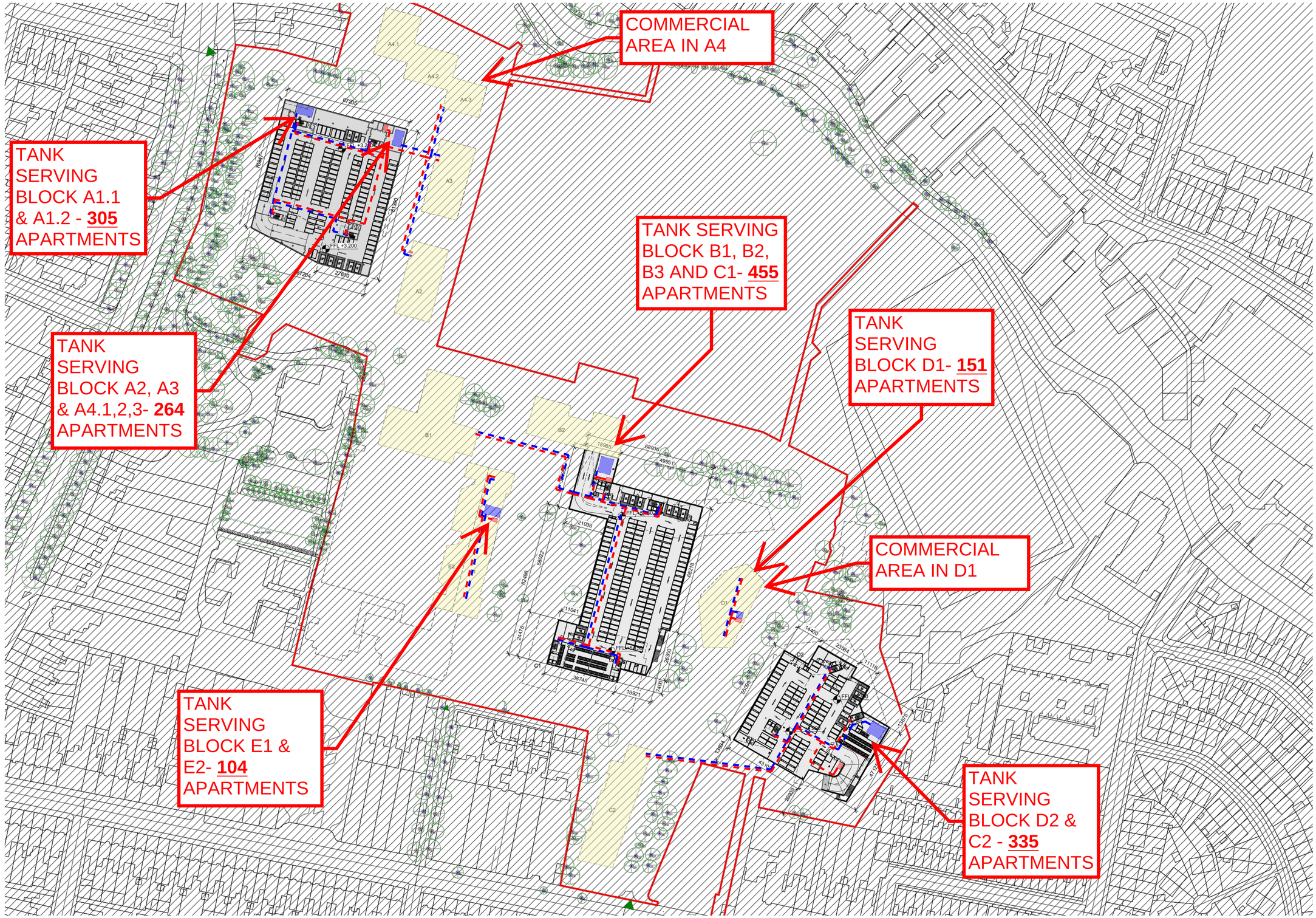
C-3007 Phasing Plan

Appendix 9

M&E Schematic Water Services Drawings

CLN-OSC-ZZ-ZZ-DR-ME-0001

CLN-OSC-ZZ-ZZ-DR-ME-0002



- FOR SETTING OUT REFER TO ARCHITECT'S DRAWINGS.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER ARCHITECTURAL AND ENGINEERING DRAWINGS AND ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
- DO NOT SCALE THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
- NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR STORED IN ANY RETRIEVAL SYSTEM OF ANY NATURE WITHOUT THE WRITTEN PERMISSION OF O'CONNOR SUTTON CRONIN AS COPYRIGHT HOLDER EXCEPT AS AGREED FOR USE ON THE PROJECT FOR WHICH THE DOCUMENT WAS ORIGINALLY ISSUED.

Rev No.	Date	Revision Note	Drn by	Chkd by
P01	30.04.20	PRELIMINARY ISSUE	J.M	S.T
P02	13.08.20	UPDATED TO UPDATED BASEMENT LAYOUT	DRP	JM
P03	05.01.21	UPDATED BASEMENT LAYOUT	JMCG	DP

Rev No.	Date	Revision Note	Drn by	Chkd by

Hines

40 Bowling Green Lane,
London, EC1R 0NE,
United Kingdom.

TEL +44 207 415 7120

e: ocsc@ocsc.co.uk
w: www.ocsc.co.uk

O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

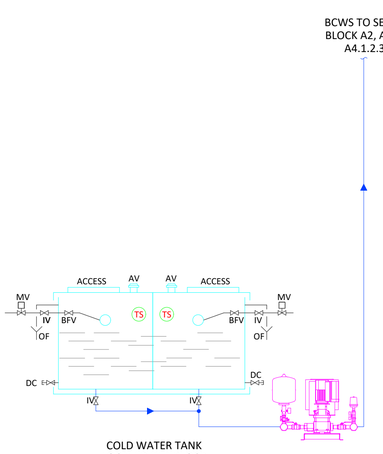
Dublin | London | Belfast | Galway | Cork | Birmingham

Client: MULTI FAMILY ICAV
Project: CLONLIFFE LANDS

Title: MECHANICAL & ELECTRICAL BASEMENT PLANT ALLOCATION

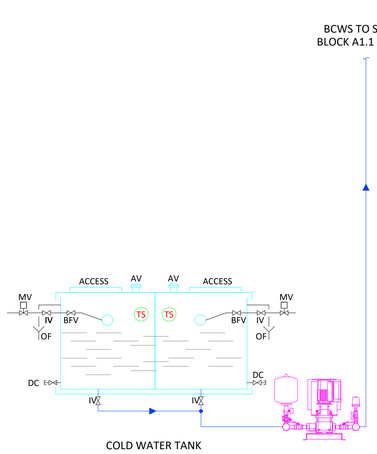
Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
CLN	OSC	ZZ	ZZ	DR	ME	0002	S2	P02

Date: APR 20 Scale: 1:1000@ A1 Drn by: J.M Chkd by: S.T Aprvd by: D.B



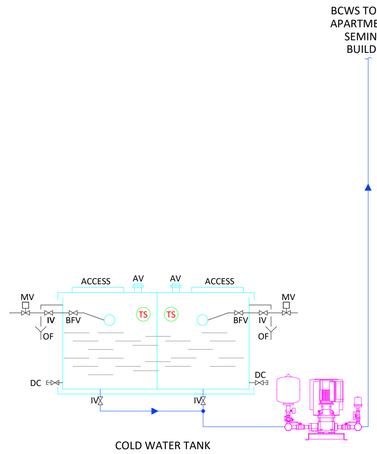
BCWS TO SERVE BLOCK A2, A3 & A4.1.2.3

COLD WATER TANK LOCATED IN A BLOCK BASEMENT



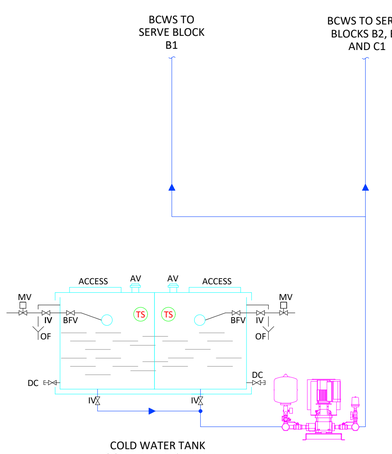
BCWS TO SERVE BLOCK A1.1 & A1.2

COLD WATER TANK LOCATED IN A BLOCK BASEMENT



BCWS TO SERVE APARTMENTS IN SEMINARY BUILDING

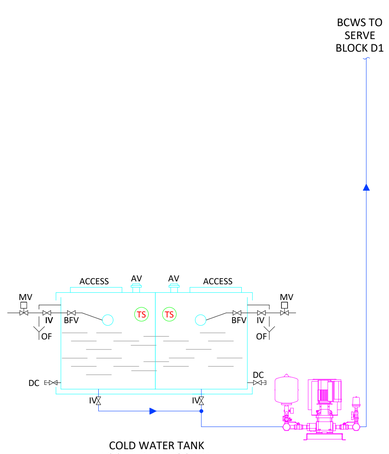
COLD WATER TANK LOCATED IN SEMINARY BUILDING GROUND FLOOR



BCWS TO SERVE BLOCK B1

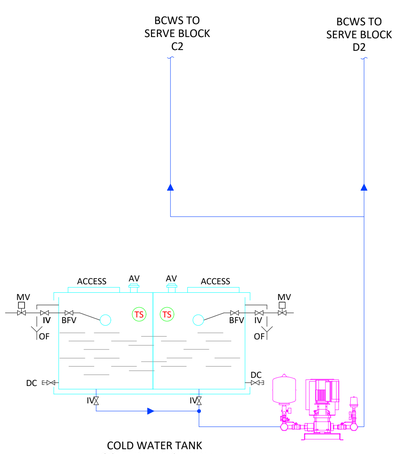
BCWS TO SERVE BLOCKS B2, B3 AND C1

COLD WATER TANK LOCATED IN BASEMENT BELOW BLOCK B2



BCWS TO SERVE BLOCK D1

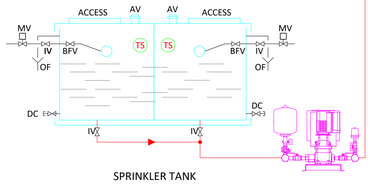
COLD WATER TANK LOCATED IN BLOCK D1 GROUND FLOOR



BCWS TO SERVE BLOCK C2

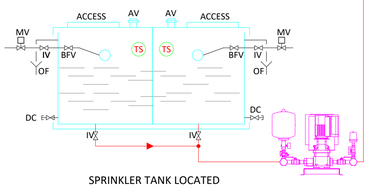
BCWS TO SERVE BLOCK D2

COLD WATER TANK LOCATED IN BASEMENT BELOW BLOCK D2



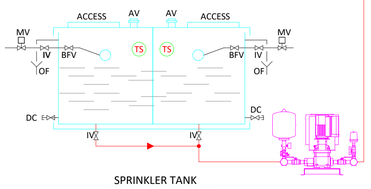
SPRINKLER TO SERVE A BLOCKS

SPRINKLER TANK LOCATED IN A BLOCK BASEMENT



SPRINKLER TO SERVE APARTMENTS IN SEMINARY BUILDING

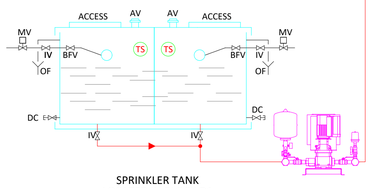
SPRINKLER TANK LOCATED IN SEMINARY BUILDING GROUND FLOOR



SPRINKLER TO SERVE BLOCK B1

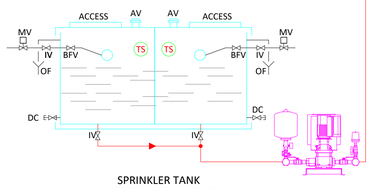
SPRINKLER TO SERVE BLOCKS B2, B3 AND C1

SPRINKLER TANK LOCATED IN BASEMENT BELOW BLOCK B2



SPRINKLER TO SERVE BLOCK D1

SPRINKLER TANK LOCATED IN BLOCK D1 GROUND FLOOR



SPRINKLER TO SERVE BLOCK C2

SPRINKLER TO SERVE BLOCK D2

SPRINKLER TANK LOCATED IN BASEMENT BELOW BLOCK D2

- FOR SETTING OUT REFER TO ARCHITECT'S DRAWINGS.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER ARCHITECTURAL AND ENGINEERING DRAWINGS AND ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
- DO NOT SCALE THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
- NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR STORED IN ANY RETRIEVAL SYSTEM OF ANY NATURE WITHOUT THE WRITTEN PERMISSION OF O'CONNOR SUTTON CRONIN AS COPYRIGHT HOLDER EXCEPT AS AGREED FOR USE ON THE PROJECT FOR WHICH THE DOCUMENT WAS ORIGINALLY ISSUED.

Rev No.	Date	Revision Note	Drn by	Chkd by
P01	05.01.21	PRELIMINARY ISSUE - SKETCH	DP	JMCG

Rev No.	Date	Revision Note	Drn by	Chkd by

40 Bowling Green Lane,
London, EC1R 0NE,
United Kingdom.

TEL +44 207 415 7120

e: ocsc@ocsc.co.uk
w: www.ocsc.co.uk

O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

Dublin | London | Belfast | Galway | Cork | Birmingham

Client: MULTI FAMILY ICAV
Project: CLONLIFFE LANDS

Title: MECHANICAL SERVICES
COLD WATER AND SPRINKLER SCHEMATIC
SITE WIDE

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
CLN	OCS	ZZ	ZZ	DR	M	0001		P01

Date: 05.01.20 Scale: N.T.S @ A1 Drn by: DP Chkd by: JMCG Aprvd by: ST

Barrett Mahony Consulting Engineers

Dublin:
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2,
D02 WR26, Ireland.
Tel: +353 1 677 3200

London:
12 Mill Street,
London, SE1 2AY,
United Kingdom
Tel: +44 203 750 3530.

Sofia:
19 Yakubitsa Street,
Lozenets,
Sofia 1164,
Bulgaria
Tel: +359 2 494 9772

WWW.BMCE.IE