KAVANAGH BURKE
CONSULTING ENGINEERS

Engineering Assessment and Surface Water Drainage Design Report

for

Residential Development

at

St. Edmunds Phase 3,
Palmerstown,
Dublin 20

Job No:	**D1621**
Client:	**Moykerr Limited**
Date:	**December 2021**
Local Authority:	**South Dublin County Council**
Revision:	**PL16 (10.12.2021)**

Contents:

1. Basis

1.0. Introduction

This drainage report relates to a proposed mixed-use development on a site in St. Edmunds, Palmerstown, Dublin 20. The proposed site is c. 2.06 ha in size or c. 2.72 ha, when including the SDCC lands located along the eastern edge of the site and parts of existing site to the west. This residential development consists of 4 no. apartment blocks ranging height from 2-9 storey comprising 313 residential units, a creche and amenity space. All the residential units will have associated private open space/ balconies/ terraces facing north/ south/ east/ west.

The development will include 214 no. car parking spaces, 5 motorcycle parking spaces and 378 no. bike parking spaces. The site is accessed through the existing vehicular access to the west, off the unnamed road to the west. There will be several pedestrian entrances along St. Loman's Road, the Fonthill Road (R113) and the unnamed road to the west. The upgrading and re-landscaping of 4,400sq.m of land to the east of the site in the ownership of South Dublin County Council.

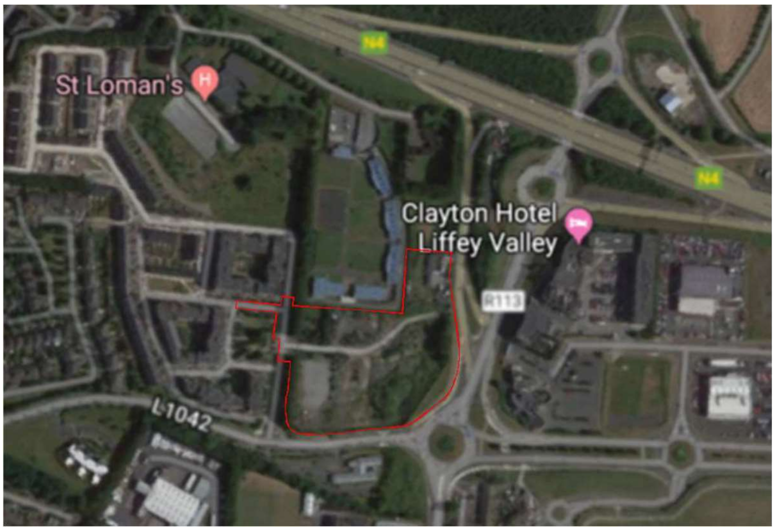
In addition to all of the new facilities all other site services and works to enable the development of the site will also be provided including site, bin stores, ESB substations, associated roadworks and services connections, a large quantity of public and communal open space, boundary treatment works and landscaping.

This engineering design package forms part of an overall planning submission for the proposed development.

1.1. Site

1.1.1. Site Location

The site is located south of the N4 Lucan Road, Dublin 20. It is bounded by an existing residential development at St Edmunds Estate to the West, St Loman's Road to the South, Fonthill Road to the East and an institutional development to the North adjacent to the Lucan Road.



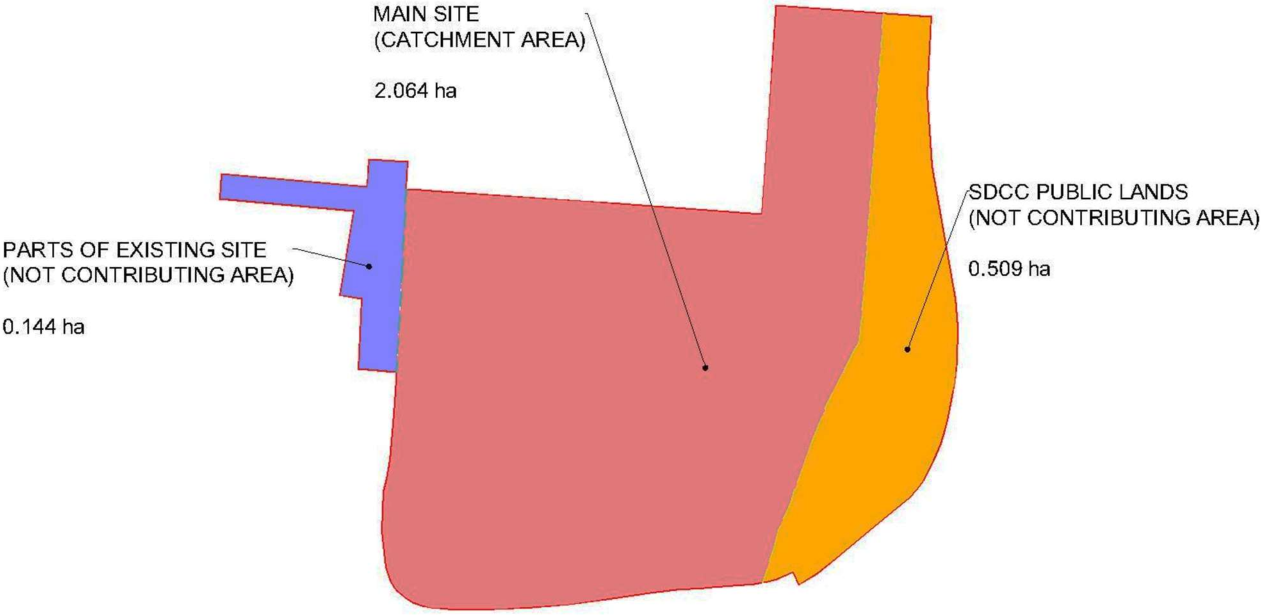
Picture 1 - Extent of subject

Map is extract of Google Maps for clarity of site location.

For further details of the proposed site layout please refer to Kavanagh Burke (KB) drawing Ref. D1621 D1 Drainage Layout Sheet 1 of 2 Rev PL15.

1.1.2. Site Description

The total area of the site is 2.06ha. In addition to same, there is c. 0.51ha of SDCC lands to the east, not included in the site (catchment) area, but forming part of the proposed development as a communal space/public open space; and c. 0.14ha of existing site to the west, neither included int the site (catchment are). The sum of all these areas is c. 2.72ha, which constitute the planning application extent. See scheme of areas show below:



Picture 2 – Schemes of areas

The topography of that portion of the land will be falling to the Fonthill Road; The existing ground elevations range from approximately 64.0m OD (Malin) in the eastern area of the site (SDCC portion of the land) to 61.40m OD (Malin) along the northeast boundary of the site.

The vehicular and main pedestrian access to the overall St. Edmund's Estate site is located on St Loman's Road and the access/egress to the subject site will be formed at the St Edmunds internal estate road – to the west site boundary.

1.1.3. Impact Comparison.

The development is an amendment to the one currently being undertaken on site, previously granted SHD proposal ABP 305857-19. This will provide an increase of 61 no. additional apartments.

Both the old and new site plans are similar in layout, building footprints, hardstanding and landscaping areas measurements. The main reason for the revised planning application, increase of the density of the development, was done by alteration of the building height and floor plans and not by change to the footprint of the buildings. Since the building footprints and road layouts remain unchanged the drainage areas, drainage and water supply networks and attenuation volumes remain as per granted planning application. Following consultations with South Dublin County Council minor alterations were done to the layout, type, and size of the proposed SUDS features. These changes include the following:

- Removal of swale running through the centre of South Dublin County Council Lands.
- Minor changes to the location of the bio-retention only, and bio-retention/tree pits areas.
- Review of submitted SuDS cross section and general details.

1.1.4. Ground Conditions

Ground investigations were undertaken by Causeway Geotech and a copy of that report is included in Appendix F. Section 7.3 of that report states that the infiltration tests for the site were abandoned due to insufficient infiltration on site. The report goes on to state that:

"…the tests are typical of those carried out in Dublin Boulder Clay which is generally an impermeable stratum. The low-permeability fine-grained soils are therefore considered to be poor infiltration media and would be deemed unsuitable for the implementation of infiltration drainage systems."

For this reason, the amount of actual infiltration on site will be minimum and this necessities' the need for an attenuation tank on site.

2. Existing Services

The existing surface water (SW) and foul sewer (FS) networks within the St. Edmund's Estate were built to service both the existing development and this subject site as shown on the enclosed KB drawings. The outfall location for both networks is via the exiting local authority SW and FS manholes located within the adjoining Mount Andrew Avenue Estate, as shown on the enclosed KB drawing ref. D1621 D2 Drainage Layout & Discharge Route Sheet 2 of 2 Rev PL13.

It is proposed to route the discharge from the subject site via the existing networks within the St Edmunds Estate to the outfall manholes located in Mount Andrew Avenue Estate.

The existing concrete attenuation tank serving the existing development at the St Edmunds Estate is located to the northwest of the proposed development, refer to the KB drawing D1621 D2 Drainage Layout & Discharge Route Sheet 2 of 2 Rev PL13 for its exact location.

The surface water discharge (restricted flow) from the proposed development will be directed through the existing St. Edmunds development storm water network and attenuation tank, prior to discharge into the local authority network.

The existing flow control device which has an allowable discharge of 13.6 l/sec. The allowable discharge from the proposed development is 4.28 l/sec as calculated in this report. It is proposed to replace the existing flow control device (13.6 l/sec) with an enlarged flow control unit with total discharge of 17.9 l/sec. The existing silt trap and petrol interceptor on the network has been assessed and the capacity of both have been found to be adequate.

The existing watermain connection to the public watermain network on Fonthill Road (R113) which serves the existing development will be retained. The existing watermain will be diverted to accommodate the proposed development as shown on our updated KB drawing D1621 D2 Drainage Layout & Discharge Route Sheet 2 of 2 Rev PL13.

3. Surface Water Drainage

3.1. SuDS Management Train

The treatment train approach was applied to both the storm water network and the attenuation design to ensure that both run-off quality and quantity are appropriately addressed. An array of techniques was used to fulfil requirements of each element of the treatment train:

- ✓ *Pollution prevention.*
  To prevent chemicals and other pollutants from contaminating the rainfall runoff, a maintenance regime for the proposed development will be established and it will include regular sweeping of the estate roads and collection of rubbish. Waste bins provided will be watertight and will incorporate lids to prevent the rainfall flushing the contaminants out of them. A proprietary silt trap and petrol interceptor will be provided on the surface water drainage network to intercept debris, silts and hydrocarbons and prevent them from entering the attenuation tank and from being discharged to the soil or receiving watercourse.

- ✓ *Source control*
  To detain and infiltrate the runoff as close as possible to the point of origin, we have included for the following:

  + Swales, bio-retention areas, carriageway runoff infiltration via tree pits and permeable paving are proposed at various locations across the site. Permeable paving with integrated infiltration pits below is proposed to all driveways and car parking spaces throughout the site. In case of the rainfall event exceeding the capacity of the infiltration pit, the runoff water will be allowed to discharge through a high-level drainage outfall connection to the storm water drain in the road.

  + The permeable paving will provide infiltration of the surface water into the angular stone filled infiltration pit below promoting water disposal at source and limiting the discharge to the SW network. Like above, where the rainfall event exceeding the capacity of the infiltration pit, runoff water will be allowed to discharge through a high-level drainage outfall connection to the storm water drain in the road.

- ✓ *Site control*
  The inclusion of SUDs devices around the site will provide a means for run-off to infiltrate into the ground across the site. That only once rainfall event exceeds the capacity of the infiltration devices will it flow into the storm water drain in the road and then into the proposed attenuation tank. This approach will inevitability reduce the quantity of water that discharges from the site.

- ✓ *Regional control*
  To mimic the behaviour of the green field site and protect the receiving watercourse, the attenuation tank is designed to cater for all durations of rainfall up to 30-year return period with 20% climate change factor applied. The attenuation system has also been designed to cater for 1 in 100-year storms of all durations exceeding the requirements of Greater Dublin Strategic Drainage Study (GDSDS). This 1 in 100-year temporary flood storage is accommodated in the sunken play space above the proposed attenuation tank.

3.2. Proposed Surface Water Strategy

The surface water runoff generated from the proposed development will be routed through a series of Sustainable Urban Drainage System (SuDS) elements which will facilitate the detention and infiltration at source. These devices include green roofs, bio-retention, permeable paving, swales, and carriageway runoff infiltration via tree pits, etc. Only once the rainfall has passed through these devices will the excess runoff enter the drainage network and then reach the underground attenuation system ("StormTech" or equivalent type).

The flow control device will be installed on the outfall to limit the runoff from this proposed development (to greenfield runoff rate) into the existing surface water network / attenuation tank serving the existing St Edmunds Estate.

For details of the proposed drainage areas extents, refer to the enclosed KB Drainage Layout drawing Ref. D1621 D1 Drainage Layout Sheet 1 of 2 Rev PL13.

3.3. Proposed SuDS elements to improve the quality and reduce run-off

3.3.1. Green Roof

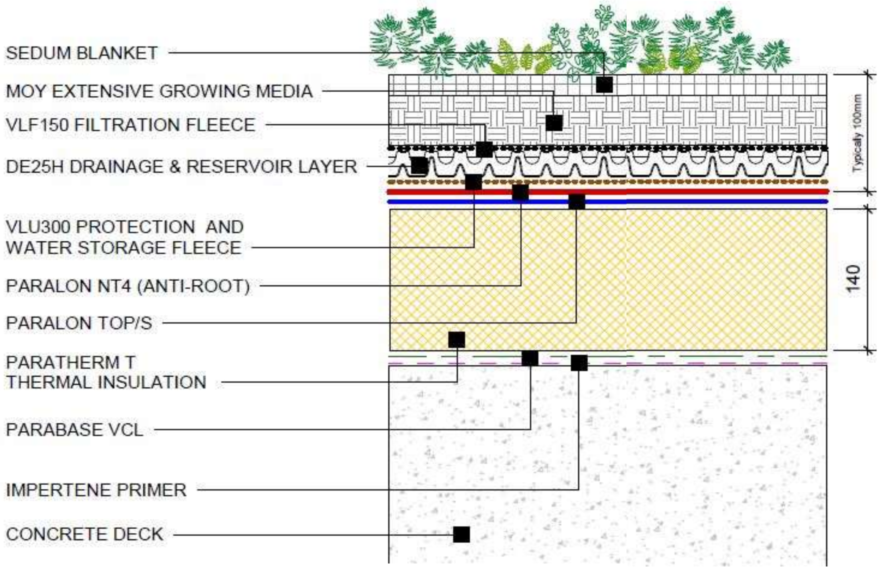
Sustainable drainage studies indicate that Green Roofs reduce annual run-off from roofs by at least 50%, and more usually by 60-70%. Moreover, the rate of release following heavy rainfall will be slower thus assisting with issues relating to storm surges. With an increasing need for developments to have limited water runoff, the UK's Environment Agency highlighted the use of green roofing in their May 2003 publication "Sustainable Drainage Systems (SUDS) – an introduction." Where achievable, it is proposed to use green roof for interception storage for smaller rainfall events.

Proposed sedum blanket type roof thickness varies form 25 – 45mm and it is installed on 50mm multilayer roof substrate composed of mineral bulk mixture with a proportion of mineral and organic matter. Maximum water capacity of the roof substrate layer is ≥35%.

Max Water Storage Capacity in the substrate of these equal: 4,804 m^2 x 50 mm x 35% = 84 m^3

It is proposed to use the green roof for interception storage for 5mm and smaller rainfall events. Max water capacity of the substrate is almost 2 times greater than the required interception storage which will limit the water runoff from consecutive rainfall events; since water from interception storage will not infiltrate to the subsoil but will be dealt with primarily by evaporation and to some extent used by the green roof plants.

Rainfall runoff from roofs can contain pollutants for example, from bird droppings and atmospheric pollution. As well, a standard roof covering such as bitumen will give off a range of pollutants under heat stress, which then are carried along with the runoff. One of the roles of a sustainable urban drainage system is to remove some if not all this pollution. Green roofs can retain and bind contaminants that fall on their surface either as dust or dissolved in rainwater. Research by (Johnston et al, 2004) found that 95% of heavy metals are removed from runoff by green roofs and nitrogen levels can be reduced.



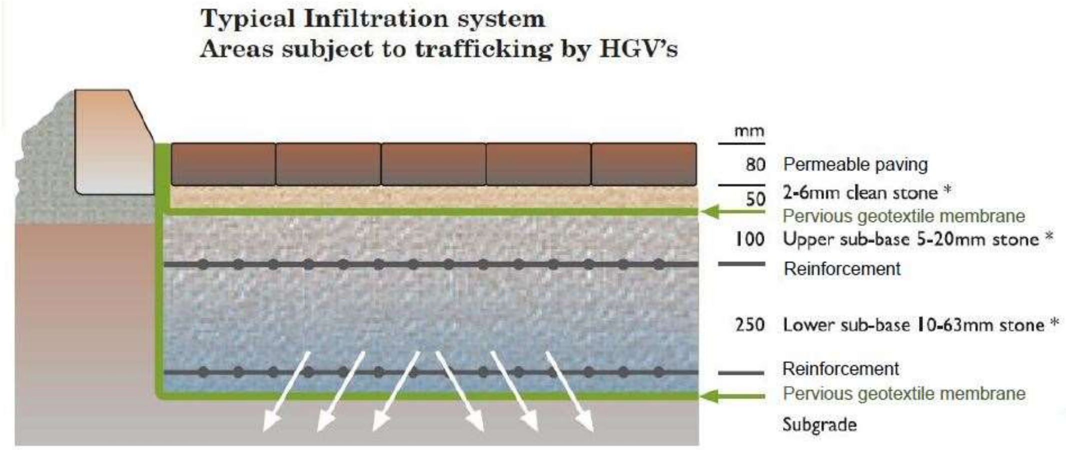
Picture 3 – Moy Materials Green Roof System Build-up (Concrete Deck).

3.3.2. Pervious Paving

Pervious paving is proposed to all car parking spaces on site and to all private driveways throughout the development allowing for infiltration of the storm water runoff from the permeable paving and from the roof of the property into underlying stone and soil. This device not only reduces the quantity of runoff, but it also has a positive impact on water quality.

Due to the shallow nature of the underlying build-up, permeable paving can be utilised even on sites with high ground water levels where other deeper infiltration devices would not work. According to CIRIA 697 SUDS Manual:" Pervious surfaces, together with their associated substructures, intercept surface water runoff and provide a pollutant treatment medium prior to discharge to receiving waters". Treatment processes that occur within the surface structure, the subsurface matrix (including soil layers where infiltration is allowed) and the geotextile layers include filtration, adsorption, biodegradation, sedimentation.

Permeable surfacing is not proposed to the carriageway due to Irish Water and Local Authority taking in charge requirements.



Picture 4 – Pervious paving schematic cross section

3.3.3. *Swales*

The grass lined swales will be used to convey run-off to allow for infiltration at source. This process will also trap pollutants and reduce runoff velocity. Pollutant removal is achieved by the channel vegetation, sub-soil matrix, and/or the infiltration into the underlying soils. Swales are particularly suitable for controlling run-off from small residential developments, parking areas and roads. As pervious paving, swales not only reduce the quantity of run-off, but it also has a positive impact on water quality.

The location of proposed swales within the proposed development is shown on the enclosed KB drawing D1621 D1 Drainage Layout Sheet 1 of 2 PL13.

3.3.4. *Silt Trap, Petro Interceptor, Attenuation Tank & Flow Control Device*

An underground surface water attenuation tank is proposed as the main runoff quantity reducing SuDS device. The attenuation facility proposed is a “StormTech” or equivalent. This proprietary system consists of thermoplastic arches backfilled in specified stone and wrapped in a pervious geotextile. Prior to entering the system, the surface water runoff will pass through a proprietary silt trap and petrol interceptor to ensure debris, silt particles and hydrocarbons are removed. Subsequently the surface runoff enters the attenuation facility through an “isolator row” whereby a row of void forming thermoplastic arches are wrapped in a pervious geotextile which provides a second level of suspended solid removal prior to the water entering the greater attenuation area. See Appendix C for details of the proposed silt trap and petrol interceptor.

These water quality control devices can be cleaned out by suction hose/tanker if required from standard maintenance inspection chambers. In the case of the isolator rows, debris can be jetted out and removed by suction hose/tanker.

The details of the surface water attenuation system including interceptor rows, flow restriction devices, volume and pipe designs are attached in this Drainage Design Report and on the accompanying KB drawing D1621 D1 Drainage Layout Sheet 1 of 2 PL13.

3.4. Proposed Surface Water Drainage Strategy for South Dublin County Council Lands

As noted in section 1 of this report, the proposed planning encompasses 0.54 ha of South Dublin County Council lands adjoining the proposed development along its eastern boundary. As part of the proposed works, it is proposed to landscape this section of ground.

While it is not proposed to direct any of the surface water runoff from this area into the surface water system within the proposed development; we have provided for swales and stone filled trenches in this area. This area will also have dense vegetation that will intercept the rainwater in this area. If there is excess water, same will be direct to the proposed swales and stone filled trenches located at lower levels. These devices will have storage capacity volumes exceeding the total runoff from a 1 in 100-year storm up to 6 hours duration from the 0.44 ha area.

- Calculated storm runoff from 1 in 100-year storm event = 112 m^3
  Volume = area x rain (mm) x CCF x Soil SPR
- Soil SPR value = 0.3
- Rainfall for 100-year return period for 6-hour duration event and 20% CCF = 70.4 mm
- Total Volume of swale and stone filled trenches in this area = 230 m^3.

As per the above calculations, the total calculated runoff for a 1 in 100-year storm of 6-hour duration is 112m^3, which is less than the total storage provided by the swales and stone filled trenches in this area. This runoff water will then infiltrate into the surrounding ground.

4. Surface Water Attenuation Calculation

4.1 Site Characteristics

Site Area	26,000 m^2 (2.6ha)
Landscaping within site boundary not contributing	5,355 m^2
Applicable Catchment Area	20,645 m^2 (2.065ha)
Landscaping - contributing (positively draining)	7,085 m^2
Green roofs	6,315 m^2
Roof area	2,275 m^2
Permeable paving (driveways and car parking)	2,145 m^2
Roads	1,900 m^2
Footpaths	1,105 m^2
Impermeable areas:	13,560 m^2

It should also be noted that the hardstanding areas include all permeable paving areas and green roofs. No reduction was applied to runoff from permeable paving and green roof. This approach is conservative, as the real runoff from these surfaces will be significantly reduced.

4.2 Interception Storage

Interception is the storage of the runoff from the first 5mm of rainfall on the developed area. For this calculation, only hardstanding areas are assumed to provide 80% runoff, and non-hardstanding areas are assumed to provide 0% runoff.

The equivalent volume of Interception Storage should be provided on site as no discharge from site should occur for this initial 5mm depth of rainfall. The Interception Storage within the proposed development will be provided via the indicated SUDs device on site, in particular the green roofs located across the proposed development.

Design Impermeable Areas: 13,560 m^2 x 0.8 = 10,848 m^2
Total volume for 5mm rainfall: 5mm x 10,848 m^2 = **54 m^3**

Note: As per the calculation in section 3.3.1, the max capacity of the green roofs is 84 m^3 and this exceeds the total volume for 5mm rainfall of 54m^3.

4.3 Green Field Run-Off Rate – QBAR (Mean Annual Flood Flow)

QBARrural (m^3/sec) = $0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

SAAR (E 3062300, N 234970): 781mm (from Met.ie climate data)

Soil Index: S1 (very low runoff); S2; S3 (moderate runoff); S4; S5 (very high runoff)

Soil = 0.1(Soil1) + 0.3(Soil2) + 0.37(Soil3) + 0.47(Soil4) + 0.53(Soil5)

As the site is relatively small in catchment terms, the soil class will be 100% Soil2 as per hydrological properties of the site (53°21'16"N 6°24'19"W) obtained from www.uksuds.com, refer to appendix C for additional details.

Soil Class:	Soil2
Runoff Potential:	Low
Soil Value:	0.3

QBAR:
As the site area is less than 50 hectares, QBAR for 50 hectares is firstly calculated:
QBAR (m3/sec) = $0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$
$0.00108 \times (0.5)^{0.89} \times (781)^{1.17} \times (0.3)^{2.17}$
103.6 l/sec
2.07 l/sec/ha

QBAR for the smaller area (i.e. the subject site catchment area):

2.07 l/sec/ha 2.0645ha = 4.28 l/sec

QBAR = **4.28 l/sec**

(ALLOWABLE DISCHARGE based on peak flood flow for a 2-year return or 2 l/sec/ha, whichever is greater), 2 l/sec/ha x 2.0645 ha = 4.13 l/sec, therefore QBAR value of 4.28 l/sec applies.

According to GDSDS chapter 6.3.1.4, if the separate long-term storage cannot be provided and temporary flood storage forms part of the single attenuation system, all the runoff from the site should be discharged at either a rate of 2.0 l/s/ha or the average annual peak flow rate QBAR, whichever is greater.

Therefore, allowable discharge (QBAR) will be set at **4.28 l/sec**.

4.4 Attenuation Storage Volume

Refer to Appendix A for detailed storm water network modelling and attenuation storage volume check with a specific Hydrobrake flow control device included.

4.5 Temporary Flood Storage

The proposed attenuation storage will accommodate all rainfall events of all durations up to 1 in 100 years return. Therefore, no separate flood storage is needed.

In summary:

- Interception Storage: 54 m^3
  To be provided by green roofs.
- Required Attenuation Volume: 989 m^3
  To be provided within the attenuation system on site.
- Temporary Flood Storage: consider within Flow storm volume storage calculations.

(Refer to StormTech Cumulative Storages spreadsheet at Appendix C)

5. Storm Water Network Calculation

The storm water drainage network and attenuation were designed in Flow drainage design software. Department of the Environment publication "Recommendations for Site Development Works for Housing Areas" recommends the "Storm Return Periods" for the Design of drainage pipework (within table 3.1 of this DOE document). For sites with average surface gradient greater than 1%, it is recommended to use 1 years return period; however more conservative 2 years return period and 50mm/h rainfall intensity was used for initial pipe sizing calculations.

The M5-60 rainfall intensity figure for the Irish Grid coordinates (306230, 234970) of the subject site, according to MET Eireann, equals 16.5mm. Climate change factor of 20% was applied to all rainfall intensities for Flow storm water network calculations. For detailed calculations of the storm water network flow capacities and sizes refer to the Appendix A.

The following figures synopsise the surface water attenuation calculations:

Table 1 – Figures for Surface Water Attenuation Calculations

SITE AREA	20,645 m^2 (2.065 ha)
SAAR	781
SOIL VALUE	0.30

STRUCTURE TYPE	**AREA (ha)**	**RUNOFF COEFFICIENTS**
Buildings	0.228	0.8
Green Roof (if any)	0.614	0.8
Roads	0.119	0.8
Pathways	0.111	0.8
Permeable paving	0.215	0.8
Grass	0.709	0.3
TOTAL	2.065	

The proposed system is designed to attenuate a 1 in 30-year storm event of any duration (plus 20% CCF); therefore, no flooding will occur on site for any duration events up to a 30-year return period as per the GDSDS requirements. In addition to the attenuation volume, temporary flood storage is provided (as part of the attenuation system) for a 100-year return events of up to 6 hours duration (plus 10% CCF) within the sunken play space directly above the attenuation tank. This approach also provides for 1 in 100-year run-off detention and infiltration in this area prior to same draining back into the surface water drainage system. All flows for the storm water network design and the attenuation volume were calculated with the 20% climate change factor applied for all rainfall intensities, greater than as per chapter 6.3.2.4 of GDSDS table 6.2 "Climate Change Factors".

Following the pipe for 1- and 2-year return events, the network was analysed for storms of all durations up to 1 in 100 years return. No surface or building flooding was recorded during this analysis.

6. Foul Sewer

6.1 Site Area

A new foul sewer has been designed to collect discharge from the proposed development and then discharge it to the existing foul sewer network within the St Edmunds Estate. A connection to the existing St Edmunds Estate foul sewage drainage network is proposed west of the subject site boundary, where the existing pipe network currently begins as shown on the KB drawing ref. D1621 D1 Drainage Layout Sheet 1 of 2 Rev PL13.

The foul network for the proposed development is modelled in Flow design software based on the fixture unit method that considers the probability of simultaneous discharge from different fixtures and translates it to the design flow as set out in EN752 "Drain and Sewer Systems Outside Buildings - Sewer System Management". Calculation of the discharge units per Blocks is enclosed within this Drainage Report.

The car parking area drainage at the ground floor level of the Block 1 will be collected through a number of designated road gullies where it is subsequently discharged to the foul sewer through a proprietary petrol interceptor. Discharge to the foul sewer for such surface water runoff is confined to this defined area (as detailed on the enclosed KB Drainage Layout, drawing No. D1621 D1 Drainage Layout Sheet 1 of 2 Rev PL13). All other surface water runoff from the building roofs or roads will be directed to the on-site surface water attenuation system incorporating proprietary filters as mentioned above in this document. All waste from the WC's and other sanitary fittings will discharge from site without passing through the foul interceptor noted above.

For detailed calculations of the foul network flow capacities and sizes and discharge units for proposed development, refer to the Appendix B.

As per requirements of the Irish Water Code of Practice min velocities of 0.75 m/s are met for the proposed gradients and contributing dwelling numbers (refer to calculation sheet in Appendix A for details). The proposed foul sewer including manholes and service connections will be constructed in compliance with design standards set out by Irish Water in the IW Code of Practice for Wastewater Infrastructure and Wastewater Infrastructure Standard Details.

6.2 Larger St. Edmund's Site – Confirmation of foul capacity

The proposed development of 313 dwellings will discharge to a 225mm diameter foul pipe which forms part of the existing foul network for the larger St. Edmunds campus. The minimum gradient for a 225mm diameter pipe within the larger campus which consists of a total of 573 number residential properties is 1 in 200. The aforementioned 225mm diameter pipe then merges downstream with another branch of the foul sewer network serving the adjacent St. Loman's Hospital and Ballydowd High Support Special School. Where the pipes combine, the pipe size increases to a 300mm diameter pipe which has a minimum gradient of 1 in 243.

- 225mm pipe: The capacity of 225mm diameter pipe at 1 in 200 gradient is 32 l/s (with roughness factor k=1.5mm).
- 300mm pipe: The capacity of 300mm diameter pipe at 1 in 243 gradient is 63 l/s (with roughness factor k=1.5mm).

The total number of existing and proposed dwellings served by a single 225mm diameter branch pipe is 886.

By using the Irish Water figures of 150 l/person/day with additional 10% flow from infiltration and an average occupancy factor of 2.7 person/dwelling; the total daily discharge will be 446 l/day/dwelling.

The population in the whole development of 886 houses based on average 2.7 person/dwelling will be approximated as P = 2,395 people.

Based on the calculation method from Appendix C of Irish Water Code of Practice for Wastewater Infrastructure Ref. IW-CDS-5030-03 Chapter 1.2.5; the peaking factor for the development of this size is equal Pfdom = 3.

Therefore, the design foul flow from the existing and proposed development together can be calculated as:

Pfdom x P x I x G = 3 x 2,395 x 1.1 x 150 = 1,185,525 l/day = 13.72 l/s

Where:

- P is population,
- I is infiltration 10%,
- G is water consumption per capita.

Based on above, the existing network where the lowest pipe capacity (for 225mm diameter pipe at 1in 200) is 32 l/s will have sufficient capacity to carry the flows from the existing and proposed development combined. The existing foul network capacity is greater than the calculated design flow even in the event of the maximum peaking factor Pfdom=6.

The 300mm diameter downstream pipe at 1 in 243 gradient has 63 l/s capacity. This 63 l/s capacity exceeds the calculated design flow by ca. 50 l/s; therefore, it has sufficient capacity to carry additional flow from the existing and proposed St. Edmunds development, the Ballydowd High Support Special School, and a possible additional discharge from future connection from the hospital. To illustrate the fact that there is sufficient capacity within the foul network we performed capacity check for 1,200 No. hospital patients and 2000 No. school students/staff: 90 l/person/day discharge from school with canteen and a 450 l/person/day discharge from the St. Loman's Hospital were used (as per IW code of Practice table of Flow Rates for Design) with peaking factor Pf = 6;

- Peak discharge from school from assumed 2000-person school:
  2000p x 90 l/p/day x 6 (peak factor) = 1,080,000 l/day = 12.5 l/s
- Peak discharge from future hospital connection (assuming 1,200 No. beds for comparison purposes):
  1200p x 450 l/p/day x 6 (peak factor) = 3,240,000 l/day = 37.5 l/s
- Total peak discharge - 12.5 l/s + 37.5 l/s = 50 l/s

The above demonstrates that, based on the Irish Water Flow Rates for Design, additional flow from 1,200 patient's hospital and a 2,000-person school to would be necessary to fully utilise this 50 l/s spare capacity.

Neither the Ballydowd High Support Special School or the St Loman's Hospital have numbers anywhere near the numbers used in the capacity check above therefore we are satisfied that the existing foul infrastructure serving the existing site has capacity for both current and proposed users.

7. Watermain

The water supply to the new development is proposed by connecting to the diverted water main within the proposed development site. There is currently an existing watermain passing through the site to the north; it is proposed to divert the watermain as shown on the enclosed KB drawing ref. D1621 D3 Watermain Layout & Swept Paths PL13. The existing watermain pipe is 160mm diameter and it is proposed to retain this sized diameter pipe. The 160mm diameter watermain serving the proposed development will be provided with adequate water meters, sluice valves and fire hydrants to provide water supply and for firefighting purposes (Hydrant locations to be within min. 6m & max. 46m from the proposed buildings) as shown on the accompanying KB Watermain Layout drawing Ref. D1621 D3 Watermain Layout & Swept Paths PL13. All watermain details will be accordance with IW Water Infrastructure Standard Details.

Guidelines set out in the Irish Water Publications IW-CDS_5020-1 & IW-CDS-5030-1 have been consulted and adopted within the design of the proposed drainage & watermain networks.

8. Flood Risk Assessment

The subject site is located within Flood Zone C where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river & coasted flooding). In CFRAM mapping Flood Zone C covers all areas of the Flood Risk Management Plan which are not in zones A&B (the higher risk areas). Therefore, the site is at minimal risk of flooding and is remote from mapped flood areas as shown on the enclosed CFRAM Map enclosed in Appendix E.

APPENDIX A

Surface Water Network Design

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	200.0
Additional Flow (%)	20	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	16.500	Minimum Backdrop Height (m)	3.000
Ratio-R	0.276	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	x
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.077	5.00	62.280	1200	306301.822	235068.183	1.405
2	0.223	5.00	62.150	1200	306280.505	235069.556	1.460
3	0.034	5.00	62.170	1200	306275.571	234991.100	1.980
4	0.191	5.00	62.000	1200	306197.374	234922.719	1.300
5	0.081	5.00	62.000	1200	306229.704	234920.574	1.440
6	0.060	5.00	62.000	1200	306248.177	234924.609	1.510
7	0.262	5.00	62.000	1200	306199.582	234952.040	1.300
8	0.088	5.00	62.000	1200	306258.508	234948.597	1.675
9	0.056	5.00	62.080	1200	306260.545	234978.057	2.065
10	0.060	5.00	62.000	1200	306163.342	234900.998	1.425
11			61.460	1200	306168.303	234983.714	1.610
11B	0.016	5.00	61.300	1200	306162.993	234983.846	1.410
12	0.150	5.00	61.720	1200	306173.313	235019.419	1.425
13	0.115	5.00	61.520	1200	306171.062	234983.617	1.790
14			61.930	1200	306234.562	234979.465	2.610
15	0.195	5.00	61.320	1200	306235.079	234990.162	2.620
16			61.320	1200	306227.520	234989.127	2.670
17			61.200	1200	306221.963	234981.673	2.590
18			60.880	1200	306146.066	234986.305	2.610
19			60.550	1200	306146.332	234996.965	2.330
S7a			60.810	1200	306138.121	234998.414	2.630

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	21.361	0.600	60.875	60.765	0.110	194.2	225	5.38	46.6
1.001	2	3	78.611	0.600	60.690	60.190	0.500	157.2	300	6.43	43.4
1.002	3	9	19.897	0.600	60.190	60.090	0.100	199.0	300	6.73	42.6
2.000	4	5	32.401	0.600	60.700	60.560	0.140	231.4	300	5.52	46.1
2.001	5	6	18.909	0.600	60.560	60.490	0.070	270.1	300	5.86	45.1

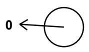
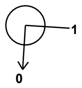
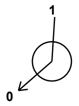
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)
1.000	0.935	37.2	11.7	1.180	1.160	0.077	0.0	87
1.001	1.251	88.4	42.4	1.160	1.680	0.300	0.0	146
1.002	1.111	78.5	46.3	1.680	1.690	0.334	0.0	166
2.000	1.029	72.7	28.6	1.000	1.140	0.191	0.0	130
2.001	0.952	67.3	39.9	1.140	1.210	0.272	0.0	167

Links

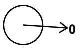
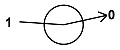
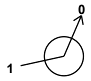
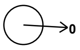
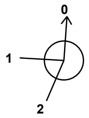
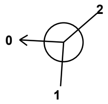
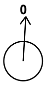
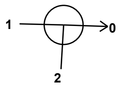
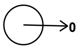
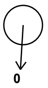
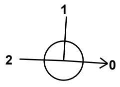
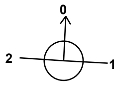
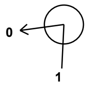
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.002	6	8	26.118	0.600	60.490	60.400	0.090	290.2	300	6.33	43.7
3.000	7	8	59.027	0.600	60.700	60.400	0.300	196.8	300	5.88	45.0
2.003	8	9	29.530	0.600	60.325	60.095	0.230	128.4	375	6.64	42.9
1.003	9	14	26.021	0.600	60.015	59.715	0.300	86.7	375	6.95	42.0
4.000	10	11	82.865	0.600	60.575	59.850	0.725	114.3	225	6.13	44.3
4.001	11	13	2.761	0.600	59.850	59.805	0.045	61.3	225	6.16	44.2
5.000	12	13	35.873	0.600	60.295	59.805	0.490	73.2	225	5.39	46.5
6.000	11B	11	5.312	1.500	59.890	59.850	0.040	132.8	225	5.09	47.6
4.002	13	14	63.636	0.600	59.730	59.470	0.260	244.8	300	7.22	41.4
1.004	14	15	10.710	0.600	59.320	59.270	0.050	214.2	450	7.35	41.1
1.005	16	17	9.000	0.600	58.650	58.610	0.040	225.0	225	7.58	40.5
1.007	17	18	76.038	0.600	58.610	58.270	0.340	223.6	225	9.04	37.4
1.008	18	19	10.663	0.600	58.270	58.220	0.050	213.3	225	9.24	37.1
1.009	19	S7a	8.338	0.600	58.220	58.180	0.040	208.4	225	9.39	36.8
Tank	15	16	7.630	0.600	58.700	58.650	0.050	152.6	600	7.41	40.9

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)
2.002	0.918	64.9	47.2	1.210	1.300	0.332	0.0	190
3.000	1.117	79.0	38.3	1.000	1.300	0.262	0.0	147
2.003	1.597	176.4	95.0	1.300	1.610	0.682	0.0	196
1.003	1.946	214.9	146.6	1.690	1.840	1.072	0.0	228
4.000	1.222	48.6	8.6	1.200	1.385	0.060	0.0	64
4.001	1.672	66.5	10.9	1.385	1.490	0.076	0.0	61
5.000	1.530	60.8	22.7	1.200	1.490	0.150	0.0	95
6.000	0.995	39.6	2.5	1.185	1.385	0.016	0.0	38
4.002	1.000	70.7	45.8	1.490	2.160	0.341	0.0	176
1.004	1.385	220.3	188.7	2.160	1.600	1.413	0.0	322
1.005	0.867	34.5	211.8	2.445	2.365	1.608	0.0	225
1.007	0.870	34.6	195.8	2.365	2.385	1.608	0.0	225
1.008	0.891	35.4	193.9	2.385	2.105	1.608	0.0	225
1.009	0.902	35.8	192.4	2.105	2.405	1.608	0.0	225
Tank	1.969	556.6	214.0	2.020	2.070	1.608	0.0	258

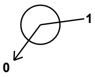
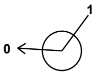
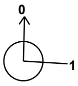
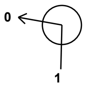
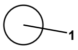
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	306301.822	235068.183	62.280	1.405	1200		0	1.000	60.875	225
2	306280.505	235069.556	62.150	1.460	1200		1	1.000	60.765	225
							0	1.001	60.690	300
3	306275.571	234991.100	62.170	1.980	1200		1	1.001	60.190	300
							0	1.002	60.190	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
4	306197.374	234922.719	62.000	1.300	1200					
							0	2.000	60.700	300
5	306229.704	234920.574	62.000	1.440	1200		1	2.000	60.560	300
							0	2.001	60.560	300
6	306248.177	234924.609	62.000	1.510	1200		1	2.001	60.490	300
							0	2.002	60.490	300
7	306199.582	234952.040	62.000	1.300	1200					
							0	3.000	60.700	300
8	306258.508	234948.597	62.000	1.675	1200		1	3.000	60.400	300
							2	2.002	60.400	300
							0	2.003	60.325	375
9	306260.545	234978.057	62.080	2.065	1200		1	2.003	60.095	375
							2	1.002	60.090	300
							0	1.003	60.015	375
10	306163.342	234900.998	62.000	1.425	1200					
							0	4.000	60.575	225
11	306168.303	234983.714	61.460	1.610	1200		1	6.000	59.850	225
							2	4.000	59.850	225
							0	4.001	59.850	225
11B	306162.993	234983.846	61.300	1.410	1200					
							0	6.000	59.890	225
12	306173.313	235019.419	61.720	1.425	1200					
							0	5.000	60.295	225
13	306171.062	234983.617	61.520	1.790	1200		1	5.000	59.805	225
							2	4.001	59.805	225
							0	4.002	59.730	300
14	306234.562	234979.465	61.930	2.610	1200		1	1.003	59.715	375
							2	4.002	59.470	300
							0	1.004	59.320	450
15	306235.079	234990.162	61.320	2.620	1200		1	1.004	59.270	450
							0	Tank	58.700	600

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
16	306227.520	234989.127	61.320	2.670	1200		1	Tank	58.650	600
							0	1.005	58.650	225
17	306221.963	234981.673	61.200	2.590	1200		1	1.005	58.610	225
							0	1.007	58.610	225
18	306146.066	234986.305	60.880	2.610	1200		1	1.007	58.270	225
							0	1.008	58.270	225
19	306146.332	234996.965	60.550	2.330	1200		1	1.008	58.220	225
							0	1.009	58.220	225
S7a	306138.121	234998.414	60.810	2.630	1200		1	1.009	58.180	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	Scotland and Ireland	Skip Steady State	✓
M5-60 (mm)	16.500	Drain Down Time (mins)	240
Ratio-R	0.276	Additional Storage (m³/ha)	25.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node 16 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	58.650	Product Number	CTL-SHE-0084-4300-2050-4300
Design Depth (m)	2.050	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	4.3	Min Node Diameter (mm)	1200

Node 16 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	58.650
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	480.0	0.0	2.061	0.1	0.0	2.570	667.0	0.0
2.060	480.0	0.0	2.560	0.1	0.0			

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 15 minute summer	235.969	66.771	100 year +20% CC 15 minute summer	305.953	86.574
30 year +20% CC 15 minute winter	165.592	66.771	100 year +20% CC 15 minute winter	214.704	86.574
30 year +20% CC 30 minute summer	162.138	45.879	100 year +20% CC 30 minute summer	211.652	59.890
30 year +20% CC 30 minute winter	113.781	45.879	100 year +20% CC 30 minute winter	148.528	59.890
30 year +20% CC 60 minute summer	113.289	29.939	100 year +20% CC 60 minute summer	147.199	38.900
30 year +20% CC 60 minute winter	75.266	29.939	100 year +20% CC 60 minute winter	97.795	38.900
30 year +20% CC 120 minute summer	72.122	19.060	100 year +20% CC 120 minute summer	92.945	24.563
30 year +20% CC 120 minute winter	47.916	19.060	100 year +20% CC 120 minute winter	61.750	24.563
30 year +20% CC 180 minute summer	56.455	14.528	100 year +20% CC 180 minute summer	72.306	18.607
30 year +20% CC 180 minute winter	36.697	14.528	100 year +20% CC 180 minute winter	47.001	18.607
30 year +20% CC 240 minute summer	45.270	11.964	100 year +20% CC 240 minute summer	57.724	15.255
30 year +20% CC 240 minute winter	30.076	11.964	100 year +20% CC 240 minute winter	38.351	15.255
30 year +20% CC 360 minute summer	35.272	9.077	100 year +20% CC 360 minute summer	44.666	11.494
30 year +20% CC 360 minute winter	22.928	9.077	100 year +20% CC 360 minute winter	29.034	11.494
30 year +20% CC 480 minute summer	28.203	7.453	100 year +20% CC 480 minute summer	35.532	9.390
30 year +20% CC 480 minute winter	18.737	7.453	100 year +20% CC 480 minute winter	23.607	9.390
30 year +20% CC 600 minute summer	23.375	6.394	100 year +20% CC 600 minute summer	29.330	8.023
30 year +20% CC 600 minute winter	15.971	6.394	100 year +20% CC 600 minute winter	20.040	8.023
30 year +20% CC 720 minute summer	21.042	5.639	100 year +20% CC 720 minute summer	26.313	7.052
30 year +20% CC 720 minute winter	14.141	5.639	100 year +20% CC 720 minute winter	17.684	7.052
30 year +20% CC 960 minute summer	17.563	4.625	100 year +20% CC 960 minute summer	21.844	5.752
30 year +20% CC 960 minute winter	11.634	4.625	100 year +20% CC 960 minute winter	14.470	5.752
30 year +20% CC 1440 minute summer	13.042	3.496	100 year +20% CC 1440 minute summer	16.100	4.315
30 year +20% CC 1440 minute winter	8.765	3.496	100 year +20% CC 1440 minute winter	10.820	4.315
30 year +20% CC 2160 minute summer	9.556	2.641	100 year +20% CC 2160 minute summer	11.706	3.235
30 year +20% CC 2160 minute winter	6.584	2.641	100 year +20% CC 2160 minute winter	8.066	3.235
30 year +20% CC 2880 minute summer	8.070	2.163	100 year +20% CC 2880 minute summer	9.830	2.634
30 year +20% CC 2880 minute winter	5.424	2.163	100 year +20% CC 2880 minute winter	6.606	2.634
30 year +20% CC 4320 minute summer	6.239	1.631	100 year +20% CC 4320 minute summer	7.533	1.970
30 year +20% CC 4320 minute winter	4.108	1.631	100 year +20% CC 4320 minute winter	4.961	1.970
30 year +20% CC 5760 minute summer	5.213	1.334	100 year +20% CC 5760 minute summer	6.255	1.601
30 year +20% CC 5760 minute winter	3.374	1.334	100 year +20% CC 5760 minute winter	4.048	1.601
30 year +20% CC 7200 minute summer	4.476	1.142	100 year +20% CC 7200 minute summer	5.343	1.363
30 year +20% CC 7200 minute winter	2.889	1.142	100 year +20% CC 7200 minute winter	3.449	1.363

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	61.166	0.291	23.4	0.7290	0.0000	SURCHARGED
15 minute winter	2	12	61.137	0.447	91.0	2.2104	0.0000	SURCHARGED
15 minute winter	3	12	60.774	0.584	86.4	0.9126	0.0000	SURCHARGED
15 minute winter	4	12	61.229	0.529	57.9	2.5344	0.0000	SURCHARGED
15 minute winter	5	12	61.160	0.600	72.1	1.5274	0.0000	SURCHARGED
15 minute winter	6	12	61.070	0.580	80.8	1.2309	0.0000	SURCHARGED
15 minute winter	7	12	61.120	0.420	79.5	2.5873	0.0000	SURCHARGED
15 minute winter	8	12	60.896	0.571	165.8	1.3977	0.0000	SURCHARGED
15 minute winter	9	12	60.635	0.620	257.5	1.1221	0.0000	SURCHARGED
15 minute winter	10	11	60.668	0.093	18.2	0.2025	0.0000	OK
2880 minute winter	11	2340	60.432	0.582	1.0	0.6578	0.0000	SURCHARGED
2880 minute winter	11B	2340	60.432	0.542	0.2	0.7665	0.0000	SURCHARGED
15 minute winter	12	12	60.478	0.183	45.6	0.6875	0.0000	OK
2880 minute winter	13	2280	60.432	0.702	4.4	1.9168	0.0000	SURCHARGED
2880 minute winter	14	2340	60.432	1.112	17.9	1.2572	0.0000	SURCHARGED
2880 minute winter	15	2280	60.432	1.732	20.0	5.1877	0.0000	SURCHARGED
2880 minute winter	16	2280	60.432	1.782	59.7	857.1482	0.0000	SURCHARGED
2880 minute winter	17	2340	58.661	0.051	4.0	0.0582	0.0000	OK
2880 minute winter	18	2340	58.323	0.053	4.0	0.0600	0.0000	OK
2880 minute winter	19	2340	58.273	0.053	4.0	0.0600	0.0000	OK
2880 minute winter	S7a	2340	58.230	0.050	4.0	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 winter	1	1.000	2	23.3	0.842	0.628	0.8495	
15 minute winter	2	1.001	3	76.6	1.256	0.866	5.5357	
15 minute winter	3	1.002	9	79.4	1.127	1.011	1.4011	
15 minute winter	4	2.000	5	48.8	0.826	0.671	2.2817	
15 minute winter	5	2.001	6	65.4	0.929	0.973	1.3316	
15 minute winter	6	2.002	8	79.8	1.150	1.230	1.8392	
15 minute winter	7	3.000	8	72.5	1.191	0.918	4.1566	
15 minute winter	8	2.003	9	164.8	1.622	0.934	3.2571	
15 minute winter	9	1.003	14	257.6	2.336	1.198	2.8288	
15 minute winter	10	4.000	11	17.5	0.910	0.361	2.2864	
2880 minute winter	11	4.001	13	1.0	0.591	0.015	0.1098	
2880 minute winter	11B	6.000	11	0.2	0.180	0.006	0.2113	
15 minute winter	12	5.000	13	44.2	1.376	0.727	1.3329	
2880 minute winter	13	4.002	14	4.4	0.560	0.062	4.4812	
2880 minute winter	14	1.004	15	17.5	0.791	0.079	1.6969	
2880 minute winter	15	Tank	16	59.7	0.779	0.107	2.1492	
2880 minute winter	16	Hydro-Brake®	17	4.0				
2880 minute winter	17	1.007	18	4.0	0.576	0.116	0.5301	
2880 minute winter	18	1.008	19	4.0	0.564	0.113	0.0760	
2880 minute winter	19	1.009	S7a	4.0	0.584	0.112	0.0574	588.2

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	1	12	61.783	0.908	30.3	2.2699	0.0000	SURCHARGED
15 minute winter	2	12	61.731	1.041	109.0	5.1497	0.0000	SURCHARGED
2160 minute winter	3	2040	61.295	1.105	6.2	1.7276	0.0000	SURCHARGED
15 minute winter	4	12	61.828	1.128	75.0	5.4097	0.0000	FLOOD RISK
15 minute winter	5	12	61.727	1.167	83.6	2.9722	0.0000	FLOOD RISK
15 minute winter	6	12	61.594	1.104	97.5	2.3453	0.0000	SURCHARGED
15 minute winter	7	12	61.691	0.991	103.0	6.1061	0.0000	SURCHARGED
15 minute winter	8	12	61.339	1.014	203.6	2.4811	0.0000	SURCHARGED
2160 minute winter	9	2040	61.295	1.280	20.1	2.3186	0.0000	SURCHARGED
2160 minute winter	10	2040	61.295	0.720	1.1	1.5731	0.0000	SURCHARGED
2160 minute winter	11	2040	61.295	1.445	1.7	1.6344	0.0000	FLOOD RISK
2160 minute winter	11B	2040	61.295	1.405	0.3	1.9882	0.0000	FLOOD RISK
2160 minute winter	12	2040	61.295	1.000	2.8	3.7641	0.0000	SURCHARGED
2160 minute winter	13	2040	61.295	1.565	6.4	4.2760	0.0000	FLOOD RISK
2160 minute winter	14	2040	61.295	1.975	25.8	2.2339	0.0000	SURCHARGED
2160 minute winter	15	2040	61.295	2.595	29.1	7.7751	0.0000	FLOOD RISK
2160 minute winter	16	2040	61.295	2.645	28.9	1045.5380	0.0000	FLOOD RISK
2160 minute winter	17	2040	58.666	0.056	4.8	0.0638	0.0000	OK
2160 minute winter	18	2040	58.328	0.058	4.8	0.0661	0.0000	OK
2160 minute winter	19	2040	58.278	0.058	4.8	0.0661	0.0000	OK
2160 minute winter	S7a	2040	58.235	0.055	4.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute winter	1	1.000	2	24.6	0.838	0.662	0.8495	
15 minute winter	2	1.001	3	89.2	1.267	1.009	5.5357	
2160 minute winter	3	1.002	9	6.2	0.662	0.079	1.4011	
15 minute winter	4	2.000	5	55.5	0.825	0.764	2.2817	
15 minute winter	5	2.001	6	79.4	1.128	1.180	1.3316	
15 minute winter	6	2.002	8	97.6	1.387	1.505	1.8392	
15 minute winter	7	3.000	8	80.1	1.191	1.014	4.1566	
15 minute winter	8	2.003	9	203.0	1.840	1.151	3.2571	
2160 minute winter	9	1.003	14	20.1	1.196	0.094	2.8700	
2160 minute winter	10	4.000	11	1.1	0.497	0.023	3.2956	
2160 minute winter	11	4.001	13	1.4	0.647	0.021	0.1098	
2160 minute winter	11B	6.000	11	0.6	0.193	0.015	0.2113	
2160 minute winter	12	5.000	13	2.8	0.781	0.046	1.4267	
2160 minute winter	13	4.002	14	6.0	0.605	0.085	4.4812	
2160 minute winter	14	1.004	15	25.4	0.837	0.115	1.6969	
2160 minute winter	15	Tank	16	28.9	0.828	0.052	2.1492	
2160 minute winter	16	Hydro-Brake®	17	4.8				
2160 minute winter	17	1.007	18	4.8	0.606	0.140	0.6063	
2160 minute winter	18	1.008	19	4.8	0.591	0.136	0.0871	
2160 minute winter	19	1.009	S7a	4.8	0.614	0.135	0.0656	515.4

APPENDIX B

Foul Sewer Network Design

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	2680	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	3.000
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	x

Nodes

Name	Units	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
2	140.0	62.150	Storm MH	306281.085	235059.280	1.450
3	170.0	62.150	Storm MH	306276.612	234989.594	2.465
4	150.0	62.100	Storm MH	306273.458	234909.787	1.425
5	100.0	62.100	Storm MH	306277.387	234927.757	1.625
6		62.100	Storm MH	306295.915	234968.962	1.965
7		62.150	Storm MH	306272.591	234986.087	2.515
8	150.0	62.000	Storm MH	306199.410	234920.867	1.275
9	100.0	62.000	Storm MH	306228.853	234918.947	1.575
10	100.0	62.000	Storm MH	306249.095	234923.136	1.785
11	275.0	62.000	Storm MH	306204.031	234953.104	1.515
12		62.000	Storm MH	306260.050	234949.647	2.085
14		62.110	Storm MH	306261.655	234976.549	2.565
15	80.0	61.730	Storm MH	306174.772	235022.204	1.730
16		61.470	Storm MH	306172.320	234982.285	2.375
17	150.0	62.100	Storm MH	306261.535	234902.877	1.425
18		62.100	Storm MH	306238.024	234900.560	1.785
19		62.100	Storm MH	306208.204	234896.109	2.085
20	150.0	62.000	Storm MH	306162.214	234899.196	2.385
21		61.250	Storm MH	306167.019	234982.652	2.185
22		60.880	Storm MH	306144.555	234985.237	1.930
23		60.700	Storm MH	306145.873	235026.101	1.960
23_OUT		60.950	Storm MH	306098.843	235030.563	2.450

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.001	2	3	69.829	1.500	60.700	59.685	1.015	68.8	225
1.002	3	7	5.335	1.500	59.685	59.635	0.050	106.7	225
2.000	4	5	18.395	1.500	60.675	60.475	0.200	92.0	225
2.001	5	6	45.179	1.500	60.475	60.135	0.340	132.9	225
2.002	6	7	28.936	1.500	60.135	59.915	0.220	131.5	225
1.003	7	14	14.511	1.500	59.635	59.545	0.090	161.2	225

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.001	0.649	1.385	55.1	5.9	1.225	2.240	0.000	0	140.0	0.0	50	0.901
1.002	0.624	1.111	44.2	8.8	2.240	2.290	0.000	0	310.0	0.0	68	0.866
2.000	0.593	1.197	47.6	6.1	1.200	1.400	0.000	0	150.0	0.0	55	0.826
2.001	0.559	0.995	39.6	7.9	1.400	1.740	0.000	0	250.0	0.0	68	0.776
2.002	0.562	1.000	39.8	7.9	1.740	2.010	0.000	0	250.0	0.0	68	0.780
1.003	0.593	0.903	35.9	11.8	2.290	2.340	0.000	0	560.0	0.0	89	0.811

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
3.000	8	9	29.506	1.500	60.725	60.425	0.300	98.4	225
3.001	9	10	20.671	1.500	60.425	60.215	0.210	98.4	225
3.002	10	12	28.685	1.500	60.215	59.915	0.300	95.6	225
4.000	11	12	56.126	1.500	60.485	59.915	0.570	98.5	225
3.003	12	14	26.950	1.500	59.915	59.645	0.270	99.8	225
1.004	14	16	89.519	1.500	59.545	59.095	0.450	198.9	225
5.000	15	16	39.994	1.500	60.000	59.095	0.905	44.2	225
1.005	16	21	5.314	1.500	59.095	59.065	0.030	177.1	225
6.000	17	18	23.625	1.500	60.675	60.315	0.360	65.6	225
6.001	18	19	30.150	1.500	60.315	60.015	0.300	100.5	225
6.002	19	20	46.093	1.500	60.015	59.615	0.400	115.2	225
6.003	20	21	83.594	1.500	59.615	59.065	0.550	152.0	225
1.006	21	22	22.612	1.500	59.065	58.950	0.115	196.6	225
1.007	22	23	40.885	1.500	58.950	58.740	0.210	194.7	225
1.008	23	23_OUT	47.241	1.500	58.740	58.500	0.240	196.8	225

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
3.000	0.573	1.157	46.0	6.1	1.050	1.350	0.000	0	150.0	0.0	56	0.806
3.001	0.622	1.157	46.0	7.9	1.350	1.560	0.000	0	250.0	0.0	63	0.863
3.002	0.660	1.174	46.7	9.4	1.560	1.860	0.000	0	350.0	0.0	68	0.916
4.000	0.631	1.157	46.0	8.3	1.290	1.860	0.000	0	275.0	0.0	65	0.876
3.003	0.715	1.149	45.7	12.5	1.860	2.240	0.000	0	625.0	0.0	80	0.979
1.004	0.615	0.812	32.3	17.2	2.340	2.150	0.000	0	1185.0	0.0	116	0.824
5.000	0.695	1.729	68.7	4.5	1.505	2.150	0.000	0	80.0	0.0	39	0.973
1.005	0.647	0.861	34.2	17.8	2.150	1.960	0.000	0	1265.0	0.0	115	0.868
6.000	0.665	1.418	56.4	6.1	1.200	1.560	0.000	0	150.0	0.0	51	0.932
6.001	0.577	1.145	45.5	6.1	1.560	1.860	0.000	0	150.0	0.0	56	0.797
6.002	0.548	1.069	42.5	6.1	1.860	2.160	0.000	0	150.0	0.0	58	0.758
6.003	0.551	0.930	37.0	8.7	2.160	1.960	0.000	0	300.0	0.0	74	0.760
1.006	0.641	0.817	32.5	19.8	1.960	1.705	0.000	0	1565.0	0.0	127	0.857
1.007	0.645	0.821	32.6	19.8	1.705	1.735	0.000	0	1565.0	0.0	126	0.859
1.008	0.641	0.817	32.5	19.8	1.735	2.225	0.000	0	1565.0	0.0	127	0.857

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	69.829	68.8	225	Foul Pipes	62.150	60.700	1.225	62.150	59.685	2.240
1.002	5.335	106.7	225	Foul Pipes	62.150	59.685	2.240	62.150	59.635	2.290
2.000	18.395	92.0	225	Foul Pipes	62.100	60.675	1.200	62.100	60.475	1.400
2.001	45.179	132.9	225	Foul Pipes	62.100	60.475	1.400	62.100	60.135	1.740
2.002	28.936	131.5	225	Foul Pipes	62.100	60.135	1.740	62.150	59.915	2.010

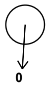
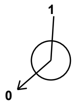
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	2	1200	Manhole	Storm MH	3	1200	Manhole	Storm MH
1.002	3	1200	Manhole	Storm MH	7	1200	Manhole	Storm MH
2.000	4	1200	Manhole	Storm MH	5	1200	Manhole	Storm MH
2.001	5	1200	Manhole	Storm MH	6	1200	Manhole	Storm MH
2.002	6	1200	Manhole	Storm MH	7	1200	Manhole	Storm MH

Pipeline Schedule

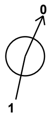
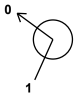
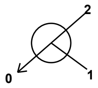
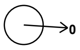
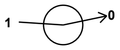
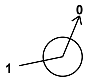
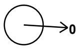
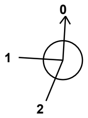
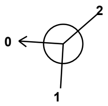
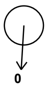
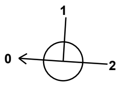
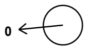
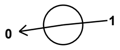
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.003	14.511	161.2	225	Foul Pipes	62.150	59.635	2.290	62.110	59.545	2.340
3.000	29.506	98.4	225	Foul Pipes	62.000	60.725	1.050	62.000	60.425	1.350
3.001	20.671	98.4	225	Foul Pipes	62.000	60.425	1.350	62.000	60.215	1.560
3.002	28.685	95.6	225	Foul Pipes	62.000	60.215	1.560	62.000	59.915	1.860
4.000	56.126	98.5	225	Foul Pipes	62.000	60.485	1.290	62.000	59.915	1.860
3.003	26.950	99.8	225	Foul Pipes	62.000	59.915	1.860	62.110	59.645	2.240
1.004	89.519	198.9	225	Foul Pipes	62.110	59.545	2.340	61.470	59.095	2.150
5.000	39.994	44.2	225	Foul Pipes	61.730	60.000	1.505	61.470	59.095	2.150
1.005	5.314	177.1	225	Foul Pipes	61.470	59.095	2.150	61.250	59.065	1.960
6.000	23.625	65.6	225	Foul Pipes	62.100	60.675	1.200	62.100	60.315	1.560
6.001	30.150	100.5	225	Foul Pipes	62.100	60.315	1.560	62.100	60.015	1.860
6.002	46.093	115.2	225	Foul Pipes	62.100	60.015	1.860	62.000	59.615	2.160
6.003	83.594	152.0	225	Foul Pipes	62.000	59.615	2.160	61.250	59.065	1.960
1.006	22.612	196.6	225	Foul Pipes	61.250	59.065	1.960	60.880	58.950	1.705
1.007	40.885	194.7	225	Foul Pipes	60.880	58.950	1.705	60.700	58.740	1.735
1.008	47.241	196.8	225	Foul Pipes	60.700	58.740	1.735	60.950	58.500	2.225

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.003	7	1200	Manhole	Storm MH	14	1200	Manhole	Storm MH
3.000	8	1200	Manhole	Storm MH	9	1200	Manhole	Storm MH
3.001	9	1200	Manhole	Storm MH	10	1200	Manhole	Storm MH
3.002	10	1200	Manhole	Storm MH	12	1200	Manhole	Storm MH
4.000	11	1200	Manhole	Storm MH	12	1200	Manhole	Storm MH
3.003	12	1200	Manhole	Storm MH	14	1200	Manhole	Storm MH
1.004	14	1200	Manhole	Storm MH	16	1200	Manhole	Storm MH
5.000	15	1200	Manhole	Storm MH	16	1200	Manhole	Storm MH
1.005	16	1200	Manhole	Storm MH	21	1200	Manhole	Storm MH
6.000	17	1200	Manhole	Storm MH	18	1200	Manhole	Storm MH
6.001	18	1200	Manhole	Storm MH	19	1200	Manhole	Storm MH
6.002	19	1200	Manhole	Storm MH	20	1200	Manhole	Storm MH
6.003	20	1200	Manhole	Storm MH	21	1200	Manhole	Storm MH
1.006	21	1200	Manhole	Storm MH	22	1200	Manhole	Storm MH
1.007	22	1200	Manhole	Storm MH	23	1200	Manhole	Storm MH
1.008	23	1200	Manhole	Storm MH	23_OUT	1200	Manhole	Storm MH

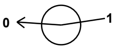
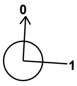
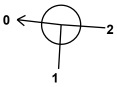
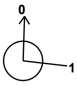
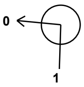
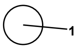
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
2	306281.085	235059.280	62.150	1.450	1200	 0	1.001	60.700	225
3	306276.612	234989.594	62.150	2.465	1200	 1	1.001	59.685	225
						0	1.002	59.685	225
4	306273.458	234909.787	62.100	1.425	1200	 0	2.000	60.675	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
5	306277.387	234927.757	62.100	1.625	1200		1	2.000	60.475	225
							0	2.001	60.475	225
6	306295.915	234968.962	62.100	1.965	1200		1	2.001	60.135	225
							0	2.002	60.135	225
7	306272.591	234986.087	62.150	2.515	1200		1	2.002	59.915	225
							2	1.002	59.635	225
							0	1.003	59.635	225
8	306199.410	234920.867	62.000	1.275	1200		0	3.000	60.725	225
9	306228.853	234918.947	62.000	1.575	1200		1	3.000	60.425	225
							0	3.001	60.425	225
10	306249.095	234923.136	62.000	1.785	1200		1	3.001	60.215	225
							0	3.002	60.215	225
11	306204.031	234953.104	62.000	1.515	1200		0	4.000	60.485	225
12	306260.050	234949.647	62.000	2.085	1200		1	4.000	59.915	225
							2	3.002	59.915	225
							0	3.003	59.915	225
14	306261.655	234976.549	62.110	2.565	1200		1	3.003	59.645	225
							2	1.003	59.545	225
							0	1.004	59.545	225
15	306174.772	235022.204	61.730	1.730	1200		0	5.000	60.000	225
16	306172.320	234982.285	61.470	2.375	1200		1	5.000	59.095	225
							2	1.004	59.095	225
							0	1.005	59.095	225
17	306261.535	234902.877	62.100	1.425	1200		0	6.000	60.675	225
18	306238.024	234900.560	62.100	1.785	1200		1	6.000	60.315	225
							0	6.001	60.315	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
19	306208.204	234896.109	62.100	2.085	1200	 1	6.001	60.015	225
						0	6.002	60.015	225
20	306162.214	234899.196	62.000	2.385	1200	 1	6.002	59.615	225
						0	6.003	59.615	225
21	306167.019	234982.652	61.250	2.185	1200	 1	6.003	59.065	225
						2	1.005	59.065	225
						0	1.006	59.065	225
22	306144.555	234985.237	60.880	1.930	1200	 1	1.006	58.950	225
						0	1.007	58.950	225
23	306145.873	235026.101	60.700	1.960	1200	 1	1.007	58.740	225
						0	1.008	58.740	225
23_OUT	306098.843	235030.563	60.950	2.450	1200	 1	1.008	58.500	225

APPENDIX C

Rainfall Return Period
SOIL Type Value (www.uksuds.com)
StormTech Storage Cumulative Volume Spreadsheet
StormTech MC4500 Chamber Information Sheet
Specification / Product Information for Separators, Silt Trap & Flow Control Device
UKROI KPC Grass Block

```
                                            Met Eireann
                          Return Period Rainfall Depths for sliding Durations
                           Irish Grid:  Easting: 306230, Northing: 234970,

                 Interval     |                                    Years
DURATION   6months, 1year,  |      2,     3,     4,     5,    10,    20,    30,    50,    75,   100,   150,   200,   250,   500,
  5 mins       2.3,   3.4,  |    4.1,   5.0,   5.7,   6.2,   7.9,   9.9,  11.2,  13.1,  14.9,  16.2,  18.4,  20.0,  21.4,  N/A ,
 10 mins       3.3,   4.8,  |    5.7,   7.0,   7.9,   8.6,  11.0,  13.8,  15.6,  18.3,  20.7,  22.6,  25.6,  27.9,  29.9,  N/A ,
 15 mins       3.8,   5.6,  |    6.7,   8.2,   9.3,  10.1,  12.9,  16.2,  18.4,  21.5,  24.4,  26.6,  30.1,  32.8,  35.1,  N/A ,
 30 mins       5.1,   7.4,  |    8.6,  10.6,  11.9,  12.9,  16.4,  20.3,  23.0,  26.8,  30.2,  32.9,  37.1,  40.3,  43.0,  N/A ,
 1 hours       6.7,   9.6,  |   11.2,  13.6,  15.2,  16.5,  20.7,  25.6,  28.8,  33.4,  37.5,  40.7,  45.6,  49.5,  52.7,  N/A ,
 2 hours       8.8,  12.5,  |   14.5,  17.5,  19.5,  21.1,  26.3,  32.2,  36.1,  41.6,  46.5,  50.3,  56.2,  60.7,  64.5,  N/A ,
 3 hours      10.4,  14.6,  |   16.9,  20.3,  22.6,  24.4,  30.2,  36.8,  41.2,  47.3,  52.7,  56.9,  63.4,  68.5,  72.6,  N/A ,
 4 hours      11.7,  16.3,  |   18.8,  22.5,  25.1,  27.0,  33.3,  40.5,  45.2,  51.8,  57.6,  62.2,  69.1,  74.5,  79.0,  N/A ,
 6 hours      13.8,  19.1,  |   21.9,  26.1,  29.0,  31.2,  38.3,  46.3,  51.5,  58.9,  65.4,  70.4,  78.1,  84.0,  89.0,  N/A ,
 9 hours      16.2,  22.3,  |   25.5,  30.3,  33.5,  36.0,  44.0,  52.9,  58.8,  66.9,  74.1,  79.7,  88.2,  94.7, 100.2,  N/A ,
12 hours      18.2,  24.9,  |   28.4,  33.7,  37.2,  39.8,  48.5,  58.2,  64.5,  73.3,  81.1,  87.0,  96.1, 103.1, 108.9,  N/A ,
18 hours      21.4,  29.1,  |   33.1,  39.0,  43.0,  46.0,  55.8,  66.6,  73.6,  83.4,  91.9,  98.5, 108.6, 116.3, 122.6,  N/A ,
24 hours      24.1,  32.5,  |   36.9,  43.3,  47.6,  50.9,  61.5,  73.2,  80.8,  91.3, 100.5, 107.6, 118.3, 126.6, 133.4, 156.9,
  2 days      30.0,  39.5,  |   44.4,  51.5,  56.2,  59.7,  71.1,  83.4,  91.3, 102.2, 111.6, 118.8, 129.7, 138.0, 144.8, 168.0,
  3 days      34.8,  45.2,  |   50.5,  58.1,  63.1,  66.9,  78.9,  91.8, 100.0, 111.3, 121.0, 128.4, 139.5, 148.0, 154.9, 178.4,
  4 days      39.0,  50.1,  |   55.7,  63.8,  69.1,  73.1,  85.7,  99.1, 107.7, 119.3, 129.3, 136.9, 148.2, 156.9, 163.9, 187.8,
  6 days      46.3,  58.7,  |   65.0,  73.8,  79.5,  83.9,  97.4, 111.8, 120.9, 133.2, 143.7, 151.6, 163.5, 172.5, 179.7, 204.3,
  8 days      52.8,  66.3,  |   73.0,  82.5,  88.7,  93.3, 107.7, 122.9, 132.4, 145.3, 156.2, 164.5, 176.8, 186.1, 193.6, 218.9,
 10 days      58.8,  73.3,  |   80.4,  90.5,  97.0, 101.8, 117.0, 132.9, 142.8, 156.2, 167.5, 176.1, 188.8, 198.3, 206.1, 232.0,
 12 days      64.4,  79.7,  |   87.2,  97.8, 104.6, 109.7, 125.5, 142.1, 152.4, 166.2, 178.0, 186.8, 199.8, 209.7, 217.6, 244.1,
 16 days      74.7,  91.6,  |   99.8, 111.4, 118.7, 124.2, 141.2, 158.9, 169.8, 184.5, 196.9, 206.2, 219.9, 230.2, 238.5, 266.2,
 20 days      84.3, 102.5,  |  111.4, 123.7, 131.6, 137.5, 155.5, 174.1, 185.7, 201.1, 214.1, 223.7, 238.1, 248.8, 257.4, 286.0,
 25 days      95.6, 115.3,  |  124.8, 138.1, 146.5, 152.8, 171.9, 191.7, 203.9, 220.1, 233.7, 243.9, 258.8, 270.0, 279.0, 308.7,
NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
’Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin’,
 Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf
```

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by: Bartosz Kedzierski

Site name: St. Edmunds

Site location:

Site Details

Latitude: 53.35442° N

Longitude: 6.405° W

Reference: 2231352229

Date: Nov 30 2021 14:21

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 2.0645

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	959	781
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	5.44	4.28
1 in 1 year (l/s):	4.62	3.64
1 in 30 years (l/s):	11.58	9.11
1 in 100 year (l/s):	14.19	11.16
1 in 200 years (l/s):	15.55	12.23

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Project: D1621 -St Edmunds development

Chamber Model - MC-4500
Units - **Metric** Click Here for Imperial
Number of Chambers - 204
Number of chambers - 28
Voids in the stone (porosity) - 43 %
Base of Stone Elevation - 58.65 m
Amount of Stone Above Chambers - 305 mm
Amount of Stone Below Chambers - 230 mm
Area of system - 780 sq.meters Min. Area - 777.188 sq.meters

☑ Include Perimeter Stone in Calculations

StormTech MC-4500 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End Cap and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
2057	0.00	0.00	0.00	0.00	8.515	8.51	1056.54	60.71
2032	0.00	0.00	0.00	0.00	8.515	8.51	1048.02	60.68
2007	0.00	0.00	0.00	0.00	8.515	8.51	1039.51	60.66
1981	0.00	0.00	0.00	0.00	8.515	8.51	1030.99	60.63
1956	0.00	0.00	0.00	0.00	8.515	8.51	1022.48	60.61
1930	0.00	0.00	0.00	0.00	8.515	8.51	1013.96	60.58
1905	0.00	0.00	0.00	0.00	8.515	8.51	1005.45	60.56
1880	0.00	0.00	0.00	0.00	8.515	8.51	996.93	60.53
1854	0.00	0.00	0.00	0.00	8.515	8.51	988.42	60.50
1829	0.00	0.00	0.00	0.00	8.515	8.51	979.90	60.48
1803	0.00	0.00	0.00	0.00	8.515	8.51	971.39	60.45
1778	0.00	0.00	0.00	0.00	8.515	8.51	962.88	60.43
1753	0.00	0.00	0.24	0.00	8.413	8.65	954.36	60.40
1727	0.00	0.00	0.67	0.01	8.223	8.90	945.71	60.38
1702	0.00	0.00	0.95	0.02	8.097	9.07	936.81	60.35
1676	0.01	0.00	1.21	0.04	7.980	9.22	927.74	60.33
1651	0.01	0.00	1.55	0.05	7.825	9.43	918.52	60.30
1626	0.01	0.00	2.62	0.07	7.360	10.05	909.09	60.28
1600	0.02	0.00	3.84	0.09	6.824	10.76	899.04	60.25
1575	0.02	0.00	4.62	0.11	6.482	11.21	888.29	60.22
1549	0.03	0.00	5.25	0.13	6.202	11.58	877.08	60.20
1524	0.03	0.01	5.79	0.15	5.958	11.90	865.49	60.17
1499	0.03	0.01	6.28	0.17	5.741	12.19	853.59	60.15
1473	0.03	0.01	6.72	0.19	5.543	12.45	841.40	60.12
1448	0.03	0.01	7.13	0.21	5.357	12.70	828.94	60.10
1422	0.04	0.01	7.51	0.24	5.185	12.93	816.24	60.07
1397	0.04	0.01	7.86	0.26	5.024	13.14	803.31	60.05
1372	0.04	0.01	8.20	0.28	4.872	13.34	790.17	60.02
1346	0.04	0.01	8.51	0.29	4.729	13.53	776.83	60.00
1321	0.04	0.01	8.81	0.31	4.592	13.71	763.29	59.97
1295	0.04	0.01	9.10	0.33	4.462	13.89	749.58	59.95
1270	0.05	0.01	9.37	0.35	4.337	14.05	735.69	59.92
1245	0.05	0.01	9.63	0.37	4.218	14.21	721.64	59.89
1219	0.05	0.01	9.87	0.38	4.104	14.36	707.43	59.87
1194	0.05	0.01	10.11	0.40	3.996	14.51	693.07	59.84
1168	0.05	0.01	10.34	0.42	3.891	14.64	678.56	59.82
1143	0.05	0.02	10.56	0.43	3.790	14.78	663.92	59.79
1118	0.05	0.02	10.76	0.45	3.694	14.91	649.14	59.77
1092	0.05	0.02	10.97	0.46	3.601	15.03	634.23	59.74
1067	0.05	0.02	11.16	0.48	3.511	15.15	619.21	59.72
1041	0.06	0.02	11.35	0.49	3.425	15.26	604.06	59.69
1016	0.06	0.02	11.53	0.51	3.342	15.37	588.80	59.67
991	0.06	0.02	11.70	0.52	3.261	15.48	573.42	59.64
965	0.06	0.02	11.86	0.53	3.184	15.58	557.94	59.62
940	0.06	0.02	12.02	0.55	3.109	15.68	542.36	59.59
914	0.06	0.02	12.18	0.56	3.037	15.78	526.68	59.56
889	0.06	0.02	12.33	0.57	2.968	15.87	510.91	59.54
864	0.06	0.02	12.47	0.59	2.900	15.96	495.04	59.51
838	0.06	0.02	12.61	0.60	2.836	16.04	479.08	59.49
813	0.06	0.02	12.74	0.61	2.773	16.13	463.04	59.46
787	0.06	0.02	12.87	0.62	2.713	16.21	446.91	59.44
762	0.06	0.02	12.99	0.64	2.655	16.28	430.71	59.41
737	0.06	0.02	13.11	0.65	2.598	16.36	414.42	59.39
711	0.06	0.02	13.22	0.67	2.542	16.43	398.07	59.36
686	0.07	0.02	13.33	0.67	2.494	16.50	381.63	59.34
660	0.07	0.02	13.44	0.68	2.445	16.56	365.14	59.31
635	0.07	0.02	13.54	0.69	2.397	16.62	348.58	59.29
610	0.07	0.03	13.63	0.70	2.351	16.69	331.95	59.26
584	0.07	0.03	13.72	0.71	2.307	16.74	315.27	59.23
559	0.07	0.03	13.81	0.72	2.265	16.80	298.52	59.21
533	0.07	0.03	13.90	0.73	2.225	16.85	281.72	59.18

508	0.07	0.03	13.98	0.74	2.187	16.90	264.87	59.16
483	0.07	0.03	14.05	0.75	2.151	16.95	247.97	59.13
457	0.07	0.03	14.12	0.76	2.116	17.00	231.02	59.11
432	0.07	0.03	14.19	0.77	2.083	17.04	214.02	59.08
406	0.07	0.03	14.26	0.78	2.052	17.08	196.98	59.06
381	0.07	0.03	14.32	0.78	2.022	17.12	179.90	59.03
356	0.07	0.03	14.37	0.79	1.994	17.16	162.77	59.01
330	0.07	0.03	14.43	0.80	1.967	17.19	145.62	58.98
305	0.07	0.03	14.48	0.81	1.942	17.23	128.42	58.95
279	0.07	0.03	14.53	0.81	1.919	17.26	111.19	58.93
254	0.07	0.03	14.60	0.82	1.886	17.30	93.94	58.90
229	0.00	0.00	0.00	0.00	8.515	8.51	76.63	58.88
203	0.00	0.00	0.00	0.00	8.515	8.51	68.12	58.85
178	0.00	0.00	0.00	0.00	8.515	8.51	59.60	58.83
152	0.00	0.00	0.00	0.00	8.515	8.51	51.09	58.80
127	0.00	0.00	0.00	0.00	8.515	8.51	42.57	58.78
102	0.00	0.00	0.00	0.00	8.515	8.51	34.06	58.75
76	0.00	0.00	0.00	0.00	8.515	8.51	25.54	58.73

StormTech®

ADS®

MC-4500 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

STORMTECH MC-4500 CHAMBER

(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
52” x 100” x 60”
1,321 mm x 2,540 mm x 1,524 mm

Chamber Storage
106.5 ft^3 (3.01 m^3)

Min. Installed Storage*
162.6 ft^3 (4.60 m^3)

Weight
120 lbs (54.4 kg)

Shipping
7 chambers/pallet
11 pallets/truck

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below chambers, 9” (230 mm) of stone between chambers/end caps and 40% stone porosity.

STORMTECH MC-4500 END CAP

(not to scale)

Nominal End Cap Specifications

Size (L x W x H)
35.1” x 90.2” x 59.4”
891 mm x 2,291 mm x 1,509 mm

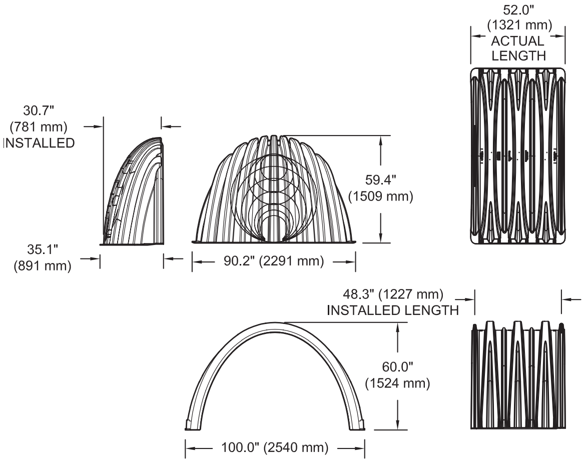
End Cap Storage
35.7 ft^3 (1.01 m^3)

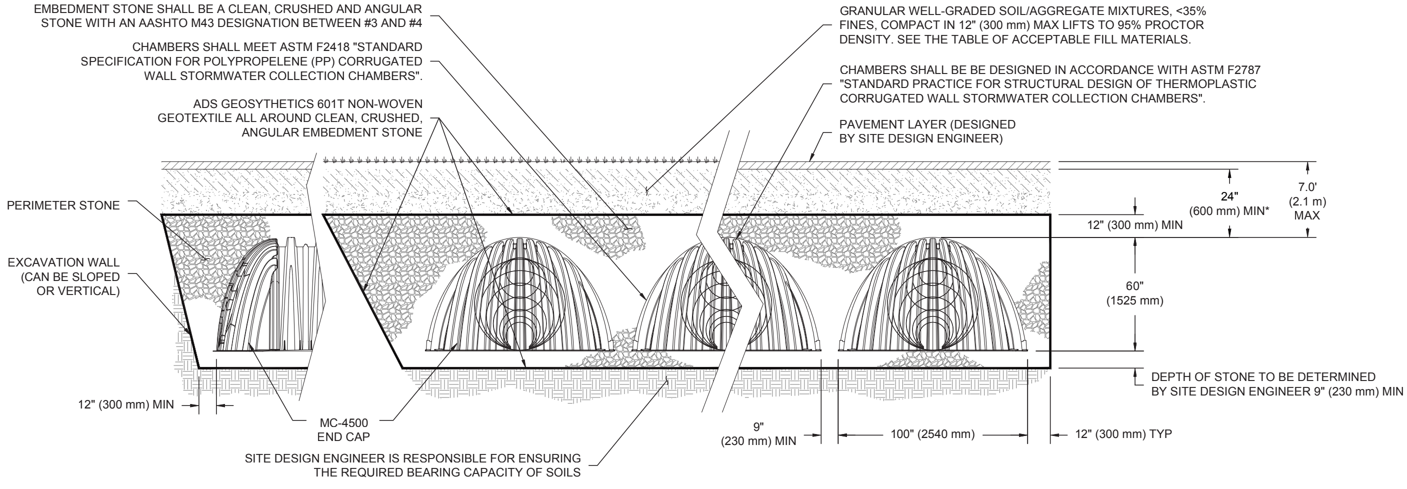
Min. Installed Storage*
108.7 ft^3 (3.08 m^3)

Weight
120 lbs (54.4 kg)

Shipping
7 end caps/pallet
11 pallets/truck

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below, 6” (150 mm) of stone perimeter, 9” (230 mm) of stone between chambers/end caps and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

MC-4500 CHAMBER SPECIFICATIONS

STORAGE VOLUME PER CHAMBER FT^3 (M^3)

	Bare Chamber Storage ft^3 (m^3)	Chamber and Stone Foundation Depth in. (mm)			
		9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
MC-4500 Chamber	106.5 (3.02)	162.6 (4.60)	166.3 (4.71)	169.6 (4.81)	173.6 (4.91)
MC-4500 End Cap	35.7 (1.0)	108.7 (3.08)	111.9 (3.17)	115.2 (3.26)	118.4 (3.35)

Note: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 12" (300 mm) stone perimeter.

AMOUNT OF STONE PER CHAMBER

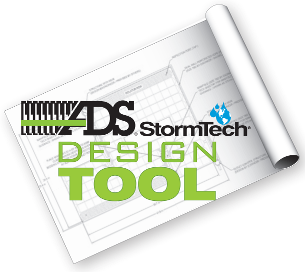
ENGLISH TONS (yds^3)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-4500 Chamber	7.4 (5.2)	7.8 (5.5)	8.3 (5.9)	8.8 (6.2)
MC-4500 End Cap	9.6 (6.8)	10.0 (7.1)	10.4 (7.4)	10.9 (7.7)
METRIC KILOGRAMS (m^3)	230 mm	300 mm	375 mm	450 mm
MC-4500 Chamber	6,681 (4.0)	7,117 (4.2)	7,552 (4.5)	7,987 (4.7)
MC-4500 End Cap	8,691 (5.2)	9,075 (5.4)	9,460 (5.6)	9,845 (5.9)

Note: Assumes 12" (300 mm) of stone above and 9" (230 mm) row spacing and 12" (300 mm) of perimeter stone in front of end caps.

VOLUME EXCAVATION PER CHAMBER YD^3 (M^3)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375mm)	18" (450 mm)
MC-4500 Chamber	10.5 (8.0)	10.8 (8.3)	11.2 (8.5)	11.5 (8.8)
MC-4500 End Cap	9.3 (7.1)	9.6 (7.3)	9.9 (7.6)	10.2 (7.8)

Note: Assumes 9" (230 mm) of separation between chamber rows, 12" (300 mm) of perimeter in front of the end caps, and 24" (600 mm) of cover. The volume of excavation will varyas depth of cover increases.



Working on a project?
Visit us at www.stormtech.com
and utilize the StormTech Design Tool

For more information on the StormTech MC-4500 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

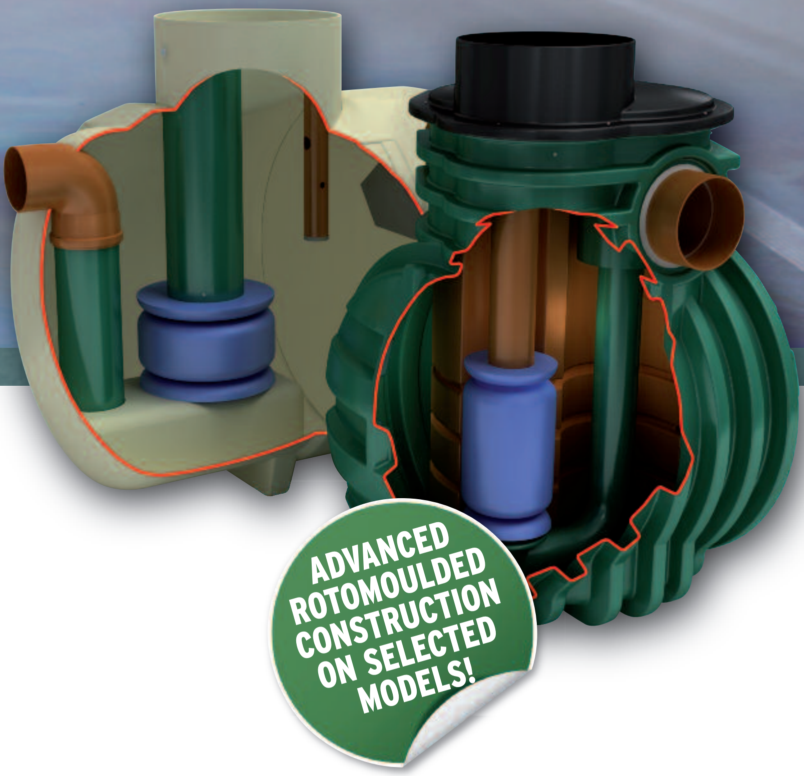
*THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™*

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

Kingspan Klargester

SEPARATORS

A RANGE OF FUEL/OIL
SEPARATORS FOR
PEACE OF MIND



ADVANCED ROTOMOULDED CONSTRUCTION ON SELECTED MODELS!

Let us help!
Free professional site visit with friendly support and advice.
helpingyou@klargester.com
to make the right decision
or call **028 302 66799**

Kingspan Environmental

Separators

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

Surface water drains normally discharge to a watercourse or indirectly into underground waters (groundwater) via a soakaway. Contamination of surface water by oil, chemicals or suspended solids can cause these discharges to have a serious impact on the receiving water.

The Environment Regulators, Environment Agency, England and Wales, SEPA, Scottish Environmental Protection Agency in Scotland and Department of Environment & Heritage in Northern Ireland, have published guidance on surface water disposal, which offers a range of means of dealing with pollution both at source and at the point of discharge from site (so called 'end of pipe' treatment). These techniques are known as 'Sustainable Drainage Systems' (SuDS).

Where run-off is draining from relatively low risk areas such as car-parks and non-operational areas, a source control approach, such as permeable surfaces or infiltration trenches, may offer a suitable means of treatment, removing the need for a separator.

Oil separators are installed on surface water drainage systems to protect receiving waters from pollution by oil, which may be present due to minor leaks from vehicles and plant, from accidental spillage.

Effluent from industrial processes and vehicle washing should normally be discharged to the foul sewer (subject to the approval of the sewerage undertaker) for further treatment at a municipal treatment works.

SEPARATOR STANDARDS AND TYPES

A British (and European) standard (EN 858-1 and 858-2) for the design and use of prefabricated oil separators has been adopted. New prefabricated separators should comply with the standard.

SEPARATOR CLASSES

The standard refers to two 'classes' of separator, based on performance under standard test conditions.

CLASS I

Designed to achieve a concentration of less than 5mg/l of oil under standard test conditions, should be used when the separator is required to remove very small oil droplets.

CLASS II

Designed to achieve a concentration of less than 100mg/l oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies (for example where the effluent passes to foul sewer).

Both classes can be produced as full retention or bypass separators. The oil concentration limits of 5 mg/l and 100 mg/l are only applicable under standard test conditions. It should not be expected that separators will comply with these limits when operating under field conditions.

FULL RETENTION SEPARATORS

Full retention separators treat the full flow that can be delivered by the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65mm/hr.

On large sites, some short term flooding may be an acceptable means of limiting the flow rate and hence the size of full retention systems.

Get in touch for a **FREE** professional site visit and a representative will contact you within 5 working days to arrange a visit.
helpingyou@klargester.com
to make the right decision
or call **028 302 66799**

BYPASS SEPARATORS

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small.

FORECOURT SEPARATORS

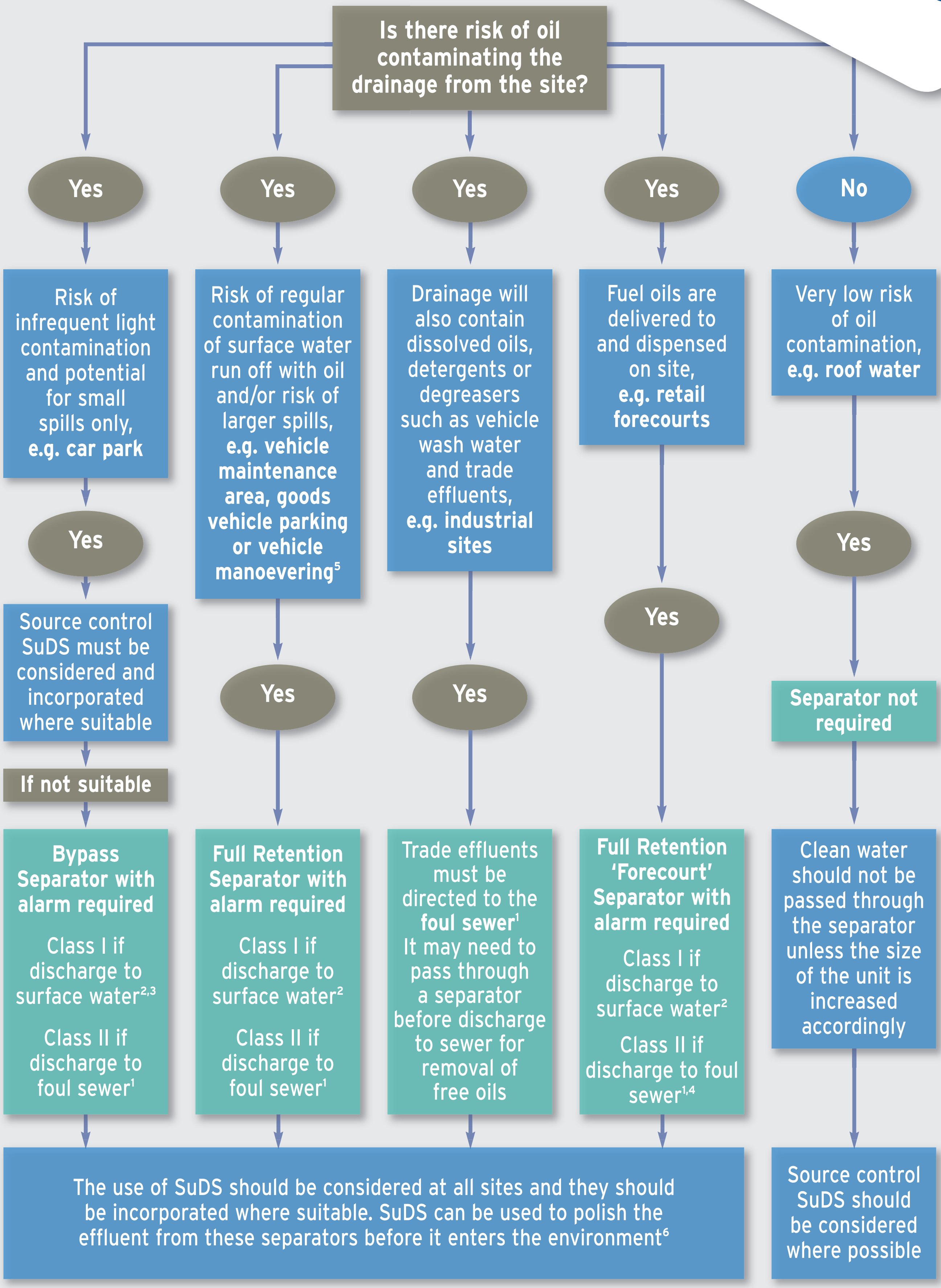
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size of the separator is increased in order to retain the possible loss of the contents of one compartment of a road tanker, which may be up to 7,600 litres.

SELECTING THE RIGHT SEPARATOR

The chart on the following page gives guidance to aid selection of the appropriate type of fuel/oil separator for use in surface water drainage systems which discharge into rivers and soakaways.

For further detailed information, please consult the Environment Agency Pollution Prevention Guideline 03 (PPG 3) 'Use and design of oil separators in surface water drainage systems' available from their website.

Klargester has a specialist team who provide technical assistance in selecting the appropriate separator for your application.



Is there risk of oil contaminating the drainage from the site?

Yes

Risk of infrequent light contamination and potential for small spills only, **e.g. car park**

Yes

Source control SuDS must be considered and incorporated where suitable

If not suitable

Bypass Separator with alarm required

Class I if discharge to surface water[2,3]

Class II if discharge to foul sewer[1]

Yes

Risk of regular contamination of surface water run off with oil and/or risk of larger spills, **e.g. vehicle maintenance area, goods vehicle parking or vehicle manoevering[5]**

Yes

Full Retention Separator with alarm required

Class I if discharge to surface water[2]

Class II if discharge to foul sewer[1]

Yes

Drainage will also contain dissolved oils, detergents or degreasers such as vehicle wash water and trade effluents, **e.g. industrial sites**

Yes

Trade effluents must be directed to the **foul sewer[1]** It may need to pass through a separator before discharge to sewer for removal of free oils

Yes

Fuel oils are delivered to and dispensed on site, **e.g. retail forecourts**

Yes

Full Retention 'Forecourt' Separator with alarm required

Class I if discharge to surface water[2]

Class II if discharge to foul sewer[1,4]

No

Very low risk of oil contamination, **e.g. roof water**

Yes

Separator not required

Clean water should not be passed through the separator unless the size of the unit is increased accordingly

Source control SuDS should be considered where possible

The use of SuDS should be considered at all sites and they should be incorporated where suitable. SuDS can be used to polish the effluent from these separators before it enters the environment[6]

[1] *You must seek prior permission from your local sewer provider before you decide which separator to install and before you make any discharge.*

[2] *You must seek prior permission from the relevant environmental body before you decide which separator to install.*

[3] *In this case, if it is considered that there is a low risk of pollution a source control SuDS scheme may be appropriate.*

[4] *In certain circumstances, the sewer provider may require a Class 1 separator for discharges to sewer to prevent explosive atmospheres from being generated.*

[5] *Drainage from higher risk areas such as vehicle maintenance yards and goods vehicle parking areas should be connected to foul sewer in preference to surface water.*

[6] *In certain circumstances, a separator may be one of the devices used in the SuDS scheme. Ask us for advice.*

Bypass NSB RANGE

APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

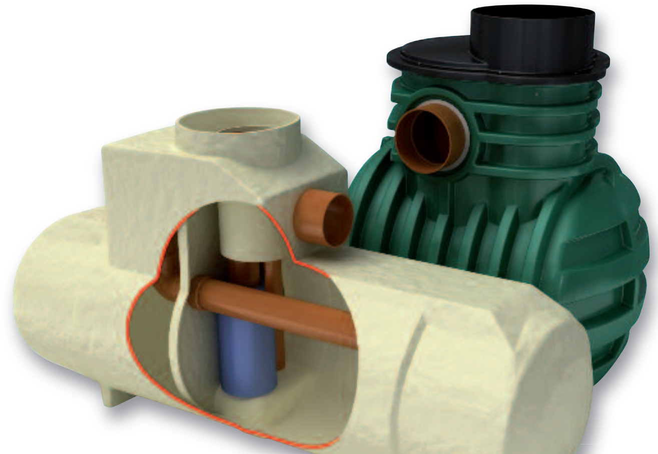
Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI) tested the required range of Klargester full retention separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Oil storage volume.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 NSB = 0.0018A(m2). Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.



Class II separators are designed to achieve a concentration of 100mg/litre of oil under standard test conditions.

Advanced rotomoulded construction on selected models
- Compact and robust
- Require less backfill
- Tough, lightweight and easy to handle

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped .
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m^2)	STORAGE CAPACITY (litres)		UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA. (mm)
				SILT	OIL								
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

🟩 *Rotomoulded chamber construction* □ *GRP chamber construction* ** Some units have more than one access shaft – diameter of largest shown.*

PROFESSIONAL INSTALLERS

Klargester Accredited Installers
Experience shows that correct installation is a prerequisite for the long-lasting and successful operation of any wastewater treatment product. This is why using an installer with the experience and expertise to install your product is highly recommended.

Services include :

- Site survey to establish ground conditions and soil types
- Advice on system design and product selection
- Assistance on gaining environmental consents and building approvals
- Tank and drainage system installation
- Connection to discharge point and electrical networks
- Waste emptying and disposal

Discover more about the Accredited Installers and locate your local expert online.

www.klargester.com/installers

Kingspan Klargester Accredited Installer

CARE & MAINTENANCE

Kingspan Environmental Services
Who better to look after your treatment plant than the people who designed and built it?

Kingspan Environmental have a dedicated service division providing maintenance for wastewater products.

Factory trained engineers are available for site visits as part of a planned maintenance contract or on a one-off call out basis.

To find out more about protecting your investment and ensuring peace of mind, call us on:

0844 846 0500

or visit us online:
www.kingspanenvservice.com

Kingspan Environmental Services

Kingspan Klargester

COMMERCIAL WASTEWATER SOLUTIONS

- **BIODISC®, BIOTEC™ & ENVIROSAFE**
  HIGH PERFORMANCE SEWAGE TREATMENT SYSTEMS
- **HILLMASTER** PACKAGE PUMP STATIONS
- **PUMPSTOR24** PUMPING SYSTEMS
- STORMWATER ATTENUATION SYSTEMS
- OIL/WATER SEPARATORS
- BELOW GROUND STORAGE TANKS
- GREASE & SILT TRAPS

Kingspan Water

NEW BUILD & RETROFIT SOLUTIONS

- BELOW GROUND RAINWATER HARVESTING SYSTEMS
- ABOVE GROUND RAINWATER HARVESTING SYSTEMS

Klargester
UK: College Road North, Aston Clinton, Aylesbury, Buckinghamshire HP22 5EW
Tel: +44 (0) 1296 633000 Fax: +44 (0) 1296 633001 Scottish Office: Tel: +44 (0) 1355 248484
email: info@klargester.com

Ireland: Unit 1a, Derryboy Road, Carnbane Business Park, Newry, Co. Down BT35 6QH
NI Tel : +44 (0) 28 302 66799 Fax: +44 (0) 28 302 60046 ROI Tel: 048 302 66799 Fax: 048 302 60046
email: info@klargester.ie

Visit our website **www.klargester.com**, or our company website **www.kingspanenv.com**

Part of Kingspan Environmental

Certificate No. FM 563603

Certificate No. OHS 563604

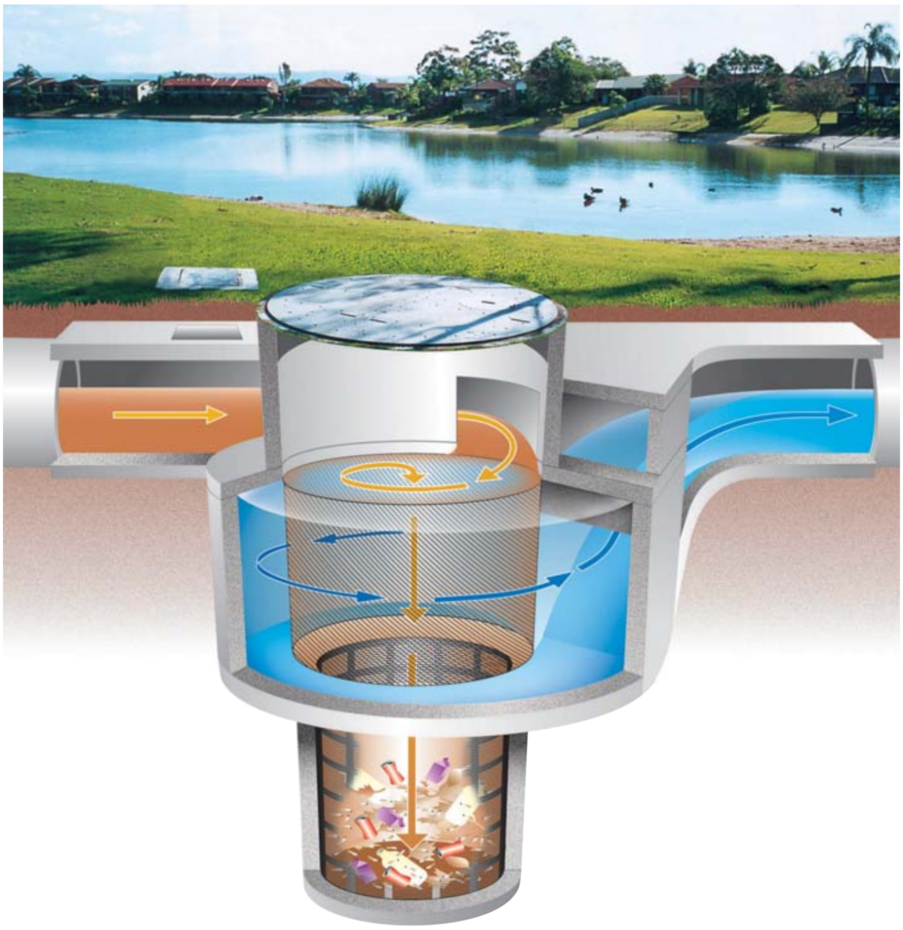
BRITISH WATER

UK GREEN BUILDING COUNCIL
Founding Member

Issue No. 20: August 2014

Specialists in Wastewater Treatment & Stormwater Management

Surface Water Treatment
SUDs Protector



The CDS Non Blocking screening technology is an innovative method of liquid / solid separation for Surface Water, Combined Sewer Overflows (CSO) and Foul Sewage Systems.

- ***SurfSep*** for Surface Water applications
- ***OverSep*** for Combined Sewer Overflow applications.

The technology accomplishes high efficiency separation of settleable particulate matter and capture of floatable material.

A unique feature of the CDS Technology is it's compact design. Both the *SurfSep* and *OverSep* are available as packaged systems, which can either be installed inside pre-cast concrete chamber rings, or complete BBA Approved Polyethylene Chambers unit.

Applications

- Storm-water Treatment
- Combined Sewer Overflow Treatment
- Parking Area Run-Off Treatment
- Vehicle Service Yard Areas
- Pre-treatment for Wetlands, Ponds and Swales
- Rainwater Harvesting
- Pre-treatment for Oil Separators
- Pre-treatment for media and Ground In-filtration Systems

Rapid installation

Primary features

- **Effective**: Capturing more than 95% of solid pollutants.
- **Non-Blocking**: Unique design takes advantage of indirect filtration and properly proportioned hydraulic forces that virtually makes the unit unblockable.
- **Non-Mechanical**: The unit has no moving parts and requires no mechanical devices to support the solid separation function.
- **Low Maintenance Costs**: The system has no moving parts and is fabricated of durable materials.
- **Compact & Flexible**: Design and size flexibility enables the use of various configurations.
- **High Flow Effectiveness**: The technology remains highly effective across a broad spectrum of flow ranges.
- **Assured Pollutant Capture**: All materials captured are retained during high flow conditions.
- **Safe & Easy Pollutant Removal**: Extraction methods allow safe and easy removal of pollutants without manual handling.

Surface Water System

Hydraulic Analysis

In storm water applications, an analysis of the catchment in terms of its size, topography and land use will provide information for determining flow to be expected for various return periods.

The *SurfSep* is designed for the flow that mobilizes the gross pollutants within the catchment. Since there are variations in catchment response due to region, land use and topography, it is recommended that the selection of flow to be treated will be for return periods of between 3 months and 1 year.

Balancing the cost to the operator against the benefits to the environment

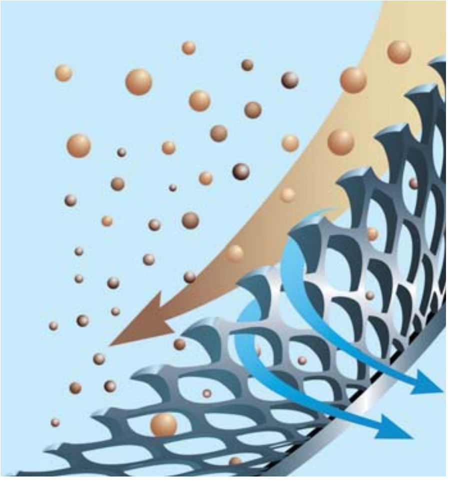
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity' for the conveyance facility - typically known as the 'first flush'.

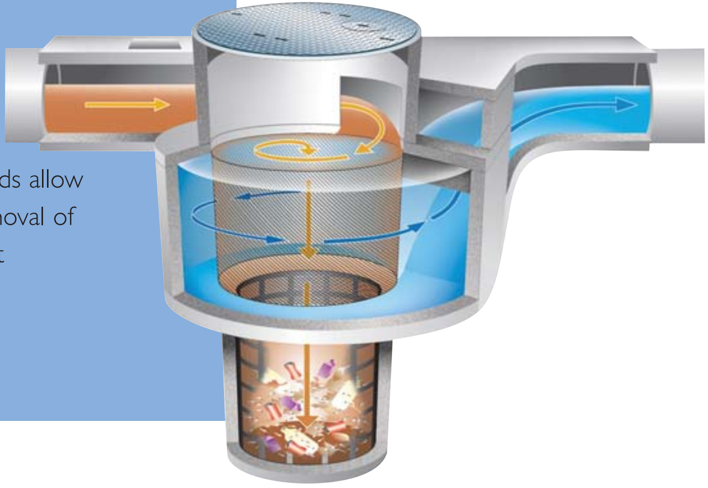
Therefore it is typical not to design the *SurfSep* models to process the conveyance system's maximum flow in order to achieve a very high level of pollutant removal.

The added value benefit to the operator is reduced civil costs without compromising the benefits to the environment.

How it works

Water and pollutants enter the system and are introduced tangentially inside the separation chamber forming a circular flow motion. Floatables and suspended solids are diverted to the slow moving centre of the flow. Negatively buoyant solids settle out to an undisturbed sump chamber below, while the water passes countercurrently through the separation screen. Floatables remain at the water surface and retained within the screen.





Surface Water Treatment Systems

Hydraulic Design

Every application requires a detailed hydraulic analysis to ensure the final installation will perform to effect optimum solids separation without blocking the screen.

After the design flow has been determined, the appropriate standard model can be selected. A selection table is provided on page 7.

The Ultimate SUDs Protector

There a four principal areas of proprietary SUDs technology;

• Infiltration • Flow Control • Storage/attenuation • Treatment

SurfSeps, although a common form of treatment are unique. When installed upstream of any proprietary SUDs technology, the *SurfSep* protects the receiving SUDs from fine solids and debris that would otherwise accumulate over time rendering the SUDs non-operational, as the worst case.

SurfSeps have been successfully installed in front of;

- Soakaways
- Infiltration Trenches
- Filters
- Wetlands
- Ponds and Water Features
- Detention and Retention Systems
- Oil Separators
- Create storage storage systems

to remove fine solids and debris that would otherwise accumulate over time reducing the down stream effectiveness of downstream SUDs assets.

Various independent field trials have shown that the *SurfSep* can remove high levels of Phosphates, Heavy Metals and PolyAramatic Hydrocarbons (PAH's) from the flow.

Infiltration

SurfSeps have been successfully installed in front of ground Infiltration systems to remove grit, fine solids and debris which accumulates in and around the SUDs causing visual degradation in the short term and accumulation of silt and grits leading to reduced volume in the long term.

Studies have also shown that Heavy metals & PAH's accumulate within the SUDs over time before being released back to the environment resulting in elevated concentrations.

Detention & Retention Systems

SurfSeps have been successfully installed in front of collection and attenuation SUDs to remove grit, fine solids and debris which accumulates in the SUDs leading to potential blockage of flow regulators resulting in increased Occupational Health & Safety risk during the treatment of blockages and during the periodic cleaning operations.

Applications

- Rainwater Harvesting
- Road run off
- New Developments
- Motorways
- A / B Roads
- Local Roads
- Residential
- Industrial
- Commercial

Purpose

Removal of plastics, oil, grit, fine solids, organic and inorganic debris, from point source pollution.

Flow Control Systems

Flow Control

Flow control is often required to reduce flooding of downstream sewer networks or receiving water courses. There are a number of ways to achieve this. The Hydroslide - Float controlled, constant flow regulator, as detailed below is ideally suited to the providing an efficient and reliable means of flow control.

There are four types of standard Hydroslide flow regulators as pictured.

1) Mini

2) HydroLimiter

3) VS - Vertical Standard

4) Combi - self flushing, can be mounted on the dry or wet side of the flow chamber.

Most applications can be dealt with using any of the four models to suit the flow. An accuracy of +/-5% is achievable.

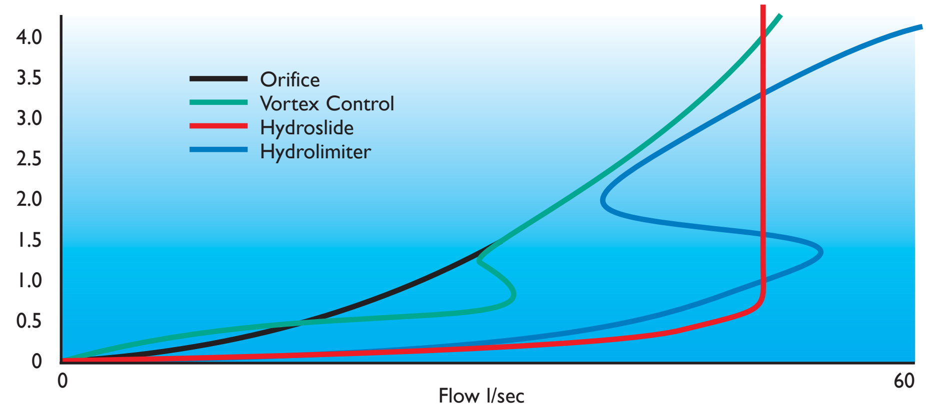
Typical SurfSep installation

Flow Control Technical Design

The Hydroslide regulator does not affect the flow until the flow is approaching the set discharge limit, this allows all flow (the first flush) to be discharged to the sewer. Because the flow to the sewer can be optimised at it's maximum permitted capacity the attentuation/storage capacity can be reduced over other methods of flow control, thus giving cost savings in storage provision. This is best explained by looking at a single storm event and comparing the 3 flow regulation processes as was done independantly by WRc in the report titled 'REDUCING THE COST OF STORMWATER STORAGE', Report No. PT1052, March 1995. The chart below represents 50 l/s control and up to 4m of head. The area difference between the curves being the detention volume saving.

Typically the volume saving when using a Hydroslide regulator is between 7% to 40%

Representation of flow through an orifice



Operation & Performance

Performance Criteria

Note: Screen apertures of 4.8 mm , 2.4 mm and 1.2 mm are available.

The 4.8 and 2.4 mm screens are generally used for Surface Water applications, with foul applications using either 2.4 or 1.2 mm aperture units.

Typical 1.2 mm aperture Performance

- shall remove all solids with a single dimension greater than 1.2 mm and positively contain those solids until the unit is cleaned.
- shall remove and positively contain 100 percent of all neutrally buoyant particles with a single dimension greater than 1.2 mm for all flow conditions to design capacity.
- shall remove and positively contain 100 percent of all floating trash and debris with a single dimension greater than 1.2 mm for all flow conditions to the design capacity.
- shall remove a minimum of 50 percent of oil and grease (as defined as the floating portion of total hexane extractable materials) for all flow conditions to the design capacity, without the addition of absorbents.
- shall provide the following minimum particle removal efficiencies (based on a specific gravity of 2.65):

a) 100 percent of all particles greater than 1100 microns.

b) 95 percent of all particles greater than 550 microns.

c) 90 percent of all particles greater than 367 microns.

d) 20 percent of all particles greater than 200 microns.

Maintenance

SurfSep maintenance can be site and drainage area specific. The installation should be inspected periodically to assure its condition to handle anticipated runoff. If pollutant loadings are known, then a preventive maintenance schedule can be developed based on runoff volumes processed.

Since this is seldom the case we recommend;

New Installations

Check the condition of the installation after the first few events. This includes a visual inspection to ascertain that the unit is operating correctly and measuring the amount of deposition that has occurred in the unit. This may be achieved using a 'Dip Stick'.

Ongoing Operation

For the first 12 months the installations sump full volume should be inspected monthly and recorded. When the inspection indicates that the sump full volume is approaching the top of the sump (base of screen) a cleanout should be undertaken.

Cleaning Methods

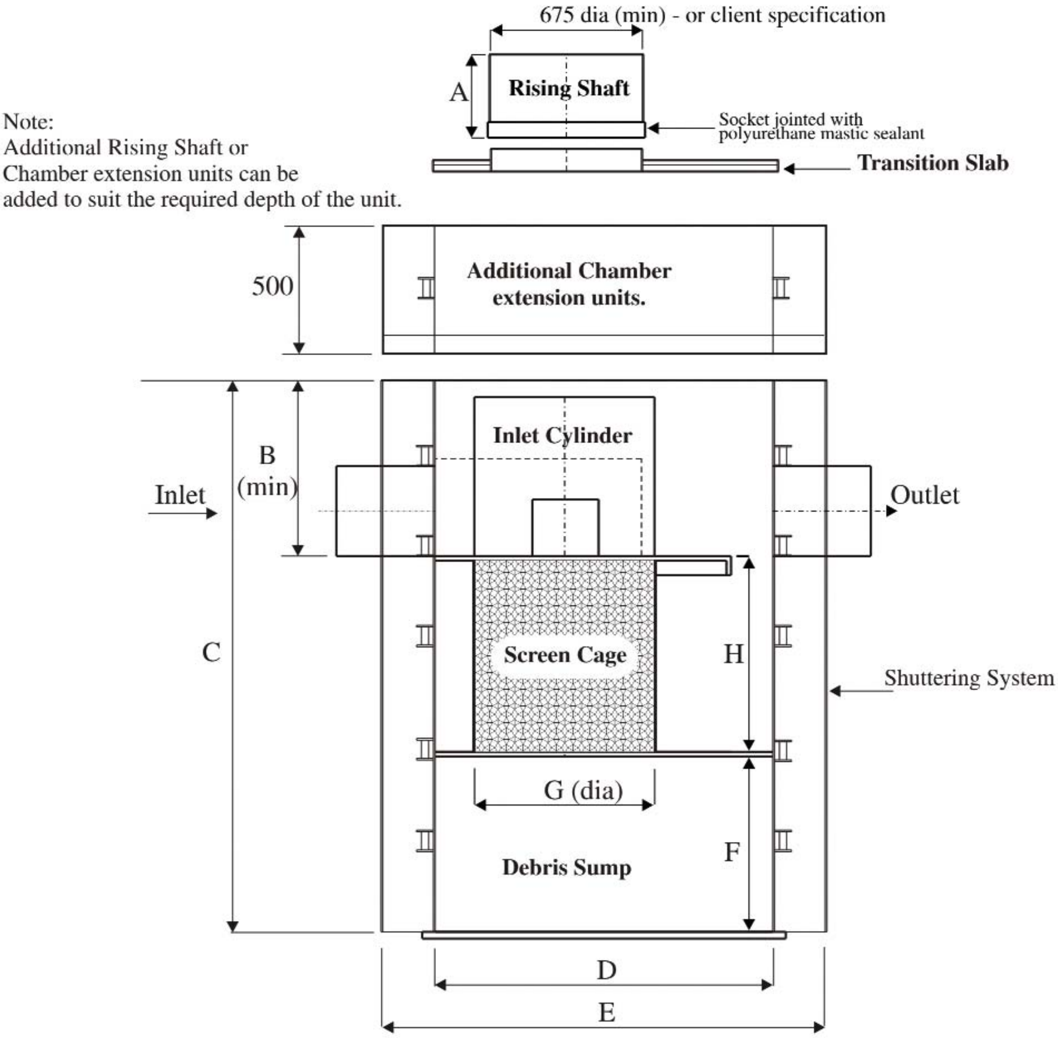
- Eduction (Suction)
- Basket Removal
- Mechanical Grab

Maintenance Cycle

Minimum once per year. Depending on the pollutant load it may be necessary to maintain the installation more frequently.

The operator shall be able to devise the most efficient maintenance schedule for any particular installation over a 12 month operating cycle.

SurfSep Dimensions



SurfSep Dimensions (mm)

	SW10404	SW0604	SW0606	SW0804	SW0806	SW0808	SW1010	SW1012	SW1015
A	370	370	370	370	370	370	500	500	500
B	444	815	615	810	830	810	800	800	830
C	1250	1985	1985	2080	2300	2480	2800	3000	3330
D	800	1200	1200	1500	1500	1500	2000	2000	2000
E	1112	1665	1665	1966	1966	1966	2475	2475	2475
F	400	700	700	700	700	800	1000	1000	1000
G (dia)	400	600	600	800	800	800	1000	1000	1000
H	400	400	600	400	600	800	1000	1200	1500

Selection Table - *SurfSep*

Model Reference	Hydraulic Peak Flow Rate l/s	Drainage Area - Impermeable m^2	Chamber Diameter (mm)	Internal Pipe Diameter (mm)
SWI 0404	30	2,000	900	150 / 225
SWI 0604	70	5,000	1200	225
SWI 0606 / 01	140	10,000	1200	225 - 375
SWI 0606 / 02	200	15,000	1200	225 - 375
SWI 0804	275	20,000	1500	300
SWI 0806	350	25,000	1500	450
SWI 0808	400	30,000	1500	450
SWI 1010	480	35,000	2000	450
SWI 1012	550	40,000	2000	450 / 750
SWI 1015	700	50,000	2000	450 / 750

* Proposed Peak Flow Rate for each model calculated using Rational Lloyd Davies with a rainfall intensity of 50mm/hr. For greater flows - special design / construction required.

In-Line *SurfSep* Units (SWI)

These units are used with in the drainage system in-line and are supplied as BBA Approved complete Polyethylene Chamber units from the selection table above.

Off-Line *SurfSep* Units (SWO)

These can be designed either using pre-cast concrete or specially designed Polyethylene chambers.

Model Designation

SurfSep models are firstly identified by the letters SW for Surface Water followed by a letter (**I** or **O**) representing the configuration (**I**nline or **O**ffline).

A four digit number representing the screen diameter and screen height then follows to give the standard model designation for a *SurfSep* screen for installation into standard commercially available pre-fabricated manhole chambers i.e SWI 0806. Example: SWI 0806 designates Surface Water Inline with a separation screen dia 0.8 m and screen height of 0.6m.

Surface Water Treatment

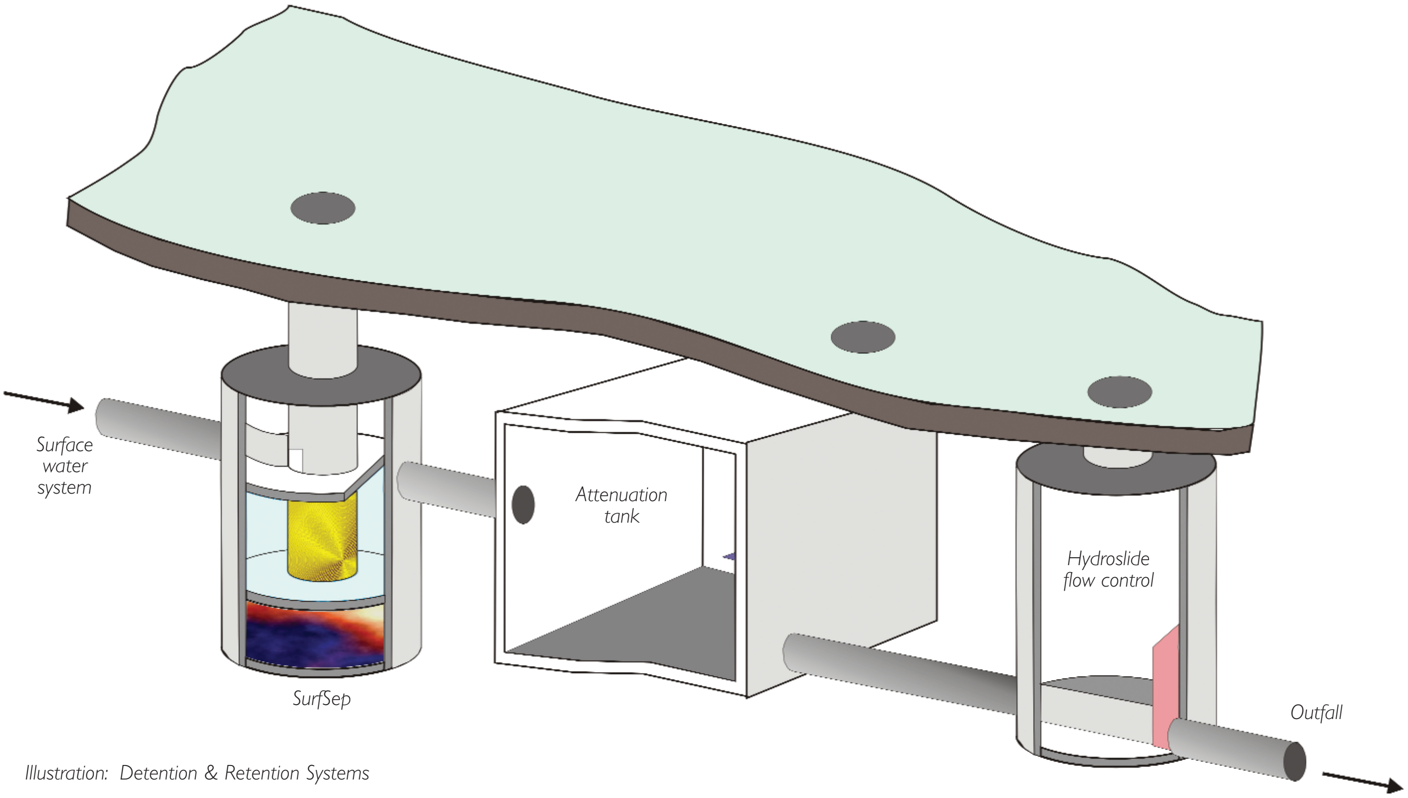


Illustration: Detention & Retention Systems

SurfSeps unit installed in front of attenuation tank / cellular storage system, to remove grit, fine sediments and floating debris which can accumulate within surface water systems. Hydroslide flow control regulating the discharge to the outfall. The Hydroslide can be supplied for installation in an insitu constructed chamber, or as a complete unit housed within a pre-fabricated polyethylene manhole chamber.

* BBA - THIS CERTIFICATE RELATES TO PIPEX UNIVERSAL MANHOLES AND ACCESS CHAMBERS, WHICH ARE MANUFACTURED FROM WELDED POLYPROPYLENE. This Certificate covers the use of the manholes and chambers for drain and sewer applications where they are used for maintenance to depths of 6 mtrs.

Approved Suppliers

If you would like more information please contact:

CDS Technologies is a multi disciplined, international, company offering a comprehensive product range of; wastewater treatment technologies and processes, and stormwater management solutions for attenuation, infiltration, flow control and overflow treatment. CDS have an established network of Distributors and Representatives. Further information can be found on our website www.cdstech.com.au
Alternatively please contact our approved supplier detailed left.

Unit Selection Design Guide

Overview

Hydro-Brake® Flow Controls restrict the flow in surface/storm water or foul/combined sewer systems by inducing a vortex flow pattern in the water passing through the device, having the effect of increasing back-pressure.

Their 'hydrodynamic' rather than 'physical restriction' based operation provides flow regulation whilst maintaining larger clearances than most other types of flow control, making them less susceptible to blockage. Their unique "S"-shaped head-flow characteristic also enables them to pass greater flows at lower heads, which can enable more efficient use of upstream storage facilities.

This document provides guidance relating to the selection and use of Hydro-Brake® Flow Controls for use in surface/storm water and foul/combined sewer systems.

The information provided here is intended for the purposes of general guidance only - individual application requirements may differ. If in doubt, or to enquire about new product additions, please contact HRD Technologies Ltd.

STH Range of Hydro-Brake® Flow Controls

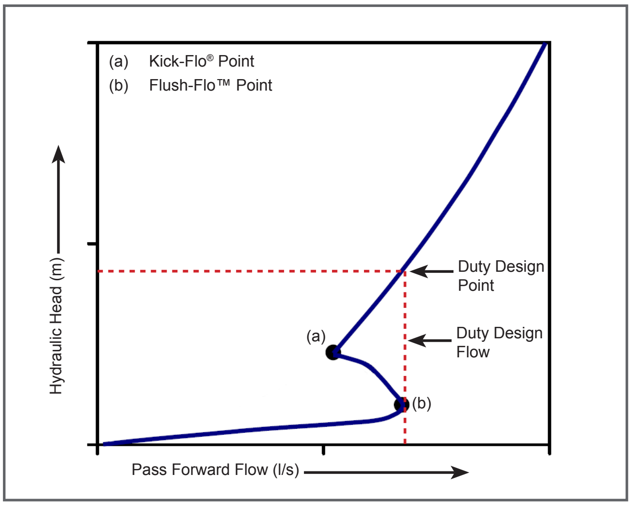
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

See back cover for details.

Hydraulic Characteristics and Specification

Hydro-Brake® Flow Controls should be selected such that the duty/design flow is not exceeded at any point on the head-flow curve, see illustration right. If this is not achievable using the initially selected unit, it may be appropriate to select an alternative option (see selection guidance overleaf).

While the primary aim of a flow control is to provide a particular flow rate at a given upstream head (giving a design/duty point), it is important to note that secondary opportunities, such as potential for optimised storage use, derive from consideration of the full hydraulic characteristic. It is therefore important to ensure that the same flow control, or one confirmed to provide equivalent hydraulic performance, is implemented in any final installation.



Typical Hydro-Brake® Head Versus Flow Characteristics

To ensure correct implementation a multiple design-point specification, defining the main hydraulic features of the selected flow control, can be provided by HRD Technologies Ltd. This should include at least the following information:

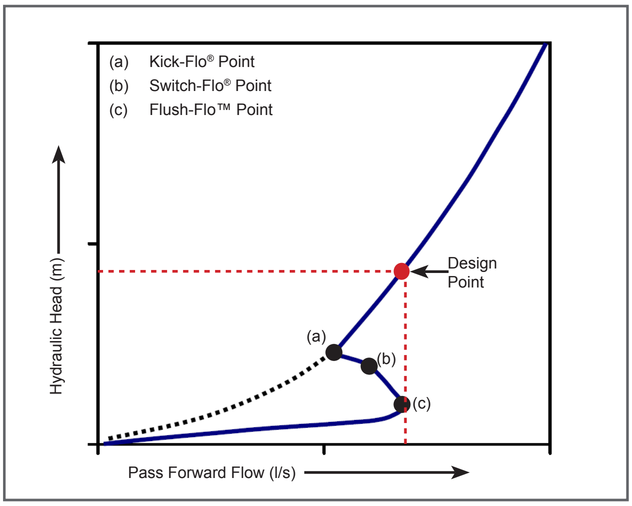
- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

To ensure that a drainage system performs as designed, it is strongly recommended that this information is reproduced on any technical specifications.

STH Type Hydro-Brake® Flow Control with BBA Approval

Now included in Win*Des*® W.12.6!

The new STH type Hydro-Brake® Flow Control range has a unique head / discharge performance curve which introduces a very important feature - the Switch-Flo® Point. This point illustrates the unique performance feature of the STH range which can lead to further savings in upstream storage, whilst also enabling increased inlet / outlet size to further reduce the risk of blockage.



Typical STH Head Versus Flow Characteristics

Kick-Flo® (a) - the point at which the vortex has initiated and at which the curve begins to return back to follow the orifice curve and reach the same design point or desired head / flow condition.

NEW Switch-Flo® (b) - marks the transition between the Kick-Flo® and Flush-Flo™, from vortex initiation to stabilisation. This point adds a new layer of resolution to the Hydro-Brake® curve that has implications to upstream storage savings.

Flush-Flo™ (c) - the point at which the vortex begins to initiate and have a throttling effect. This point on the Hydro-Brake® curve is usually much nearer to the maximum design flow (Design Point), than other vortex flow controls leading to more water passing through the unit during the earlier stages of a storm, thus reducing the amount of water that needs to be stored upstream.

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

STH Range of
Hydro-Brake® Flow Controls

The STH Hydro-Brake® Flow Control is the only vortex flow control available today that has been given the prestigious BBA Approval Certificate. The BBA assessment procedure entails rigorous assessment of production and manufacturing standards, and confirms that the hydraulic performance of the Hydro-Brake® Flow Control matches the data given to designers by HRD Technologies with their head / discharge curves.

A worked example showing the steps to model a Hydro-Brake® Flow Control and associated Stormcell® Storage System within Micro Drainage Win*Des*® is available on our website:

www.hrdtec.com

Take a Look at Our New Stormwater Web Resource

Engineering Nature's Way™

www.engineeringnaturesway.co.uk

Engineering Nature's Way is a brand new resource for people working with Sustainable Drainage and flood management in the UK.

The site provides an opportunity to share news, opinion, information and best practice for people working in local and central Government; developers, consulting engineers and contractors. Do you have something to share? We would be delighted to receive your contributions.

turning water around ...®

HRD Technologies Ltd • Tootenhill House • Rathcoole • Co. Dublin • Ireland
Tel: +353 (0) 1 4013964 • Fax: +353 (0) 1 4013978 • www.hrdtec.com
HRD Technologies Ltd is a subsidiary of Hydro International plc

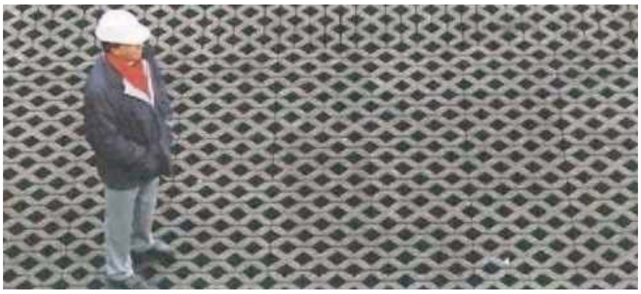
KPC | UK & ROI

Killeshal Precast Concrete

TRUSTED SINCE 1969

UK tel: 0800 0393367 - Rep. Irl tel: 057 9353018

grass blocks



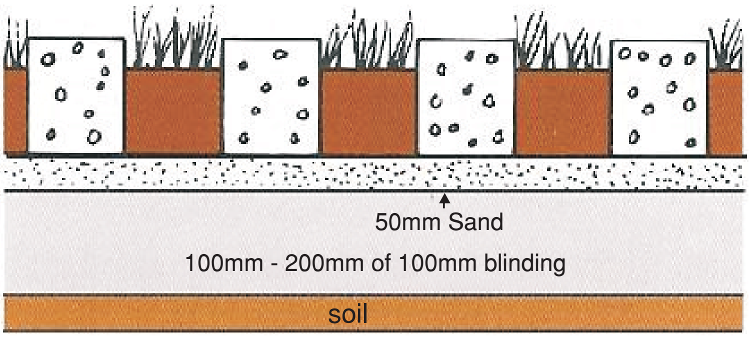
Environmental awareness now plays a significant part in the modern build environment to meet the needs of architects, engineers and planners, we offer a system that will overcome the problems of soil erosion, soil retention, armouring verges and preserving banks on waterways and road ways in an aesthetic and ecological manner.

KPC Grass Blocks provide:

- hard standing
- erosion control
- ground armouring
- access paths and parking in environmentally sensitive areas

INSTALLATION

As with any surfacing system the sub-base is most important in achieving a stable and level finish. The drawing bellow shows typical detail but will vary, naturally, depending on local ground conditions. Roll the sub-base until firm, then screed 50mm layer of sand on top, place units and tamp down. Then fill the grass block cavities to 20-40mm below the surface with good quality soil and seed. Allow 3-6 weeks for grass to take hold.



UK site

RoI site

standard grass blocks

Turfstone is a ground reinforcement grass paving system ideally suited to projects where a hard surface capable of supporting vehicles is required within a grassed area or other space where a naturalistic appearance is preferred. It functions as a SUDS permeable pavement, controlling surface water at source by directing it to the sub-layers.

Turfstone provides a low cost paving option with minimal visual impact. Its honeycombed cavities are designed to facilitate the growth of grass within a supporting concrete matrix, allowing grass to be cut in the conventional manner.

Each element weighs approximately 35kg and so we recommend machine-aided installation to comply with manual handling regulations. Special lifting aids that can be attached to excavators, tele-handlers and cranes are readily available.

product specifications

Product type	Concrete paving block
Manufactured to	BS EN 1338:2003
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Strength	> 3.5MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533-3:2005
NSSPlus	Q25 800
Applications	Residential and Commercial when used in conjunction with the correct sub-base design in accordance with the latest British standard.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint (Approved by the Carbon Trust)	24kgCo^{2}e/m^2
Recyclable	100% of this product can be recycled
Manufacturing location	Produced in the UK with locally sourced materials
breeam rating	**A** (In accordance with the Green Guide to Specification, 2nd edition 2009) **A+** (can be achieved when used with recycled sub-base, in accordance with the Green Guide to Specification, 2nd edition 2009) www.bre.co.uk
Complementary kerbs	Country Kerb, Half Battered

Typical uses include:

- Off-street residential parking
- Vehicular access for occasional usage i.e. ?re lanes, utility access
- Overspill commercial or retail parking
- Occasional parking for cricket clubs, schools, churches, caravan parks, cemeteries etc.
- Nature reserves, sensitive heritage sites and country parks
- Environmental erosion control areas such as riverbanks and waterways
- Road verges
- Field entrances and farm tracks
- SUDS schemes

product information

size (mm)	colours available	in stock	m^2 per bale	m^2 per slice	no. per m^2	no. per bale	weight (kg) per bale
600 x 400 x 100	Natural	YES	7.68	3.84	4.17	32	1070

UK site

RoI site

scs integra and agrablock

The SUDS Concept

SCS INTEGRA & AGRABLOCK are both key products within a sustainable urban drainage system (SUDS). The porous paving allows the efficient attenuation, infiltration and treatment of stormwater runoff at or near its source, in accordance with current Best Management Practices (BMPs). They are ideal products for grass and gravel reinforcement.

The Products

Made in the EU from 100% recycled polymers, SCS INTEGRA & AGRABLOCK are modular units which work in conjunction with neighbouring units to create an exceptionally durable, permanently porous, high load bearing structure when infilled with either grass or natural aggregate.

Applications

SCS INTEGRA is a Heavy Duty system, whereas SCS AGRABLOCK is a Medium Duty system for grass and gravel reinforcement. These systems are ideal for the following typical applications:

Demarcation Blocks

These are used to delineate parking spaces within car parking areas. Four individual blocks are used to form a simple "T" or alternatively this "T" can be extended to create a series of dotted lines running the length of the parking bay (see photo) requiring eighteen blocks per bay.

Special Applications

Slopes

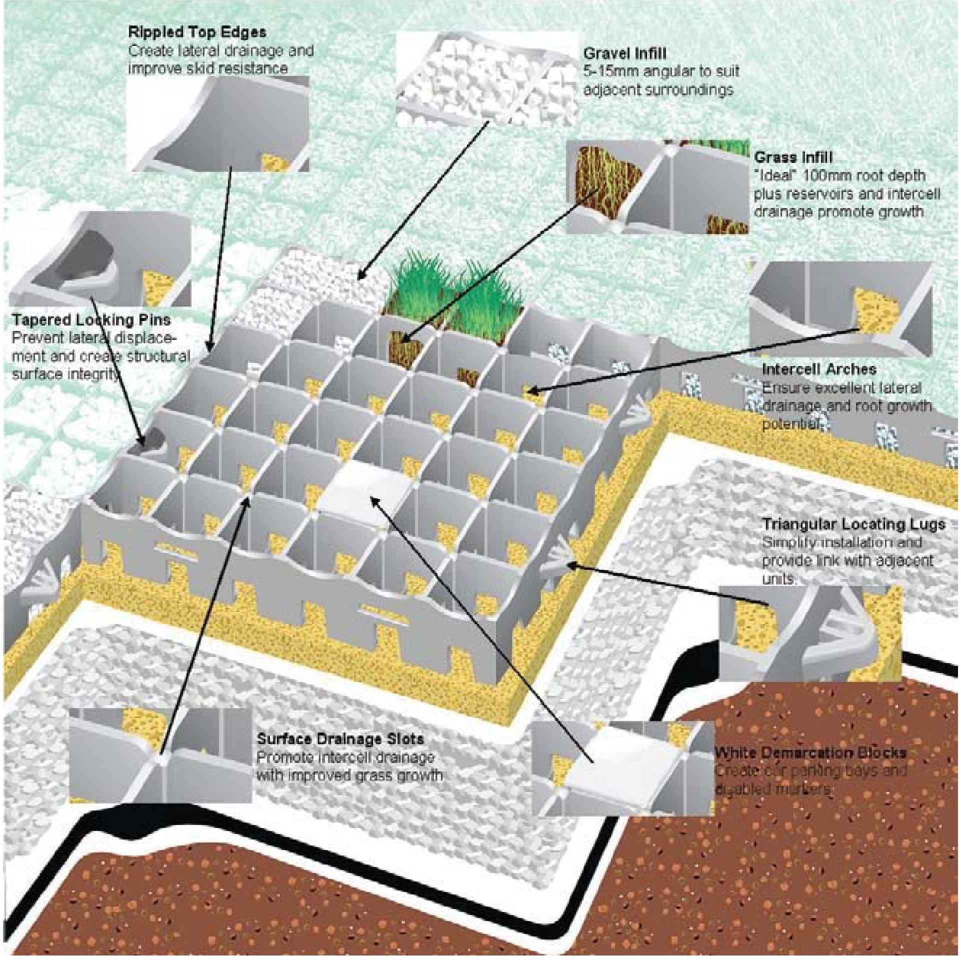
SCS INTEGRA and AGRABLOCK can be laid on slopes of up to 15 degrees without additional staking. Where SCS Agrablock is used on the underside of a bridge abutment (e.g. to comply with the HSE recommended limits) every unit should be staked and the sand bed stabilised with a 12:1 cement mix on the 40 - 45 degree slope.

Disabled Parking Bays:

SCS INTEGRA and SCS AGRABLOCK are suitable for installation in disabled access areas. A disabled bay sign can easily be created using the Demarcation Blocks (please ask for data sheet).

HGV Areas:

The SCS INTEGRA system is able to withstand slow moving HGV's (roadside lay-bys etc) but in common with most plastic grid systems should NOT be used in turning areas or where HGV's will scrub the product by the use of power steering.



scs integra and agrablock

SUDS - The Principle

SUDS are physical structures built to receive surface water runoff, normally in the form of infiltration or attenuation solutions. They also provide treatment of surface water by sedimentation, filtration, absorption and bio-degradation. Research shows that up to 80% of sediment; 60% of phosphorous and; 80% of nitrogen can be removed from rainwater through porous paving, together with substantial levels of heavy metals and hydrocarbons.

Design Details - SUDS

Associated with porous paving:

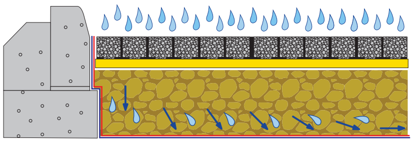
Attenuation

Used when direct infiltration is not appropriate and when water storage is required.

This shows SCS INTEGRA, infilled with grass or natural aggregate, installed on a layer of sand/grit on an SCS GT geotextile separation/filtration layer. Beneath this is a voided sub-base wrapped in an SCS GM Geomembrane. Collected runoff is discharged via an appropriate SCS storage device (SCS Aquavoid) positioned within or below the sub-base and sealed where it exits the geomembrane storage reservoir.

TYPICAL ATTENUATION SYSTEM

Rainfall enters porous Integra/Agrablock surface



Water passes through porous surface and is directed by the geomembrane to storage or sewer

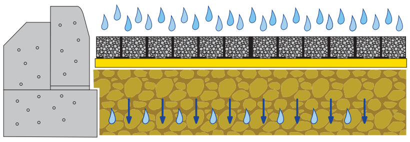
Infiltration

Used whenever possible, subject to appropriate soil conditions and environmental considerations.

This shows SCS INTEGRA infilled with grass or natural aggregate, installed on a layer of sand/grit on an SCS GT geotextile separation/filtration layer. Beneath this is a sub-base which is encapsulated within another SCS GT geotextile separation/filtration layer. Collected runoff is allowed to permeate naturally, through the geotextile separation/filtration layer, into the sub-grade eliminating the need for a positive discharge facility.

TYPICAL INFILTRATION SYSTEM

Rainfall enters porous Integra/Agrablock surface



Water passes through porous surface and is directed by the geomembrane to storage or sewer

APPLICATIONS	INTEGRA	AGRABLOCK
Park & Ride Schemes	✓	✖
Commercial Car Parks	✓	✖
Overflow Car Parks	✓	✓
Helipads	✓	✓
Paths & Bridleways	✓	✓
Light Aircraft Taxiways	✓	✖
Domestic Driveways	✓	✓
Golf Buggy Paths	✓	✓
Caravan Parks	✓	✓
Emergency Access	✓	✖
Verge Reinforcement	✓	✖
Stables	✓	✓
Bank Stabilisation	✓	✓
Under Bridges	✖	✓

PRODUCT DATA	SCS INTEGRA	SCS AGRABLOCK
Nominal Size	500mm x 500mm +0/-2%	500mm x 500mm +0/-2%
Thickness of Unit	70mm	40mm
Unit Weight	1.8Kg	1.1Kg
Colour	Black	Black
Infiltration Rate	>5,000mm/hr	>5,000mm/hr
Run Off Coefficient	0.05 - 0.25	0.05 - 0.25
Lateral Drainage Void Ratio	>20%	>12%
Infill Surface Area	>90%	>90%
Compressive Strength (Filled)	2,400kN/m^2	1,780kN/m^2
Pallet Size	1m x 1m x 1.2m	1m x 1m x 1.2m
Pallet Weight	210Kg	130Kg


Helipads & Aircraft Taxiways


Emergency


Equestrian Areas & Stables

Paving Surfaces - Installation

Subgrade

Excavate to formation level as indicated on the drawing, providing a minimal (1:30 - 1:100) fall to the drainage system. Compact subgrade, using either a vibrating roller or plate, making good soft spots with suitable material.

Sub-base For Infiltration Surfaces

Use granular material (crushed gravel, rock or concrete) as specified - for SUDs schemes this must be free draining. Install the designed depth of sub-base as specified, in 200mm layers compacting each layer (vibratory plate, type DVP 75/22”). Overlay the sub-base with the specified SCS GT 1900 geotextile (essential to prevent migration), overlapping joints by 200mm.

Bedding Layer

Lay, screed and compact to a 30mm depth of appropriate bedding layer material (sharp sand or 5mm grit). Selection of the bedding layer material is dependant upon the application. For grass reinforcement mix the bedding layer 4:1 with a good quality top soil to ensure good root growth.

Wearing Course

SCS INTEGRA & AGRABLOCK should be laid on a 45 degree face such that each modular unit abuts its neighbouring units, with the triangular locating lugs fitting within the corresponding slots. As laying progresses each unit should be pinned (4 per unit) together with the pins supplied and the specified root zone/grass seed infill material or natural aggregate should be used to infill each cell such that a continuous, permanently porous, high load bearing structure is created.

Infill Materials (sand and soil mix/aggregate)

The selected infill material should be specified on a project specific basis based on the application and design, but the following could act as a guide:

For Sand Bed: A good quality compacted silica sharp sand should be used, of approximately 30mm thickness after compaction; alternatively a 5mm grit is also suitable if required.

For Gravel Fill: Aggregate size should be 5 - 15mm angular gravel and if adjacent to schools should ideally be 10mm single sized crushed rock. The use of an angular gravel rather than a river washed gravel will aid compaction and prevent migration from the units.

For Grass Fill: A good quality topsoil should be used to infill the units to the top and allowed to settle (5 - 7mm); grass seeding followed by a top dressing of a good quality fertiliser should ensure adequate grass growth. Seeded areas must be watered regularly for a period of 6 weeks following installation and traffic kept off the area until grass growth is established.

Maintenance: For gravel areas; an occasional sweeping of any overfill back into the units. If gravel appears to be sinking check for the installation of the geotextile.

For grass areas; once grass is established the area can be trafficked and a normal mowing regime resumed. If infill appears to be sinking top up with loam mix and check for presence of geotextile.

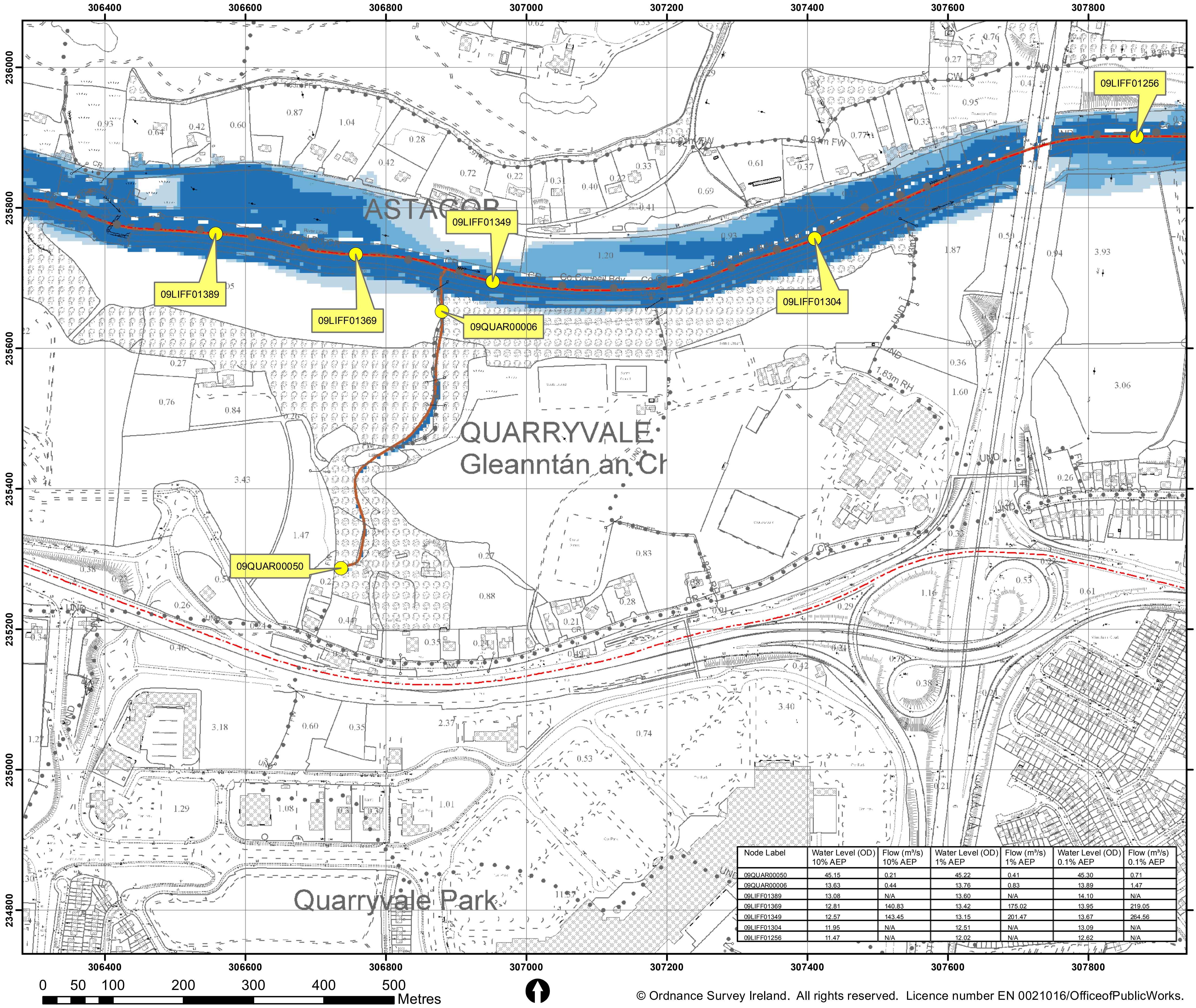

Overflow & Temporary Parking


Driveways and Gravel Areas

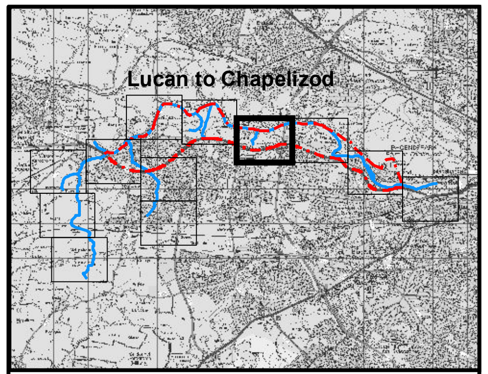

Park & Rides & General Parking

APPENDIX D

Flood Map



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09QUAR00050	45.15	0.21	45.22	0.41	45.30	0.71
09QUAR00006	13.63	0.44	13.76	0.83	13.89	1.47
09LIFF01389	13.08	N/A	13.60	N/A	14.10	N/A
09LIFF01369	12.81	140.83	13.42	175.02	13.95	219.05
09LIFF01349	12.57	143.45	13.15	201.47	13.67	264.56
09LIFF01304	11.95	N/A	12.51	N/A	13.09	N/A
09LIFF01256	11.47	N/A	12.02	N/A	12.62	N/A



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- ■ 10% Fluvial AEP Event
- ■ 1% Fluvial AEP Event
- ■ 0.1% Fluvial AEP Event
- — Modelled River Centreline
- ▭ AFA Extents
- ● Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map:
Lucan to Chapelizod Fluvial Flood Extents

Map Type: EXTENT
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : C.C. Date : 27 July 2016
Checked By : S.P. Date : 27 July 2016
Approved By : G.G. Date : 27 July 2016

Drawing No. :
E09LUC_EXFCD_F0_09

Map Series : Page 9 of 12

Drawing Scale : 1:5,000 @ A3

APPENDIX E

Infiltration Test Results

CAUSEWAY
GEOTECH

APPENDIX G

INFILTRATION TEST RESULTS

CAUSEWAY GEOTECH

Project No.: 19-0848	**Project Name:** St Edmund's, Lucan		**Trial Pit No.:** **SA01**
Co-ordinates: 306200.57 E 235015.04 N	**Client:** Corcom Developments		Sheet 1 of 1
Method: Soakaway	**Client's Representative:** Kavanagh Burke Consulting Engineers		**Scale:** 1:25
Plant: 8T Tracked Excavator	**Ground Level:** 61.86 mOD	**Date:** 09/05/2019	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.45)	▩	MADE GROUND: Dark grey very sandy very silty angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	
			61.41	0.45	▤	Stiff light brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of siltstone.	
				(0.75)			
			60.66	1.20		End of trial pit at 1.20m	

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

Remarks

Terminated at scheduled depth.

Water Strikes:

Struck at (m):	Remarks:

Stability: Stable

Width: 0.25

Length: 1.20

Soakaway Infiltration Test

Project No.: 19-0103
Site: St.Edmund's Lucan
Test Location: ST01
Test Date: 30 April 2019

Analysis using method as described in BRE Digest 365 and CIRIA Report C697-The SUDS Manual

	width (m)	length (m)
test pit top dimensions	0.25	1.20
test pit base dimensions	0.25	0.50

test pit depth (m) 1.20

depth to groundwater before adding water (m) = Dry

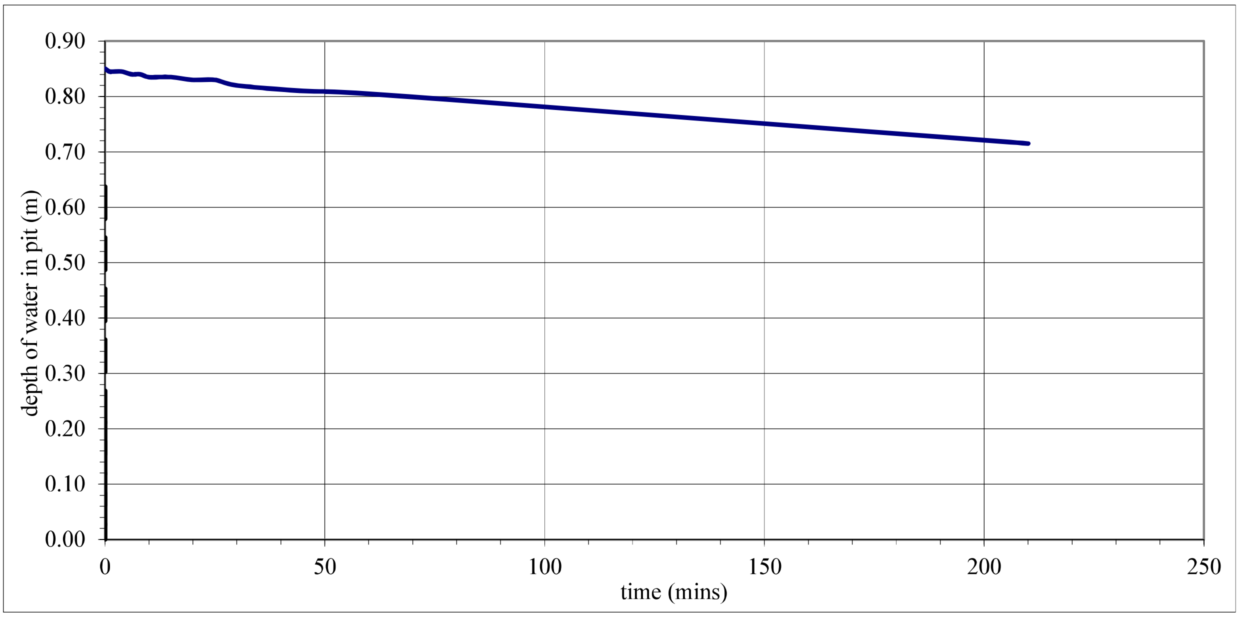
time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.35	0.85
1	0.36	0.85
2	0.36	0.85
4	0.36	0.85
6	0.36	0.84
8	0.36	0.84
10	0.37	0.84
15	0.37	0.84
20	0.37	0.83
25	0.37	0.83
30	0.38	0.82
45	0.39	0.81
60	0.40	0.81
210	0.49	0.72

From graph below:
test start - 75% depth at
0.6375 m water depth
time is not determined

test end - 25% depth at
0.2125 m water depth
time is not determined

infiltration rate (q) is very low

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m^3)	Area of walls and base at 50% drop (m^2)	q (m/min)	q (m/h)
	0.56	0.6375					
	0.99	0.2125					



CAUSEWAY GEOTECH	**Project No.:** 19-0848	**Project Name:** St Edmund's, Lucan	**Trial Pit No.:** **SA02**
	Co-ordinates: 306223.55 E 235012.27 N	**Client:** Corcom Developments	Sheet 1 of 1
Method: Trial Pitting		**Client's Representative:** Kavanagh Burke Consulting Engineers	**Scale:** 1:25
Plant: 8T Tracked Excavator	**Ground Level:** 62.17 mOD	**Date:** 09/05/2019	**Logger:** RS

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			62.02	(0.15) 0.15	▨	MADE GROUND: Dark grey very sandy very silty angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	
			60.97	(1.05) 1.20	▨	Stiff light brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of siltstone.	
						End of trial pit at 1.20m	

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

Remarks

Terminated at scheduled depth.

Water Strikes:

Struck at (m):	Remarks:

Stability:
Stable

Width: 0.25
Length: 1.20

Soakaway Infiltration Test

Project No.: 19-0103
Site: St.Edmund's Lucan
Test Location: ST02
Test Date: 30 April 2019

Analysis using method as described in BRE Digest 365 and CIRIA Report C697-The SUDS Manual

	width (m)	length (m)
test pit top dimensions	0.25	1.20
test pit base dimensions	0.25	0.40

test pit depth (m) 1.20

depth to groundwater before adding water (m) = Dry

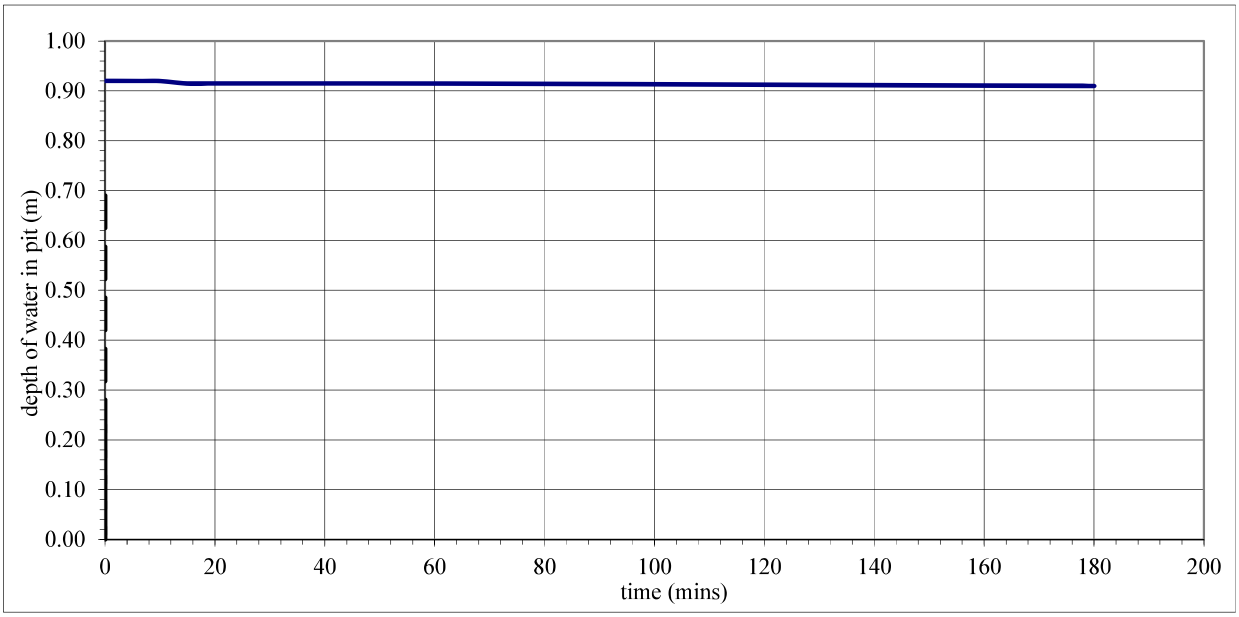
time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.28	0.92
1	0.28	0.92
2	0.28	0.92
4	0.28	0.92
6	0.28	0.92
8	0.28	0.92
10	0.28	0.92
15	0.29	0.92
20	0.29	0.92
25	0.29	0.92
30	0.29	0.92
45	0.29	0.92
60	0.29	0.92
180	0.29	0.91

From graph below:
test start - 75% depth at
0.69 m water depth
time is not determined

test end - 25% depth at
0.23 m water depth
time is not determined

infiltration rate (q) is very low

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m^3)	Area of walls and base at 50% drop (m^2)	q (m/min)	q (m/h)
	0.51	0.69		0.08	0.87		
	0.97	0.23					



APPENDIX F

Irish Water Pre-Connection Enquiry – Confirmation Letter

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

Declan O' Sullivan

Kavanagh Burke Consulting Eng.

Unit F3, G3 Calmount Park
Ballymount
Dublin 12

14 July 2021

Re: CDS21001902 pre-connection enquiry - Subject to contract | Contract denied

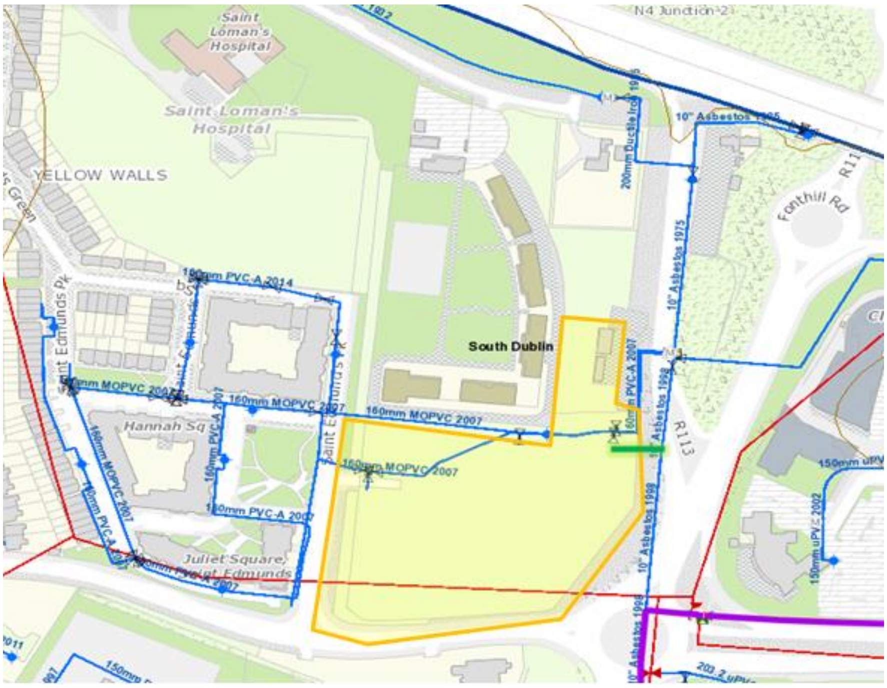
Connection for Multi/Mixed Use Development of 326 units at Corner Site, St. Edmunds, Dublin

Dear Sir/Madam,

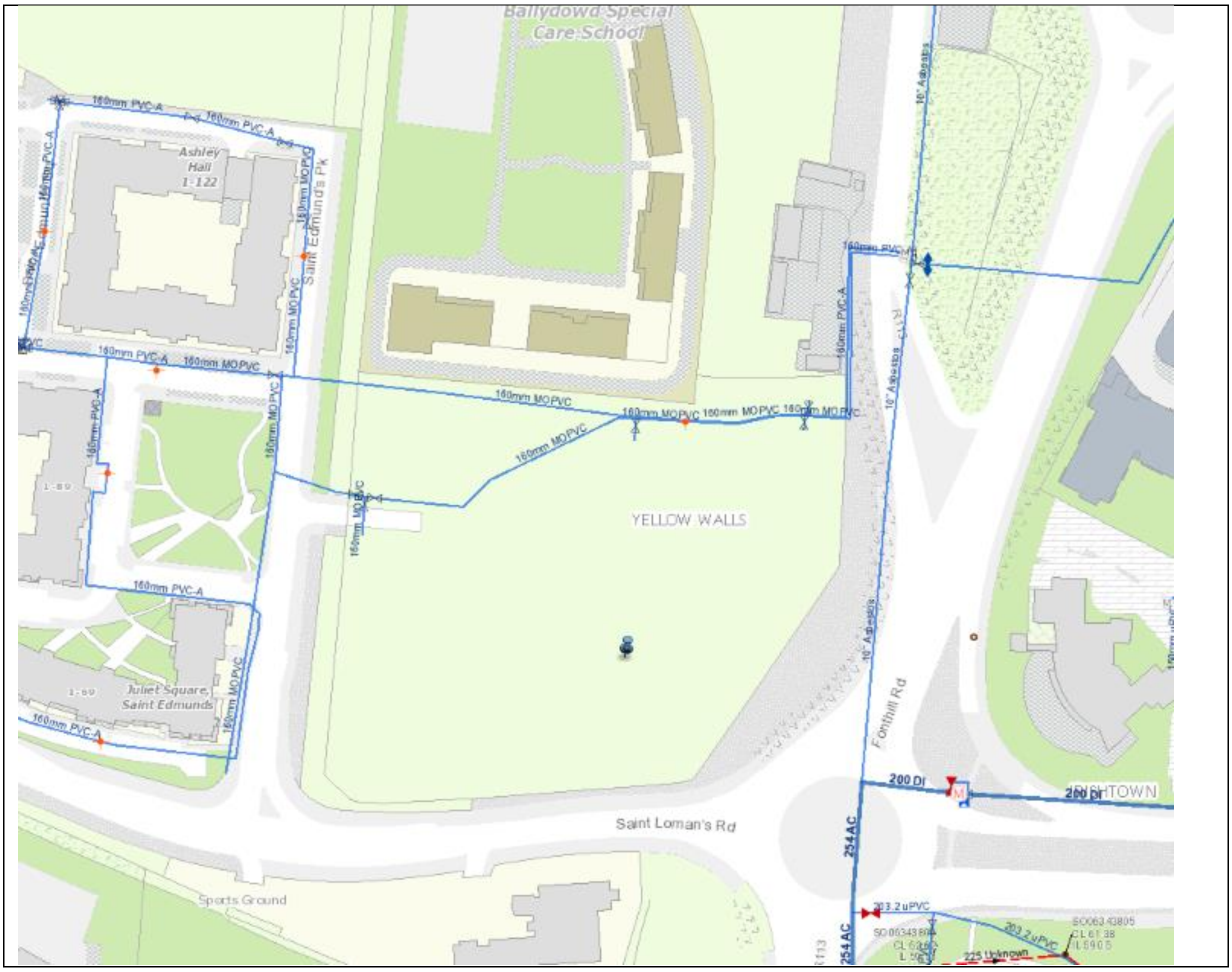
Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Corner Site, St. Edmunds, Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the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

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	The connection main should be 200mm ID pipe (green line in figure below) supplied from existing 10'' AC main in R113 Road. On site water storage will be required, for the average day peak week demand rate of the commercial section, for 24-hour period with 12- hour re-fill time. The proposed development indicates that Irish Water infrastructure is present on the site. The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the infrastructure during and after the works. Drawings (showing clearance distances, changing to ground levels) and Method Statements should be included in the Detailed Design of the

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363
IW-HP-BUS
REV012

<table>
<tr><td></td><td>Development. A wayleave in favour of Irish Water will be required over the infrastructure that is not located within the Public Space. For design
submissions and queries, related to diversion/build near or over, please contact IW Diversion Team via email address diversions@water.ie
 </td></tr>
<tr><td>Wastewater Connection</td><td>The proposed wastewater connection for this development connects to the Irish Water network via infrastructure that has not been taken in charge by Irish Water (Third Party Infrastructure). Please be advised that at connection application stage and prior to the commencement of any Self-Lay Works, you have to:
• identify and procure transfer to Irish Water of the arterial infrastructure within the Third-Party Infrastructure
• demonstrate that the arterial infrastructure is in compliance with requirements of Irish Water Code of Practice and Standard Details and in adequate condition and capacity to cater for the additional load from the Development.</td></tr>
<tr><td colspan="2">The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.</td></tr>
</table>

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



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

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

General Notes:

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

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

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

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations

APPENDIX G

Irish Water Design Submission – Confirmation Letter

Pablo Bussi
Kavanagh Burke Consulting Engineers
Unit F3 Calmount Park
Ballymount
Dublin 12

8 December 2021

Re: Design Submission for Strategic Housing Development at Corner Site, St.Edmunds, Saint Lomans Road, Dublin 20 (the "Design Submission") / Connection Reference No:483315954

Dear Pablo,

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

- [D1621 D3 Watermain Layout & Swept Paths Rev PL17]
- [D1621 D1 Drainage Layout Sheet 1 of 2 Rev PL16]
- [D1621 D4 Longitudinal Sections Trough Foul Sewer Drainage Rev PL16]

Standard Details/Code of Practice Exemption:

The water network is subject to a separate diversions agreement.

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.

A0

FOR WATERMAIN DETAILS, FOUL SEWER DETAILS, AND ALL ASSOCIATED WORKS DETAILS REFER TO IRISH WATER DETAILS AND IRISH WATER CODE OF PRACTICE FOR WATER AND WASTEWATER INFRASTRUCTURE:

- IW-CDS-5020-1
- IW-CDS-5020-3
- IW-CDS-5030-1
- IW-CDS-5030-3

WATERMAIN PIPE MATERIAL TO COMPLY WITH SECTION 3.9 OF IW CODE OF PRACTICE FOR WATER INFRASTRUCTURE:

3.9 Materials Selection: Mains and Service Connections

Water Mains suitable for Works and approved by Irish Water shall be either ductile iron (DI) or polyethylene (PE), with PE80 or PE100 rating (MDPE, HDPE or HPPE). All plastic water pipes shall be blue in colour. U-PVC pipes shall not be used on water supply networks, unless a compelling reason is provided for its use.

By exception other materials may be considered but these will require specific Irish Water agreement and written approval. Such materials would include MoPVC and CPE/PVC alloys. The risk of impact of contaminated ground on pipe materials should be a determining factor in the choice of the pipe material selection.

3.9.1 ***Ductile Iron (DI)*** pipes shall conform to IS EN 545 and shall have a minimum C40 pressure rating. Ductile Iron fittings shall have 16 bar rating at least. All ductile iron pipework shall be coated internally with a blast furnace cement lining which complies with the requirements of BS 6920. External protection shall include an alloy of zinc and aluminium, with a minimum 15% aluminium, with or without other materials, having a mass of 400 g/m2 complete with a finishing layer of blue fusion bonded epoxy in accordance with IS EN 14901.

3.9.2 MDPE and HDPE pipes shall be of a type PE-80 and have an SDR-11 or SDR-17 rating. They shall conform to iS EN 12201: Part 1 and Part 2 (Plastic Systems for Water Supply, Drainage and Sewerage Under Pressure - Part 1, General, and Part 2, Pipes) and I.S. EN 12201-3 (Plastic Systems for Water Supply, Drainage and Sewerage Under Pressure - Part 3: Fittings).

3.9.3 HPPE pipes shall be of a type PE-100 and have an SDR-11 or SDR-17 rating. They shall conform to IS EN 12201: Part 1 and Part 2 (Plastic Systems for Water Supply, Drainage and Sewerage Under Pressure - Part 1, General, and Part 2, Pipes) and I.S. EN 12201-3 (Plastic Systems for Water Supply, Drainage and Sewerage Under Pressure - Part 3: Fittings).

Polyethylene pipes shall also conform to the following UK Water Industry Specifications (WIS):

3.9.4 4-32-08 - Specification for the fusion jointing of polyethylene pressure pipeline systems using PE80 and PE100 materials,

3.9.5 4-32-16 - Specification for Butt Fusion Jointing Machines,

3.9.6 4-32-19 - Specification for polyethylene pressure pipeline systems with an aluminium barrier layer for potable water supply in contaminated land,

3.9.7 IGN 4-01-03 - Pressure Testing of Pressure Pipes and Fittings for use by Public Water Supplies

In exceptional circumstances, where specific Irish Water approval is provided to the use of ***MoPVC*** pipes, they shall conform to the UK Water Industry Specification No. 4-31-08 and ISO 16422, and manufacturers shall operate a quality system in compliance with BS EN ISO 9001.

In exceptional circumstances, where specific Irish Water approval is provided to the use of ***CPE/PVC*** alloy pressure pipes, they shall conform to bS PAS 27. All fittings shall conform to this standard also.

Service Connection pipes suitable for Works shall be of ***MDPE*** or ***HDPE*** (PE-80) material with SDR-11 or SDR-17 rating. All plastic water Service Connection pipes shall be blue in colour. ***(HPPE*** (PE-100) material with SDR-11 and SDR-17 rating may also be used though this pipe is less flexible.) An alternative pipe material, to Irish Water's written approval, shall be provided where pressure in the Works is greater that the performance rating of these materials. The ***MDPE, HDPE*** and ***HPPE*** service pipes shall comply with IS EN 12201 Part 2 (Plastic Systems for Water Supply, Drainage and Sewerage Under Pressure - Part 2, Pipes) and IS EN 12201 Part 3 (Plastic Systems for Water Supply, Drainage and Sewerage Under Pressure - Part 3: Fittings) and with UK WIS 4-32-08 (Specification for the fusion jointing of polyethylene pressure pipeline systems using PE80 and PE100 materials).

The Customer shall determine the Pressure Class of pipe that is required having regard to the pressure at the connection point and the maximum in-service operating pressure. The sizing of service connections to any premises and the approval of fittings for this purpose must be obtained in advance from Irish Water.

Jointing of pipes should be carried out in accordance with the requirements of the Standards associated with the pipe material selected.

LEGEND:

EXISTING WATER MAIN TO BE REMOVED	‐ ‐ ‐
EXISTING WATER MAIN	— — —
NEW WATERMAIN WITH PROPOSED SLUICE VALVES, ISOLATION VALVES FIRE HYDRANTS AND BOUNDARY BOXES	WM HYDRANT WM BB SV WM IV
TOPOGRAPHICAL SURVEY DATA	——
DENOTES ROAD SURFACING	■
DENOTES FOOTPATH SURFACING	▨
DENOTES PERMEABLE FOOTPATH	🟨
DENOTES PERMEABLE WALKWAY	🟦
DENOTES PERMEABLE PARKING SPACE	🟥
DENOTES BIO-RETENTION AREA -TREE PIT WITH WATERING FACILITATED BY STORM WATER RUNOFF FROM THE CARRIAGEWAYS	▦
DENOTES GREEN ROOFS	🟩
DENOTES PUBLIC OPEN SPACE / LANDSCAPE	▢
DENOTES GREEN ROOFS OVER CARPARK	▨
DENOTES GRASSCRETE FOOTPATH	🟩
DENOTES TYPICAL ROOF TO ARCH DESIGN	🟫
DENOTES PUMPING APPLIANCE SWEPT PATH	Pumping Appliance
DENOTES DB32 REFUSE VEHICLE SWEPT PATH	DB32 Refuse Vehicle

Mark	Date	By	Chk.	App.	Revision
PL17	15-12-2021	PB	BK	DOS	UPDATED 150Ø PROPOSED WATERMAIN TO 200Ø.
PL16	06-12-2021	PB	BK	DOS	WATERMAIN DESIGN MOFIDIED ACCORDINGLY TO IW.
PL14	02-12-2021	PB	BK	DOS	ISSUED FOR PLANNING. REVIEWED ACCORDING TO SDCC.
PL13	30-11-2021	PB	BK	DOS	ISSUED FOR PLANNING. ADJUSTMENT OF SWALES.

Drawing Status
PLANNING

Job Title
RESIDENTIAL DEVELOPMENT
@ ST. EDMUNDS PHASE 3,
PALMERSTOWN,
DUBLIN 20

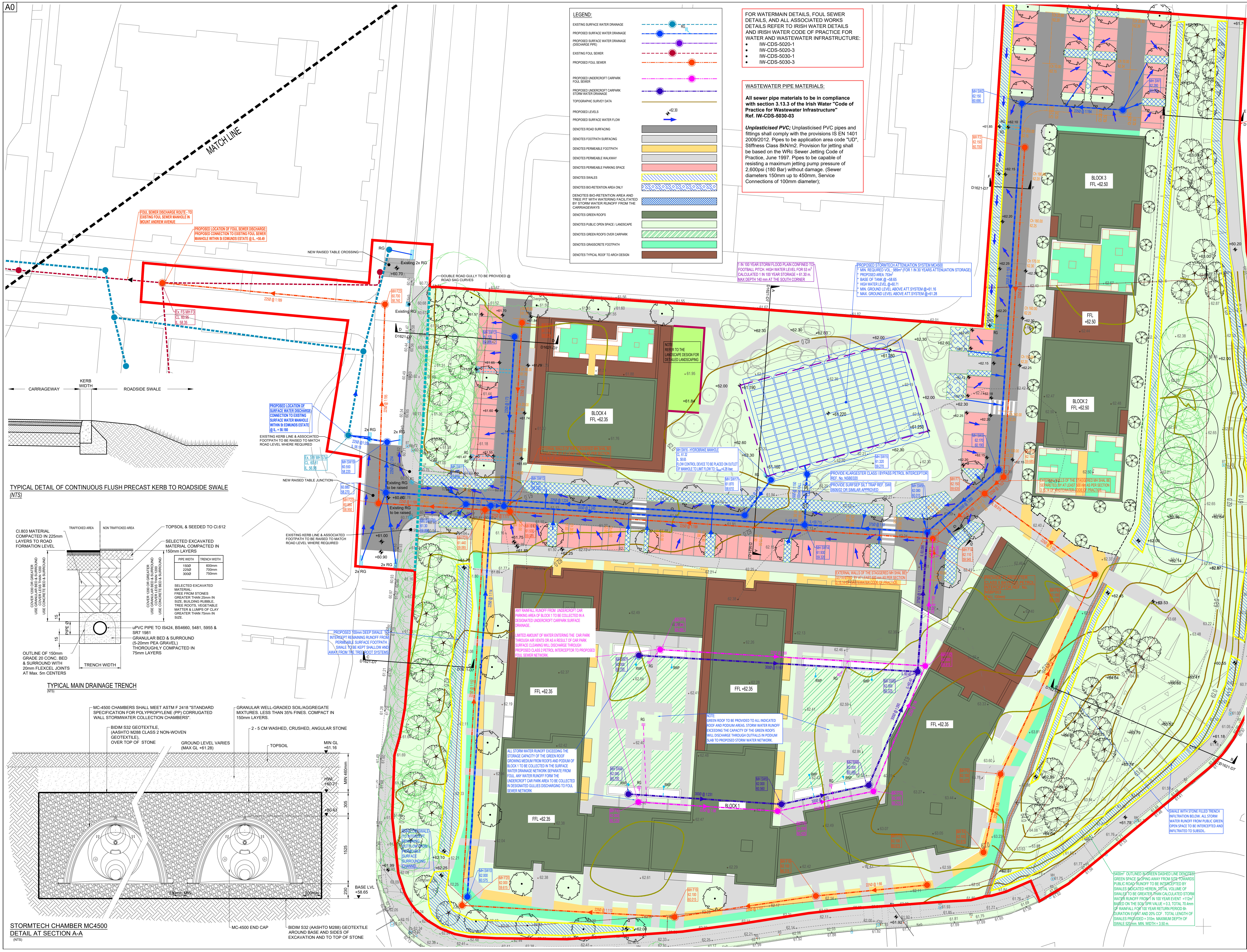
Drawing Title
WATERMAIN LAYOUT &
SWEPT PATHS

Architect/Client
MOYKERR LIMITED

KAVANAGH BURKE
CONSULTING ENGINEERS
Tel. 01 – 450 0694
Fax. 01 – 426 4340
Email: pkavanagh@kavanaghburke.ie
Unit G3, Calmount Pk.
Ballymount,
Dublin 12.

Drn PB
Checked BK
Approved DOS
Scales 1:250
Date December 2021
Job No. D1621
Drawing No. D3
Rev. PL17

A0



LEGEND:

- EXISTING SURFACE WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE (DISCHARGE PIPE)
- EXISTING FOUL SEWER
- PROPOSED FOUL SEWER
- PROPOSED UNDERCROFT CARPARK FOUL SEWER
- PROPOSED UNDERCROFT CARPARK STORM WATER DRAINAGE
- TOPOGRAPHIC SURVEY DATA
- PROPOSED LEVELS +62.30
- PROPOSED SURFACE WATER FLOW
- DENOTES ROAD SURFACING
- DENOTES FOOTPATH SURFACING
- DENOTES PERMEABLE FOOTPATH
- DENOTES PERMEABLE WALKWAY
- DENOTES PERMEABLE PARKING SPACE
- DENOTES SWALES
- DENOTES BIO-RETENTION AREA ONLY
- DENOTES BIO-RETENTION AREA AND TREE PIT WITH WATERING FACILITATED BY STORM WATER RUNOFF FROM THE CARRIAGEWAYS
- DENOTES GREEN ROOFS
- DENOTES PUBLIC OPEN SPACE / LANDSCAPE
- DENOTES GREEN ROOFS OVER CARPARK
- DENOTES GRASSCRETE FOOTPATH
- DENOTES TYPICAL ROOF TO ARCH DESIGN

FOR WATERMAIN DETAILS, FOUL SEWER DETAILS, AND ALL ASSOCIATED WORKS DETAILS REFER TO IRISH WATER DETAILS AND IRISH WATER CODE OF PRACTICE FOR WATER AND WASTEWATER INFRASTRUCTURE:

- IW-CDS-5020-1
- IW-CDS-5020-3
- IW-CDS-5030-1
- IW-CDS-5030-3

WASTEWATER PIPE MATERIALS:

All sewer pipe materials to be in compliance with section 3.13.3 of the Irish Water "Code of Practice for Wastewater Infrastructure" Ref. IW-CDS-5030-03

Unplasticised PVC; Unplasticised PVC pipes and fittings shall comply with the provisions IS EN 1401 2009/2012. Pipes to be application area code "UD", Stiffness Class 8kN/m2. Provision for jetting shall be based on the WRc Sewer Jetting Code of Practice, June 1997. Pipes to be capable of resisting a maximum jetting pump pressure of 2,600psi (180 Bar) without damage. (Sewer diameters 150mm up to 450mm, Service Connections of 100mm diameter);

1 IN 100 YEAR STORM FLOOD PLAIN CONFINED TO FOOTBALL PITCH. HIGH WATER LEVEL FOR 53 m³ CALCULATED 1 IN 100 YEAR STORAGE = 61.30 m. MAX DEPTH 140 mm AT THE SOUTH CORNER

PROPOSED STORMTECH ATTENUATION SYSTEM MC4500
- * MIN. REQUIRED VOL.: 989m³ (FOR 1 IN 30 YEARS ATTENUATION STORAGE)
- * PROPOSED AREA: 753m²
- * BASE OF TANK @ +58.65
- * HIGH WATER LEVEL @+60.71
- * MIN. GROUND LEVEL ABOVE ATT.SYSTEM @+61.16
- * MAX. GROUND LEVEL ABOVE ATT.SYSTEM @+61.28

TYPICAL DETAIL OF CONTINUOUS FLUSH PRECAST KERB TO ROADSIDE SWALE

(NTS)

CI.803 MATERIAL COMPACTED IN 225mm LAYERS TO ROAD FORMATION LEVEL

TOPSOIL & SEEDED TO CI.612

SELECTED EXCAVATED MATERIAL COMPACTED IN 150mm LAYERS

PIPE WIDTH	TRENCH WIDTH
150Ø 225Ø 300Ø	600mm 700mm 750mm

SELECTED EXCAVATED MATERIAL:
FREE FROM STONES GREATER THAN 25mm IN SIZE, BUILDING RUBBLE, TREE ROOTS, VEGETABLE MATTER & LUMPS OF CLAY GREATER THAN 75mm IN SIZE.

uPVC PIPE TO IS424, BS4660, 5481, 5955 & SR7 1981

GRANULAR BED & SURROUND (5-20mm PEA GRAVEL) THOROUGHLY COMPACTED IN 75mm LAYERS

OUTLINE OF 150mm GRADE 20 CONC. BED & SURROUND WITH 20mm FLEXCEL JOINTS AT Max. 5m CENTERS

TYPICAL MAIN DRAINAGE TRENCH

(NTS)

MC-4500 CHAMBERS SHALL MEET ASTM F 2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".

BIDIM S32 GEOTEXTILE, (AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE), OVER TOP OF STONE

GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES. LESS THAN 35% FINES. COMPACT IN 150mm LAYERS.

2 - 5 CM WASHED, CRUSHED, ANGULAR STONE

BIDIM S32 (AASHTO M288) GEOTEXTILE AROUND BASE AND SIDES OF EXCAVATION AND TO TOP OF STONE

STORMTECH CHAMBER MC4500 DETAIL AT SECTION A-A

(NTS)

Mark	Date	By	Chk.	App.	Revision
PL16	06-12-2021	PB	DOS	DOS	FOUL SEWER SPECIFICATION ADDED ACCORDING TO IW.
PL15	03-12-2021	PB	BK	DOS	ISSUED FOR PLANNING. REVIEWED ACCORDING TO SDCC.
PL14	02-12-2021	PB	BK	DOS	ISSUED FOR PLANNING. REVIEWED ACCORDING TO SDCC.
PL13	30-11-2021	PB	BK	DOS	ISSUED FOR PLANNING. ADJUSTMENT OF SWALES.

Drawing Status
PLANNING

Job Title
RESIDENTIAL DEVELOPMENT
@ ST. EDMUNDS PHASE 3,
LUCAN, DUBLIN 20

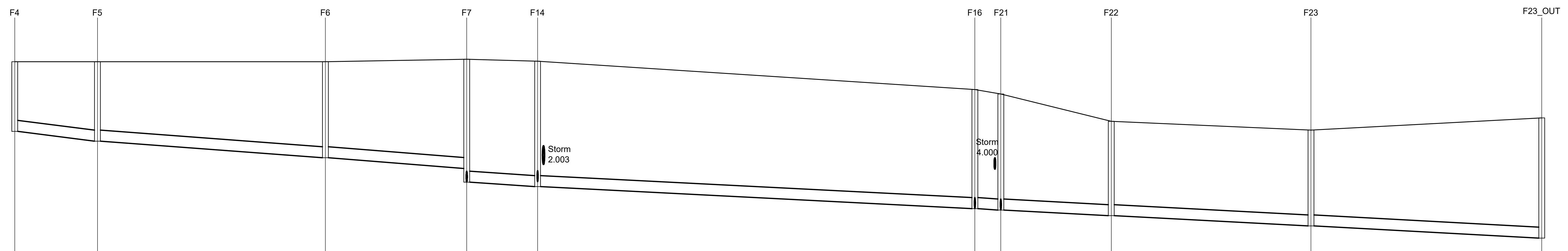
Drawing Title
DRAINAGE LAYOUT
Sheet 1 of 2

Architect/Client
ST EDMUNDS PHASE 3 LIMITED

KAVANAGH BURKE
CONSULTING ENGINEERS
Tel. 01 – 450 0694
Fax. 01 – 426 4340
Email: pkavanagh@kavanaghburke.ie
Unit G3, Calmount Pk.
Ballymount,
Dublin 12.

Drn PB	Checked BK	Approved DOS
Scales 1:250		Date December 2021
Job No. D1621	Drawing No. D1	Rev. PL16

A0

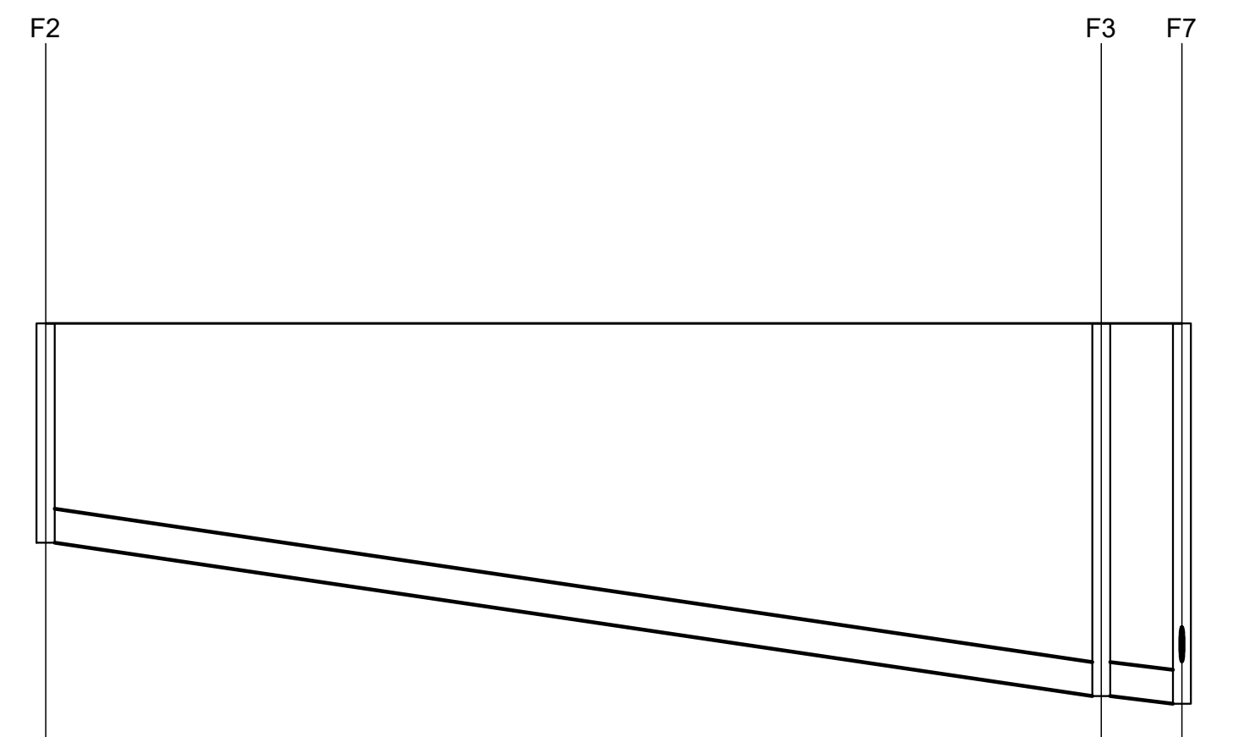


Horizontal Scale 1:500
Vertical Scale 1:50

Vert. exaggeration = 10.0

Datum = 57.0

Link Name		1.000		1.001		1.002		1.003		1.004		1.005		1.006		1.007		1.008	
Section Type		225mm		225mm		225mm		225mm		225mm		225mm		225mm		225mm		225mm	
Slope		1:85		1:137		1:132		1:161		1:199		1:177		1:197		1:195		1:197	
Cover Level	62.100		62.100		62.100		62.150		62.110		61.530		61.440		60.880		60.700		60.950
Invert Level	60.675		60.475 60.475		60.135 60.135		59.915 59.635		59.545 59.545		59.095 59.095		59.065 59.065		58.950 58.950		58.740 58.740		58.490
Length		16.93		46.66		28.94		14.51		89.52		5.31		22.61		40.89		47.24	

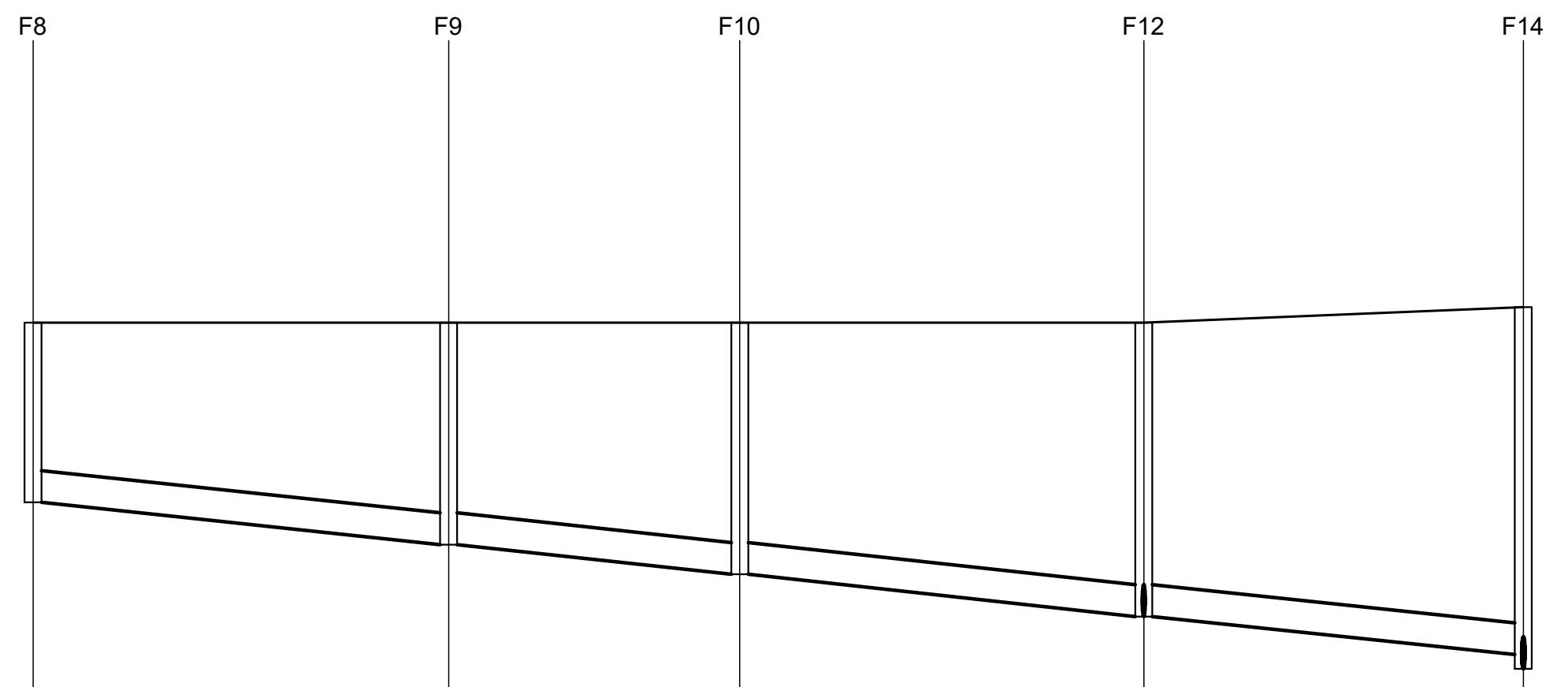


Horizontal Scale 1:500
Vertical Scale 1:50

Vert. exaggeration = 10.0

Datum = 58.0

Link Name		2.000		2.001	
Section Type		225mm		225mm	
Slope		1:69		1:107	
Cover Level	62.150		62.150		62.150
Invert Level	60.700		59.685 59.685		59.635
Length		69.83		5.34	

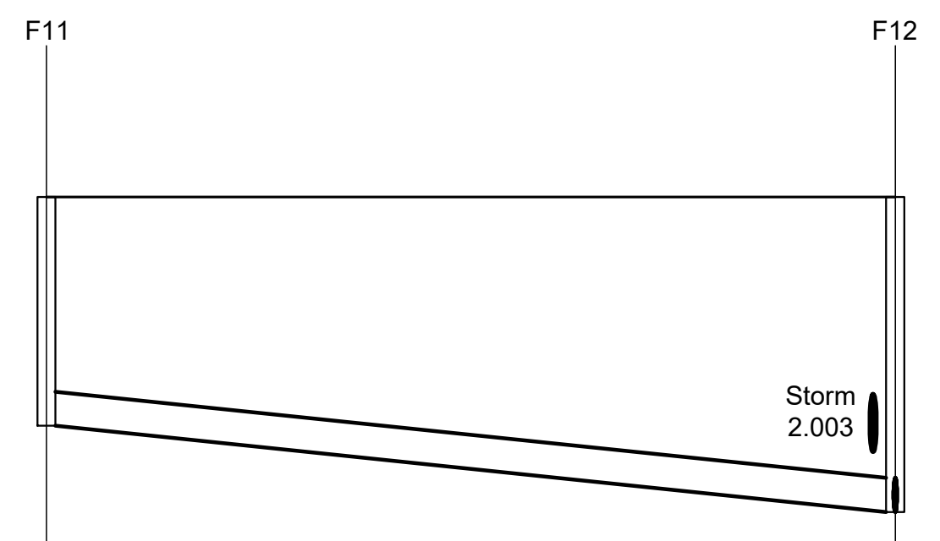


Horizontal Scale 1:500
Vertical Scale 1:50

Vert. exaggeration = 10.0

Datum = 58.0

Link Name		3.000		3.001		3.002		3.003	
Section Type		225mm		225mm		225mm		225mm	
Slope		1:98.4		1:98.4		1:95.6		1:99.8	
Cover Level	62.000		62.000		62.000		62.000		62.110
Invert Level	60.725		60.425 60.425		60.215 60.215		59.915 59.915		59.645
Length		29.506		20.671		28.685		26.950	



Horizontal Scale 1:500
Vertical Scale 1:50

Vert. exaggeration = 10.0

Datum = 58.0

Link Name		4.000	
Section Type		225mm	
Slope		1:96	
Cover Level	62.000		62.000
Invert Level	60.485		59.915
Length		56.13	

CAPACITY CHECK OF EXISTING FOUL SEWER NETWORK IN THE EXISTING PHASE OF ST. EDMUND'S DEVELOPMENT.

The proposed development of 250 dwellings will discharge to a 225mm diameter foul pipe which forms part of the existing foul network for the larger St. Edmunds campus. The minimum gradient for a 225mm diameter pipe within the larger campus which consists of a total of 573 number residential properties is 1 in 200. The aforementioned 225mm diameter pipe then merges downstream with another branch of the foul sewer network serving the adjacent St. Loman's Hospital and Ballydowd High Support Special School. Where the pipes combine, the pipe size increases to a 300mm diameter pipe which has a minimum gradient of 1 in 243.

- 225mm pipe: The capacity of 225mm diameter pipe at 1 in 200 gradient is 32l/s (with roughness factor k=1.5mm);
- 300mm pipe: The capacity of 300mm diameter pipe at 1 in 243 gradient is 63l/s (with roughness factor k=1.5mm);

The total number of existing and proposed dwellings served by a single 225mm diameter branch pipe is 825.

By using the Irish Water figures of 150l/person/day with additional 10% flow from infiltration and an average occupancy factor of 2.7 person/dwelling; the total daily discharge will be 446l/day/dwelling.

The population in the whole development of 825 houses based on average 2.7 person/dwelling will be approximated as P = 2230 people.

Based on the calculation method from Appendix C of Irish Water Code of Practice for Wastewater Infrastructure Ref. IW-CDS-5030-03 Chapter 1.2.5; the peaking factor for the development of this size is equal Pfdom = 3.

Therefore, the design foul flow from the existing and proposed development together can be calculated as:

Pfdom x P x I x G = 3 x 2230 x 1.1 x 150 = 1,103,850 l/day = 12.78 l/s

Where:
- P is population
- I is infiltration 10%
- G is water consumption per capita

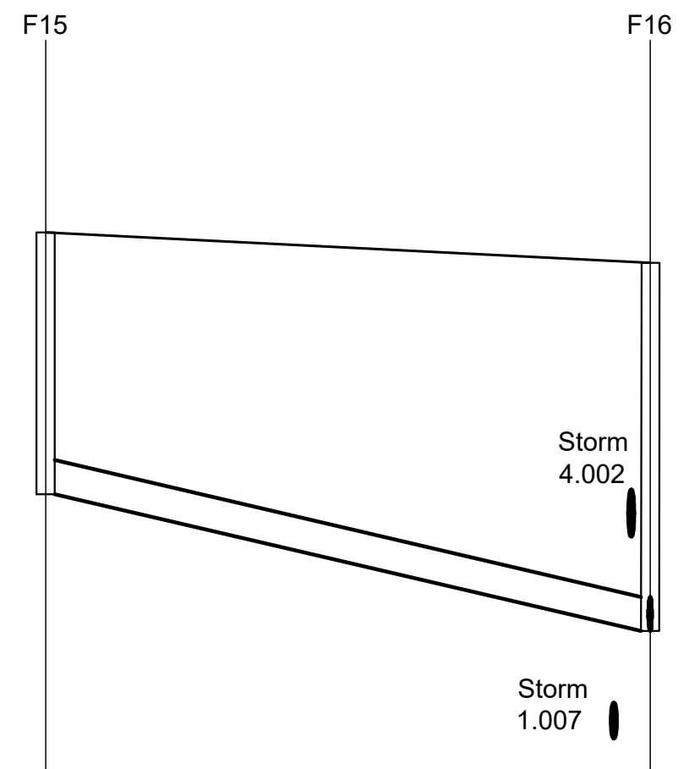
Based on above, the existing network where the lowest pipe capacity (for 225mm diameter pipe at 1 in 200) is 32l/s will have sufficient capacity to carry the flows from the existing and proposed development combined. The existing foul network capacity is greater than the calculated design flow even in the event of the maximum peaking factor Pfdom=6.

The 300mm diameter downstream pipe at 1 in 243 gradient has 63l/s capacity. This 63 l/s capacity exceeds the calculated design flow by ca. 50l/s; therefore, it has sufficient capacity to carry additional flow from the existing and proposed St. Edmunds development, the Ballydowd High Support Special School and a possible additional discharge from future connection from the hospital. To illustrate the fact that there is sufficient capacity within the foul network we performed capacity check for 1,200 No. hospital patients and 2000 No. school students/staff:
90 l/person/day discharge from school with canteen and a 450 l/person/day discharge from the St. Loman's Hospital were used (as per IW code of Practice table of Flow Rates for Design) with peaking factor Pf = 6;

- Peak discharge from school from assumed 2000-person school:
  2000p x 90 l/p/day x 6 (peak factor) = 1,080,000 l/day = 12.5 l/s
- Peak discharge from future hospital connection (assuming 1,200 No. beds for comparison purposes):
  1200p x 450 l/p/day x 6 (peak factor) = 3,240,000 l/day = 37.5 l/s
- Total peak discharge - 12.5 l/s + 37.5 l/s = 50 l/s

The above demonstrates that, based on the Irish Water Flow Rates for Design, additional flow from 1,200 patients hospital and a 2000 person school to would be necessary to fully utilise this 50 l/s spare capacity.

Neither the Ballydowd High Support Special School or the St Loman's Hospital have numbers anywhere near the numbers used in the capacity check above therefore we are satisfied that the existing foul infrastructure serving the existing site has capacity for both current and proposed users.

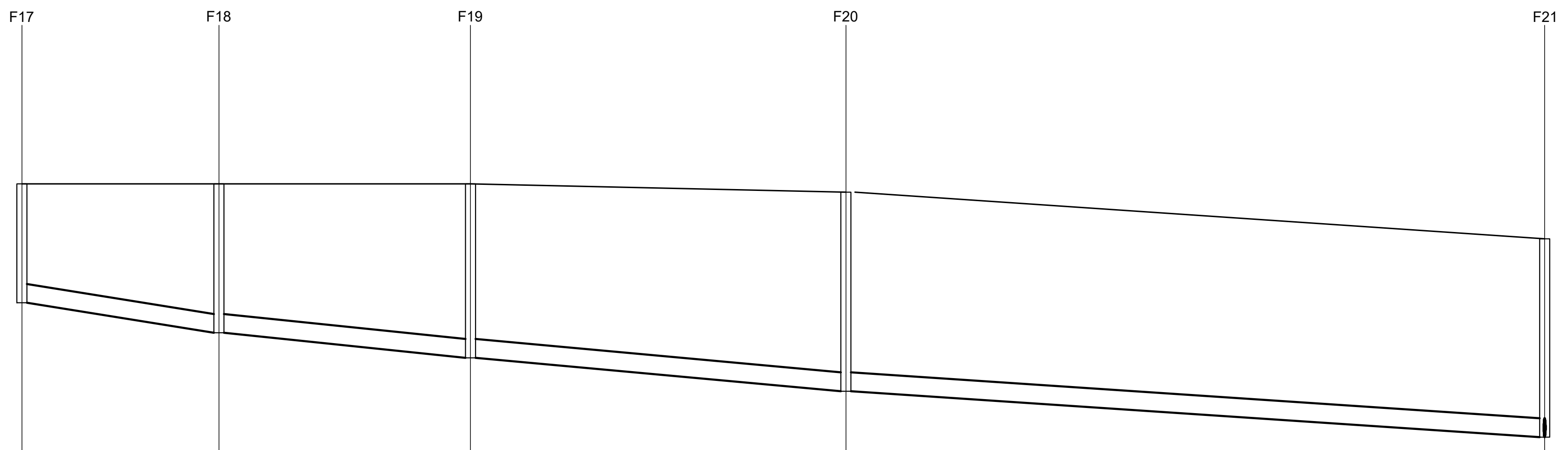


Horizontal Scale 1:500
Vertical Scale 1:50

Vert. exaggeration = 10.0

Datum = 58.0

Link Name		5.000	
Section Type		225mm	
Slope		1:44	
Cover Level	61.73		61.53
Invert Level	60.000		59.095
Length		40.000	



Horizontal Scale 1:500
Vertical Scale 1:50

Vert. exaggeration = 10.0

Datum = 58.0

Link Name		6.000		6.001		6.002		6.003	
Section Type		225mm		225mm		225mm		225mm	
Slope		1:66		1:101		1:113		1:152.0	
Cover Level	62.100		62.100		62.100		62.000		61.440
Invert Level	60.675		60.315 60.315		60.015 60.015		59.615 59.615		59.065
Length		23.63		30.15		45.01		83.594	

PL16	06-12-2021	PB	DOS	DOS	SCALES TO EACH INDIVIDUAL LONGSECTION.
PL14	02-12-2021	PB	BK	DOS	ISSUED FOR PLANNING. REVIEWED ACCORDING TO SDCC.
PL13	30-11-2021	PB	BK	DOS	ISSUED FOR PLANNING. ADJUSTMENT OF SWALES.
PL12	25-11-2021	PB	BK	DOS	DRAINAGE LAYOUT CHANGED.
Mark	Date	By	Chk.	App.	Revision

Drawing Status
PLANNING

Job Title
RESIDENTIAL DEVELOPMENT
@ ST. EDMUNDS PHASE 3,
LUCAN, DUBLIN 20

Drawing Title
LONGITUDINAL SECTIONS THROUGH
FOUL SEWER DRAINAGE

Architect/Client
MCROM

KAVANAGH BURKE
CONSULTING ENGINEERS

Tel. 01 – 450 0694
Fax. 01 – 426 4340
Email: pkavanagh@kavanaghburke.ie

Unit G3, Calmount Pk.
Ballymount,
Dublin 12.

Drn PB
Checked BK
Approved DOS
Scales 1:500, 1:50
Date December 2021
Job No. D1621
Drawing No. D4
Rev. PL16