PHM Consulting
Civil - Structural - Environmental

Mixed Use Development

Pa Healy Road, Limerick

CIVIL ENGINEERING REPORT

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Mixed Use Development
Pa Healy Road, Limerick

Civil Engineering Report

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1.0 INTRODUCTION

PHM Consulting have been engaged by Revington Developments Ltd. (applicant) to provide engineering design solutions for a proposed strategic housing development consisting of a mixed-use development of build-to-rent apartments, student apartments incorporating common areas, café and 3 No. retail units, crèche and management facilities building, and dwelling houses on lands at Pa Healy Road, Limerick which is to be the site for a planning application to An Bord Pleanala. Engineering design services to cover Roads, Foul Drainage and disposal, Surface water collection, attenuation and disposal, and Water supply connection to public mains and internal network.

The planning application comprises of a mixed use development on a circa 4 ha site with vehicular access points from Pa Healy Road. The development will consist of:

(A) Demolition of existing 800m^2 warehouse building on site.

(B) Block 1 – Student accommodation building of 8,238m^2 stepped from three to six storeys, with ground floor café of 144.60m^2 and 3 no. retail units facing onto Pa Healy road of 86.59m^2 each, with 9 no. two bedroom, 37 no. three bedroom, and 15 no. four bedroom student apartments, totalling 189 bed spaces, ancillary laundry, refuse and enclosed communal courtyard with landscaping and bicycle storage;

(C) Block 2 - A residential apartment building of 6,013.25m^2 with nine storeys and two penthouse storeys, total eleven storeys containing 10 no. studio, 1 no. one bedroom and 52 no. two-bedroom apartments;

(D) Block 3 – A residential apartment building of 8,107.10m^2 with six storeys and two penthouse storeys, total eight storeys containing 16 no. studio, 9 no. one bedroom, and 63 no. two-bedroom apartments;

(E) Block 4 – A residential apartment building of 3,869.18m^2 with six storeys and one penthouse storey, total seven storeys containing 7 no. studio, 13 no. one bedroom and 25 no. two-bedroom apartments;

(F) Block 5 – A residential apartment building of 5,849.40m^2 with six storey and one penthouse storey total seven storeys containing 14 no. studio, 15 no. one bedroom and 37 no. two-bedroom apartments;

(G) Block 6 a residential apartment building of 3,869.18m^2 with six storeys and one penthouse storey, total seven storeys containing 7 no. studio, 13 no. one bedroom and 25 no. two-bedroom apartments;

(H) Block 7 a residential apartment building of 4,962m^2 with five storeys and one penthouse storey, total six storeys containing 12 no. studio, 13 no. one bedroom and 31 no. two-bedroom apartments;

(I) Community facilities building of 1,336.90m^2 and three storeys with creche, café, management offices and common accommodation for use by apartment dwellers;

(J) 18 no. Executive Houses – Consisting of 2 no. detached four-bedroom houses of 194.62m2 each and 16 no. terraced four-bedroom houses of 177.82m2 each, with off street parking to front separate from communal parking;

(K) 145 Car parking spaces throughout the development and 420 secured bicycle parking spaces throughout the development;

(L) Ancillary works comprising; new vehicular entrance onto Pa Healy Road, pedestrian and cycle links to Pa Healy road, Park road and City Canal, bin storage for all developments adjacent to all entrances, New public park of 0.5ha along city canal, communal open space and communal roof gardens for all apartments, all ancillary drainage, civil and landscape works, public lighting within estate and Electricity Sub-station to rear of Block 1.

This report outlines the provision of services for the proposed development as described above.

The planning application site area (red line boundary) is 4.0 ha.

2.0 SITE PARTICULARS

Details of the site physical setting are outlined below. Information on the site location, hydrology, geology, hydrogeology of the area has been obtained from records held by the Geological Survey of Ireland (GSI), Environmental Protection Agency (EPA), Ordnance Survey of Ireland (OSI) databases and on-line resources of Department of Environment, Community and Local Government (myplan.ie).

2.1 Topography

An electronic topographical survey of the site has been carried out for the purpose of the preparation of the design of the roads and infrastructure of this proposed development. All surveyed information has been tied into National Grid Reference system and Ordnance Survey Malin. The site is located at 158793E, 157504N IGR. Existing ground levels range from 4.75m to 6.50m above ordnance datum (AOD) Malin.

The lands are currently undeveloped and unused. In the mid to late 1990's the site was filled with various construction and demolition material. The site is bounded to the north by the City Canal, to the south by the Pa Healy Road and Park Road to the east. The site is vacant apart from a single industrial building (c.600 sq m plan area) located to the east.

2.2 Geology

The GSI describes the subsoils underlying the site as Made Ground with marine/estuarine silts and clays located in the north western corner.

According to GSI data, the majority of the site is located on top of undifferentiated limestones. The southwest corner of the site is underlain by volcanoclastic rocks among limestones.

2.3 Hydrogeology

According to GSI data, the bedrock aquifer underlying the majority of the site is classified as Lm, Locally Important aquifer which is generally moderately productive. The maximum recharge capacity of such an aquifer is 200mm/year.

The GSI classification of the bedrock aquifer beneath the majority of the site is described as having a vulnerability rating of (L) Low. This suggests that bedrock will not be encountered in the first 10m BGL. The eastern boundary has a vulnerability rating of (M) Moderate. This suggests that bedrock will not be encountered in the first 10m BGL in this area also.

2.4 Ground Investigation

As part of the preparation of the scheme design a site investigation was undertaken by VERDE Environmental Consultants.

The principal findings of the investigation included:

Fifteen trial pits were excavated across the site. Trial pits were excavated to a maximum depth of 3.5m BGL. The trial pits were located across the site to give a spatial representation of the shallow subsurface soils.

The general ground conditions encountered from the trial pits excavated on site comprised of brown silty top soil to a maximum depth of 0.3mBGL underlain by made ground comprising brown, light brown or brownish-grey sandy, clay or clayey sand & gravel with an abundance of demolition concrete, frequent red brick fragment and occasional limestone cobbles, metal and glass fragments to the maximum depth of 3.1m BGL. The thickness of manmade deposits was greater in the trial pits located in the central and western portions of the site.

These anthropogenic deposits were underlain by natural soils comprising dark grey or black peaty clay or peat, light brown clayey gravelly sand with large limestone cobbles and boulders and light brown or brownish-grey sandy clay to a maximum depth of 3.4m. Bedrock was not encountered during trial pitting on site.

During trial pit excavation entries of shallow groundwater were observed in the man-made deposits and natural sand and clay at depths between 0.7 and 2.8m bgl. Volumes of encountered shallow groundwater were significant in some locations.

Four groundwater monitoring wells were drilled. All four wells were installed as permanent groundwater monitoring wells in the limestone bedrock aquifer. Each of the wells was completed with a 50mm diameter standpipe to a maximum depth of 10.8m BGL with a slotted screen installed in the bottom 0.55-1.0 metres to capture the groundwater present in the bedrock aquifer.

The general ground conditions encountered during drilling the monitoring wells comprised man made deposits of grey gravels and cobbles with some addition of concrete and red brick fragments to a maximum depth 4.0m BGL. The made ground deposits were underlain by brown peaty clay followed by light grey or brownish-grey silty CLAY to a maximum depth of 8.8m BGL. Weathered, grey limestone bedrock was encountered during drilling at depths between 6.2mBGL and 8.7m BGL.

3.0 ROADS

3.1 General

The proposed roads layout for the development is shown on Drawing No. 108-96-101 Series. Signage and Markings are identified on drawing 108-96-102.

Access to the proposed development will be off Pa Healy Road via a new priority junction. Pa Healy Road is of recent construction and was completed in 2007. Currently there is an existing priority junction provision for access which was constructed as part of the Pa Healy project. The proposed development seeks to replace this junction with a similar junction located slightly to the north. The existing Bus Bay, currently located to the north of the entrance, will be relocated to the south of the entrance making for a safer junction for vehicular users. An additional Left In / Left Out is proposed at the eastern end of the Pa Healy Road which will accommodate customers and deliveries to the retail units without interfering with the main entrance which is intended principally for residents of the development.

Pa Healy Road comprises of a 10.5m wide two-way carriageway with a central staking lane. The inbound and outbound lanes measure 3.75m wide. Off-carriage cycle and footpaths are provided on both sides.

To the east is Park Road which comprises of a two lane carriage of 8.0m width and with footpaths on both sides.

The proposed entrance utilises 6.0m radii to encourage careful entry into the development. The proposed entrance is located in a 50 km/h speed zone. Clear sightlines of 70m x 2.4m setback are available without additional works to the existing carriageway.

Within the development the road widths are generally 6.0m with 3.0m radii. All footpaths are 2.0m wide. The main through road includes a 1.0m grass margins on both sides of the road initially and reduced to one side as you get into the development. All proposed dwellings and apartments have a footpath to the front boundary. Full pedestrian linkage from each dwelling to the main entrance is available based on a system of desire lines and utilising the provided open spaces coupled with a detailed landscaping scheme. Further linkages are provided to the Park Road and the City Canal Cycle/footpath.

To discourage speeding through the development given the straight alignment of the main roads a series of traffic tables are proposed on the main junctions. These tables shall be paved in a contrasting material to the carriageway in order to raise the priority of the pedestrian and reduce the dominance of the vehicle. Designated pedestrian crossings have been incorporated for vulnerable pedestrians.

All junctions have been checked for sightline requirement in accordance with the Design Manual for Urban Roads and Street.

Dished kerbs are to be provided at all entrances to properties and at pedestrian crossing points, wherever traffic tables are not provided.

The design of the scheme is such that vehicular speed is to be self regulating (max 30km/h).

3.2 Road Construction and Drainage

Construction details for the Roads of the proposed development are shown on enclosed drawings. The pavement construction details have been designed in accordance with the guidelines set out in the DoEHLG's '*Recommendations for Site Development Works for Housing Areas*'. Actual pavement construction depths will be dependent on CBR tests carried out during the construction stage of this

development. Where soils with a CBR of less than 2% underlie the carriageway, custom designs will be required for the pavement make-up. The rate of CBR testing is given in Table 1 below:

CBR TESTING RATE
Minimum 1 per road or 1 per 100m length of road

Table 1

Roads are to be constructed with cambers or crossfalls of 1/40. Road gullies are to be spaced at less than 30m centres with double gullies with separate connections provided at all sag curves and low points. Vertical gradients will be a minimum of 0.5% (1/200) and a maximum of 5.0% (1/20). Private driveways shall be limited to a maximum gradient of 8% (1/12.5). Each dwelling shall have a parking area that is at a gradient of not greater than 5% (1:20) to ensure compliance with TGD Part M – Access and Use of the Building Regulations.

4.0 FOUL WATER MANAGEMENT STRATEGY

4.1 INTRODUCTION

This section outlines the proposed provision of the foul water service for the proposed mixed-use development.

The development will comprise: Refer to Section 1.0

4.2 Foul Water Design Strategy

The proposed foul sewer system has been design in accordance with the DoEHLG Recommendations, and with BS 8005: Part 1, 1987 *'Guide to New Sewerage Construction'*. Foul sewers are sized for a peak flow of 6 DWF assuming a discharge of 160 Litres per person per day and an average of 2.7 and 1.7 persons per dwelling/apartment unit respectively. A schedule of Accommodation is included in Appendix A.

A minimum size of 225mm ϕ pipe uPVC SN8 is used for all foul sewers with minimum gradients. The designed gradients will ensure velocities greater than the minimum velocity specified in the DoEHLG *'Recommendations for Site Development Works for Housing Areas'*, Section 3 – 0.7 metres per second to a maximum of 3.0 metres per second. A minimum size of 100mm ϕ is used for the private foul drains. Each dwelling is to be provided with individual private foul connections to the main system. Each dwelling unit will be provided with an inspection chamber located inside the front boundary of the property in accordance with Irish Water requirements. All main system sewers are located within roads or open spaces.

The proposed foul sewer layout is shown on Drawings 108-96-201. Calculations for the foul sewer network are included in Appendix A.

Within the boundaries of the site and running parallel with the Canal there is an existing 1000mm Foul Sewer (Limerick Main Drainage System). Access chambers are provided within the site. The existing Wayleave over is being preserved with no structures proposed within the said wayleave.

It is proposed to discharge the development at a single location at Manhole FOut on drawing 108-97-201.

A pre-connection enquiry has been sent to Irish Water and a **Confirmation of Feasibility** in included in Appendix H.

The design of the system has been assessed by Irish Water and a **Statement of Design Acceptance** has been issued by Irish Water – See Appendix H.

5.0 STORM WATER MANAGEMENT STRATEGY

5.1 Storm Water Drainage

This chapter of the Services Report outlines the way in which the storm water runoff from the proposed development is to be managed and discharged.

The storm water sewer layout for the proposed development is shown on Drawings 108-96-201.

5.2 Drainage Strategy and SuDS

It is proposed that all generated storm waters from the development will be collected via a separate stormwater gravity network and discharged to the Canal which is located along the western boundary of the development site. Currently there is an open channel within the site which runs parallel with the canal and discharges to the canal at the southern corner of the site.

Refer to Appendix B for Storm Network design spreadsheets.

Sustainable drainage systems (SuDS) are a feature of all modern developments and their aim is to maintain or restore a more natural hydrological regime, such that the impact of urbanisation on downstream and upstream flooding and water quality is negated. Originally, SuDS were introduced primarily as single purpose facilities, however, this has now evolved into more integrated systems which serve a variety of purposes, including habitat and amenity enhancement.

SuDS involve a change in our way of managing urban run-off from solely looking at volume control to an integrated multi-disciplinary approach which addresses water quality, water quantity, amenity and habitat. SuDS minimise the impacts of urban runoff by capturing runoff as close to source as possible and then releasing it slowly. The use of SuDS to control runoff also provides the additional benefit of reducing pollutants in the surface water by settling out suspended solids, and in some cases providing biological treatment.

The successful achievement of sustainable urban drainage does not solely rely on the use of engineered techniques to control and treat runoff. 'Good housekeeping' measures, such as safe storage and handling of oils and chemicals, street sweeping and control of sediment run-off from construction sites are an essential component of SuDS. Public awareness is also an important factor in ensuring the successful implementation of sustainable drainage practices.

The drainage strategy employed for dealing with storm water from the proposed development follows the principles of Sustainable Urban Drainage Systems (SUDS) as set out in CIRIA document C521 *'Design Manual for Scotland and Northern Ireland'*. Specifically, the Best Management Practices (BMP's) for the control of surface waters, as prepared by Dublin Corporation and as set out in their document *'Storm Water Management Policy for Developers 1999'*, have been used in the design of the surface water

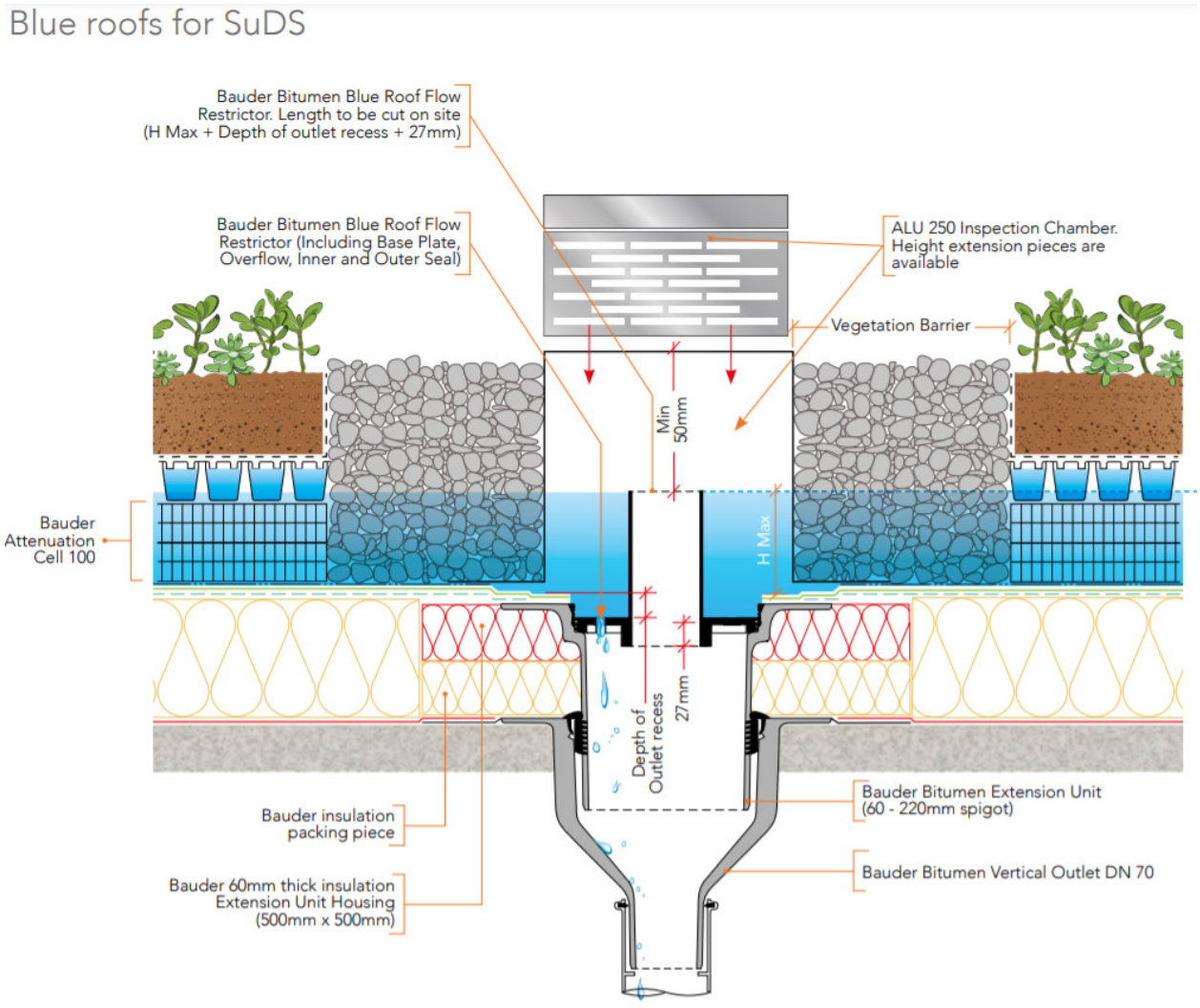
system. The adopted principals are in line with the 'Greater Dublin Strategic Drainage Strategy', April 2005.

A key part of the design strategy is limiting the amount of post-development run-off below the Mean Annual Peak Flow (Rural) ($QBAR_R$) associated with the lands in their pre-development state. Given the vulnerability of the receiving Canal which flows into the Abbey River it is proposed to limit run-off below the Annual Peal Flow and adopt a limiting pass forward flow of 2 litres per second per hectare.

Given the physical aspects of the current site condition and essentially the imported material in the past that was used to raise the site levels and in consultation with the Environmental Due diligence report prepared by VERDE Environmental it is not proposed to provide for discharge or permeation to ground.

The inclusion of systems which promote the discharge of surface water to ground have not been considered in this particular instance given the pre-existing condition of the site. It is however proposed to include a Blue Roof to a number of the proposed buildings. Blue roofs provide a system of retention of water on the roofs with a slow release mechanism that is designed for each individual area. The proposed Bauder Blue Roof can retain a depth of 100mm of rainfall on the roof surface with the capacity to support either a growing medium or a paved pedestrian system over.

See details below.



The areas proposed to be provided with the above system include:

Building	Blue Roof Area (m2)	Attenuated Volume (m3)
Block 2	308	30.8

Block 3	307	30.7
Block 4	260	26
Block 5	260	26
Block 6	260	26
Block 7	260	26
Total	**1655**	**165.5**

All surface run-off from roofs, roads, paved areas, and open space areas which graduate towards paved areas is to be captured, detained, treated, and eventually discharged to the Canal channel.

Within the calculations an allowance for predicted increased Rainfall intensities due to Climate Change has been incorporated in the form of an increase in recorded rainfall data by 20%. Met Eireann Rainfall Data for this site location is presented in Appendix C, while the data used in the calculation is presented in Appendix D.

5.3 Attenuation

In order to provide for adequate storage of storm waters it is necessary to establish the current discharge rate for the site as a Greenfield. The existing storm water discharge from the site ($QBAR_R$) is calculated using the estimation method contained in the Institute of Hydrology Report No. 124:

$QBAR_R = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

$= 0.00108 \times (0.5)^{0.89} \times (995)^{1.17} \times (0.3)^{2.17}$

$= 0.0137 m^3/s$ (137.5 l/s)

The calculation is based on a minimum site area of 50 hectares and then adopted for the specific site area. Therefore, for the total site area of 4.0ha the pre-development run-off is calculated as 11.0 litres per second. As stated in the previous section a limiting run-off of 2.0 l/s has been adopted which allows for a run-off of 8.12 litres per second. For the full calculation refer to Appendix D.

Limiting the post development flow to that of the pre-development run-off is to be achieved by means of a throttle in the form of a "Hydrobrake" flow control device on the outfall pipe. Details of the Hydrobrake product are included in Appendix E.

The impact of limiting the run-off is the creation of a requirement to store excess flow. The required storage volume is a function of the return period of the rainfall event along with the duration of the event. An analysis has been carried out of various storm durations from 30 minutes to 48 hours within the 30 and 100 Year Return Periods based on the most up to date site specific rainfall return data available from Met Eireann.

The resulting critical storm events occur as follows:

30 Year Event – 12 Hour Storm – Storage Required = $840.5m^3$

100 Year Event – 12 Hour Storm - Storage Required = $1178.5m^3$

It is proposed that the storage of the attenuated storm water will be provided within carpark and landscaped areas in the form of 3 No. subsurface 'StormTech' MC-3500 arched attenuation units with capacity for the 1 in 30 and 1 in 100 year critical storm events without flooding.

Attenuation A1 = 314.8m^3

Attenuation A2 = 314.8m^3

Attenuation B = 440.8m^3

Storm Network capacity = 82.5m^3

Bauder Blue Roof Storage = 165.5m^3

Total Volume of Storage Provided = 1318.4m^3

1318.4 - 1178.5 / 1178.5 = 12% Extra Over

This extra over storage is available for the required allowance to cater for 'Urban Creep' which is recommended at 10%.

When the run-off from the development exceeds the allowable peak, the flow will back up in the sewers and will be detained within the basins. When the storm passes and the run-off reduces below the allowable peak, water from the detention basins will flow through the discharge outfall and off the site.

Analysis has also been carried out for various scenarios whereby in a tidal event the discharge from the site is limited. Latest available data from the OPW indicates the following high water level in the vicinity of the development:

1 in 10 Year Tidal Event (10% AEP) – 4.08m AOD

1 in 200 Year Tidal Event (0.5% AEP) – 4.75m AOD

1 in 1000 Year Tidal Event (0.1% AEP) – 5.15m AOD

When the normal water level of the Canal is raised as a consequence of these events the result will be reduced discharge availability through the outfall. The proposed Check Valve will prevent surcharging of the system from the Canal thereby preserving 100% of the provided capacity within the development. Worst case scenario would be a Zero Litres per Second discharge for a period of high water levels.

In the low probability scenario that a storm event occurs corresponding with a high tidal event the necessary volumetric capacities that will be required within the development system for a period of 4 hours (including rainfall Climate Change allowance of 20%) are as follows:

1 in 10 year storm with a 4 hour duration – 693.2m^3 Storage

1 in 30 year storm with a 4 hour duration - 904.3m^3 Storage

1 in 100 year storm with a 4 hour duration – 1195.3m^3 Storage.

Adequate storage is therefore provided within the development system to cater for the above low probability senarios.

5.4 Water Quality

The removal of suspended solids and other contaminates is integral to the success of any sustainable urban drainage system; therefore it is proposed that all road gulleys and drainage channels are trapped to retain grit and debris prior to entering the collection system.

It is proposed to provide for hydrocarbon removal prior to surface waters reaching the Hydrobrake manhole through the provision of a Class I Bypass Interceptor located as per drawing 108-96-201. This 'Klargester' NSBE040 Bypass Interceptor has been sized based on the cumulative contributing paved areas and the peak discharge rates of the full gravity system. Refer to Appendix F for Details.

The interceptor will require monitoring to ensure that materials that are separated and stored are removed for disposal.

5.5 Storm Network Detailed Design

The storm water sewers are designed in accordance with the DoELG's 'Recommendations for Site Development Works for Housing Areas' 1998. The sewer network has been designed using the 1 in 5 year intensities to generate the hydrograph applied to the network design.

The minimum storm sewer size specified is 225mm diameter. Road gullies are to be provided at maximum 30m centres and are to be trapped. Gully connections are to be 150mm diameter. Double gullies with separate connections provided at all low points.

The minimum private storm drain shall be 100mm diameter. Each dwelling unit will have its own separate storm water connection.

Access for maintenance purposes has been allowed through standard D400 manhole covers. For the details of the proposed system and layout see drawing 108-96-201. The system will require minimal maintenance. Velocities within the network range from 1.0m/s to 3.0m/s.

5.6 Surface Water Outfall

Surface water from the collection system shall discharge through a precast concrete headwall. The proposed outfall level is set above the surveyed water level of the canal. In the event of surcharge of the collection system it is proposed to provide a backflow prevention valve devise which is fitted within the outfall pipe. Refer to Appendix G for details.

In relation to the Outfall it is proposed to precast the head wall off-site in order to eliminate any potential contamination of the canal waters from the use of wet pour concrete. Refer to drawing 108-97-161 for full details

6.0 WATERMAINS

6.1 General

This chapter of the Services Report outlines the way in which potable water will be supplied to the proposed residential development.

6.2 Water Supply

The proposed water main layout is shown on Drawing No. 108-96-301. As seen from this drawing, there is an existing 300mm ϕ Ductile Iron watermain located on Pa Healy Road. It is proposed to service the proposed development via a new connection to this existing 300mm diameter Public water main.

6.3 Watermain Design

All material shall be in accordance with the relevant European Standards (EN) covering the subject which is in force in the European Union. In Ireland ENs are published as IS EN and in the UK ENs are published as BS EN. Where there is no relevant European Standard, materials shall be in accordance with an Irish Standard (IS) or a British Standard (BS). A Water UK Water Industry Specification (WIS) may be used where there is no relevant European Standard, Irish Standard, British Standard or European Union National Standard available.

The design of the Works shall be such that a minimum design life is achieved of 60 years for pipework and structures, 25 years for mechanical and electrical plant and 15 years for information, communication and telemetry (ICT) plant.

An internal watermain network will comprise of 200mm ϕ DI, 150mm ϕ PE80 SDR17 and 100mm ϕ PE80 SDR17 spurs.

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.

MDPE and HDPE pipes shall be of a type PE-80 and have an 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).

HPPE pipes shall be of a type PE-100 and have an 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).

Service connection pipes suitable for works shall be of MDPE or HDPE (PE-80) material with SDR-17 rating. All plastic water service connection pipes shall be blue in colour.

Watermain jointing:

Fusion welded joints, site fusion jointing shall be strictly in accordance with UK WIS 4-32-08 (specification for fusion jointing of polyethylene pressure pipeline systems using PE80 and PE100 materials). Equipment used for butt fusion welding shall be in accordance with UK WIS 4-32-16 (butt fusion joining machines).

Depth of cover:

The desirable minimum depth of cover from the finished ground level to the external crown of a single premise service connection pipe shall be 750mm with an absolute minimum of 600mm for short distances. The desirable depth of cover at the boundary box should be 600mm +\- 25mm, with a maximum depth of 750mm. The minimum depth of cover from the finished ground level to the external crown of a water main shall be 900mm where the pipe is to be located in housing estate roads.

Boundary boxes:

All service connections shall include the installation of an approved boundary box (meter box) with integral stopcock and suitable for the reception of a water meter. The boundary box shall be a telescopic type, self-contained chamber system with Class B or Class C covers in accordance with BS 5834.

Boundary boxes in association with pressure reducing valves for individual premises shall be provided where necessary and with the specific approval of Irish Water.

The boundary box shall be located as near as possible to the curtilage boundary but set back at least 225mm from the face of the boundary, on a footway or service strip, off the public road/street and, if possible, sited to avoid vehicle crossing points, drives and parking areas to ensure future maintenance requirements are achievable.

Hydrants (80mm):

Hydrants have been positioned so that no dwelling or part of a building is greater than 46m from any hydrant, in accordance with DoEHLG *'Recommendations for Site Development Works for Housing Areas'*.

Hydrants shall be double flanged drilled to PN 16. They shall comply with the requirements of IS EN 14339, IS EN 1074: Part 6 and BS 750. Fire hydrants shall be Type 2 and shall have an 80mm diameter flange, PN16 rated. The hydrant shall incorporate a screw-down gate valve, underground, "guide to head" type, with screw connection outlet and false spindle cap and iron chain. The surface of the hydrant shall be blue and it shall be protected from corrosion by a coating in accordance with WIS 4-52-01 or IS EN 14901. For coatings in accordance with WIS 4-52-01, the internal water-wetted surface shall be coated to Class A standard while all other surfaces shall be coated to Class B standard. The depth of the hydrant cap shall be located at most 350mm from the finished ground level. All hydrants shall be ANTI-CLOCKWISE OPENING. Hydrants can be provided either on line or off line depending on the site requirements. The hydrant shall have a minimum flow coefficient (Kv) value of 92m3 per hour.

Sluice Valves:

Sluice valves have been positioned to meet the requirements as set down by Irish Water, and that a maximum of 40 houses can be isolated at any one time.

Sluice valves shall be double flanged with ductile iron resilient seal gate valves, suitable for use in Water Mains. They shall comply with the requirements of BS 5163, Part 1 and 2 and IS EN 1074, Part 1 and Part 2, and they shall have a CE marking in accordance with the EU Construction Products Regulations (No. 305/2011 –CPR) and any other relevant Directives. All flanges shall be drilled to PN 16 in accordance with BS EN 1092 -2 and shall be suitable to accommodate a maximum differential pressure during operation of 16 bar. Telescopic spindles and shall be fitted with a cast iron square false cap (complete with grub screw).

Air Valves:

Air valves shall be of double air valve type with isolating valve in accordance with the requirements of IS EN 1074: Part 4. Air valves shall be of ductile iron to IS EN 1563, with a minimum tensile strength 420

N/mm2 and shall have flanged inlets, PN16 rated. Each valve shall have a large and a small air escape orifice with an isolating valve. The isolating valve shall be either a resilient seated gate valve to BS 5163 Part 1 Type B and IS EN 1074, Part 2 and shall be of a boltless bonnet design, or a butterfly valve to IS EN 1074 Part 2. The air valve shall be capable of automatically releasing accumulated air/gas from the pipe system while the system is under pressure, release large quantities of air/gas from the pipe system during filling and prevent negative pressure occurring in the pipe system during draining.

Water Meter Chambers:

The Bulk flow meter shall be installed in a chamber which shall be suitably sized to accommodate the meter and allow access for maintenance. The Chamber internal dimensions shall be 1,500mm by 1,500mm. The Chambers shall be provided with IW-CDS-5020-03 (Revision 1 – December 2017) 63 ductile iron pipework and fittings. The inlet and outlet pipework shall be built into the walls of the Chamber and fully sealed, complete with puddle flanges. The Chamber should be located off road, if possible, to allow ease of access and maintenance of the meter. The base and walls of the Chamber shall be constructed in C30/37 concrete, complying with the requirements of IS EN 206, 20mm aggregate size, with a minimum thickness of 250mm. The Chamber shall be complete with a reinforced concrete roof formed with C30/37 concrete, 20mm aggregate size concrete of minimum thickness of 225mm, reinforced with high tensile reinforcement to BS 4449.

Indicator Marker Plates and Posts:

Indicator plates shall clearly identify hydrant, air valve, scour valve, washout hydrant, meter, pressure reducing/sustaining valve and sluice valve locations. They shall be located to the approval of both Irish Water and the Roads Authority for the area. The plates shall be mounted on marker posts at the back of footpaths or on the boundary wall of the public thoroughfare nearest to the hydrant or valve. Indicator plates and baseboard plates shall comply with BS 3251, with hydrant plates of fixed black letter H on a canary yellow background (colour reference 309 to BS 381C). The plate shall show the diameter of the trunk Main in “mm” and the distance from the marker to the hydrant in “m”. Indicator plates for air valves, sluice valves, scour valves, washout hydrant, pressure reducing/sustaining valves, meters and bulk meters shall also comply with BS 3251 with fixed black letters (AV, SV, ScV, WO, PRV/PSV, Me and BM respectively) on a white background. The plate shall show the diameter of the Main in “mm” and the distance from the marker to the fitting shall be indicated in “m”. Marker plates shall be metal and shall be fixed with stainless steel non-retractable screws. Marker posts shall be of concrete construction, complying with IS EN 206, to conform to IS 162. They shall be set 450mm deep in a 0.06 m3 support base of C25/30 concrete, 20 mm aggregate size.

Boundary Box Standards:

Boundary Boxes must have WRAS approval and be compliant with WIS 4-37-01: Specification for Boundary Boxes for the metering and control of domestic and small industrial water services. Loading classification to BS 5834-2:2011, Section 4: Surface boxes, guards and underground Chambers for the purposes of utilities. Specification for Water Meters IS EN ISO 4064:2014 Water Meters for Cold and Hot Water, Part 1 – Part 5.

A pre-connection enquiry has been sent to Irish Water and a **Confirmation of Feasibility** in included in Appendix H.

The design of the system has been assessed by Irish Water and a **Statement of Design Acceptance** has been issued by Irish Water – See Appendix H.

Appendix A – Foul Sewer Network Design

Foul Sewer Design

Design Parameters				Appliance Flows(BS EN 752-4)					
Pipe Material	uPVC	Density(kg/m3)	1000	Discharge Rates			Frequency Factors		
Viscosity (Pa s)	0.0012	Limiting V(m/s)	0.7 - 3.0m/s	Apartment PE	1.7		Intermittent (Dwelling/Office)		0.50
Roughness(mm)	1.5			Dwelling PE	2.7		Frequent (School,hospit,rest)		0.70
Gravity (m/s2)	9.81			PE (l/h/d)	160		Congested (Public Facilities)		1.00
				PE (l/s - 6DWF)	0.011111				

Table 10.6 Discharge unit ratings for domestic appliances

Appliance	*Discharge units, DU*	
	BS EN 12056–2	*BS EN 752–4*
WC (9 l)	1.6–2.1	1.2–2.5
Wash basin	0.3	0.3–0.6
Kitchen sink	1.3	0.8–1.3
Bath	1.3	0.8–1.3
Washing machine (up to 6 kg)	0.6	0.5–0.8

Section	Units Connected			Flow	Infiltration	Cumul Q	Cumul Q	Grd Lvl U.S.	Grd Lvl D.S.	Inv U.S.	Inv D.S.	Cover U.S	Cover D.S	Cover Check		ΔH	Plan Length	Pipe Length	Section
	Apartment	Dwelling	Other (PE)	l/s	l/s	l/s	l/s	m	m	m	m	m	m	US >1.2m	DS >1.2m	m	m	m	
						1 DWF	6 DWF							US >1.2m	DS >1.2				
F1-F2	56			1.05	0.10	1.15	6.92	6.10	5.60	4.675	3.964	1.20	1.41	U.S OK	D.S OK	0.711	56.87	56.87	F1-F2
F2.1-F2.0	33			0.62	0.06	0.69	4.11	6.10	5.60	4.675	4.180	1.20	1.19	U.S OK	D.S OK	0.495	34.62	34.62	F2.1-F2.0
F2-F3				0.00	0.00	1.84	11.03	5.60	5.60	3.964	3.588	1.41	1.79	U.S OK	D.S OK	0.376	45.12	45.12	F2-F3
F3.1-F3	23			0.43	0.04	0.47	2.81	6.00	5.60	4.575	4.158	1.20	1.22	U.S OK	D.S OK	0.417	33.38	33.38	F3.1-F3
F3-F4	33			0.62	0.06	2.99	17.95	5.60	5.40	3.588	3.029	1.79	2.15	U.S OK	D.S OK	0.559	44.73	44.74	F3-F4
F4.1-F4		16		0.48	0.05	0.53	3.17	5.75	5.40	4.325	3.334	1.20	1.84	U.S OK	D.S OK	0.991	79.28	79.29	F4.1-F4
F4-F5		2		0.06	0.01	3.59	21.52	5.40	5.27	3.029	2.862	2.15	2.18	U.S OK	D.S OK	0.168	20.10	20.10	F4-F5
F5.1-F5			20	0.22	0.02	0.24	1.47	4.70	5.27	3.275	2.326	1.20	2.72	U.S OK	D.S OK	0.949	75.88	75.89	F5.1-F5
F5-F6				0.00	0.00	3.83	22.98	5.27	5.50	2.326	2.117	2.72	3.16	U.S OK	D.S OK	0.210	25.18	25.18	F5-F6
F6.1-F6	56			1.05	0.10	1.15	6.92	5.90	5.50	4.475	3.729	1.20	1.55	U.S OK	D.S OK	0.746	59.72	59.72	F6.1-F6
F6-F7	31			0.58	0.06	5.62	33.70	5.50	5.18	2.117	1.906	3.08	2.97	U.S OK	D.S OK	0.211	37.96	37.96	F6-F7
F7.1-F7	23			0.43	0.04	0.47	2.81	5.60	5.18	4.175	3.728	1.20	1.22	U.S OK	D.S OK	0.447	35.78	35.79	F7.1-F7
F7-F8				0.00	0.00	6.08	36.51	5.18	5.08	1.906	1.738	2.97	3.04	U.S OK	D.S OK	0.167	30.11	30.11	F7-F8
F8.1-F8.0	31			0.58	0.06	0.63	3.80	5.00	5.08	3.575	3.224	1.20	1.63	U.S OK	D.S OK	0.351	28.09	28.09	F8.1-F8.0
F8-F9				0.00	0.00	6.72	40.31	5.08	5.20	1.738	1.625	3.04	3.28	U.S OK	D.S OK	0.114	22.78	22.78	F8-F9
F9-F10	50		45	1.44	0.14	8.30	49.81	5.20	5.70	1.625	1.375	3.28	4.03	U.S OK	D.S OK	0.250	49.92	49.92	F9-F10
F10.2-F10.1	70			1.32	0.13	1.45	8.73	5.800	5.80	4.375	4.079	1.20	1.50	U.S OK	D.S OK	0.296	23.68	23.68	F10.2-F10.1
F10.1-F10	50			0.94	0.09	2.49	14.96	5.800	5.70	4.079	3.744	1.50	1.73	U.S OK	D.S OK	0.335	40.19	40.19	F10.1-F10
F10-FOut				0.00	0.00	10.80	64.77	5.700	4.50	1.375	1.308	3.95	2.82	U.S OK	D.S OK	0.067	13.47	13.47	F10-Fout

Foul Sewer Design

Design Parameters				
Pipe Material	uPVC		Density(kg/m3)	1000
Viscosity(Pa s)	0.0012		Limiting V(m/s)	0.7 - 3.0m/s
Roughness(mm)	1.5			
Gravity(m/s2)	9.81			

Section	Gradient	Gradient	Diameter	Manholes	d (water dp)	d/D	Angle	Wet Peri	Liquid Area	M	SQRT (32gmi)	Prop Vel	Vel Check	Angle	Liquid	Q = VA	Cap Check	Section
	dec	1 in	mm		mm		Rad	m	m2			m/s		Rad	m2	l/s	l/s	
F1-F2	0.013	80	225	OK	43	0.193	1.820	0.205	0.022	0.105	0.643	1.932	Velocity OK	1.820	0.022	42	Capacity OK	F1-F2
F2.1-F2.0	0.014	70	225	OK	29	0.128	1.466	0.165	0.012	0.072	0.570	1.620	Velocity OK	1.466	0.012	19	Capacity OK	F2.1-F2.0
F2-F3	0.008	120	225	OK	70	0.311	2.365	0.266	0.042	0.158	0.644	2.049	Velocity OK	2.365	0.042	86	Capacity OK	F2-F3
F3.1-F3	0.013	80	225	OK	23	0.103	1.309	0.147	0.009	0.059	0.481	1.324	Velocity OK	1.309	0.009	11	Capacity OK	F3.1-F3
F3-F4	0.013	80	225	OK	86	0.382	2.667	0.300	0.056	0.186	0.855	2.786	Velocity OK	2.667	0.056	156	Capacity OK	F3-F4
F4.1-F4	0.013	80	225	OK	25	0.113	1.370	0.154	0.010	0.064	0.501	1.398	Velocity OK	1.370	0.010	14	Capacity OK	F4.1-F4
F4-F5	0.008	120	225	OK	115	0.513	3.194	0.359	0.082	0.229	0.773	2.588	Velocity OK	3.194	0.082	213	Capacity OK	F4-F5
F5.1-F5	0.013	80	225	OK	15	0.067	1.045	0.118	0.005	0.039	0.390	1.002	Velocity OK	1.045	0.005	5	Capacity OK	F5.1-F5
F5-F6	0.008	120	225	OK	122	0.541	3.307	0.372	0.088	0.236	0.786	2.641	Velocity OK	3.307	0.088	232	Capacity OK	F5-F6
F6.1-F6	0.013	80	225	OK	43	0.192	1.815	0.204	0.021	0.105	0.641	1.926	Velocity OK	1.815	0.021	41	Capacity OK	F6.1-F6
F6-F7	0.006	180	300	OK	141	0.470	3.023	0.453	0.131	0.288	0.709	2.443	Velocity OK	3.023	0.131	319	Capacity OK	F6-F7
F7.1-F7	0.013	80	225	OK	23	0.103	1.309	0.147	0.009	0.059	0.481	1.324	Velocity OK	1.309	0.009	11	Capacity OK	F7.1-F7
F7-F8	0.006	180	300	OK	150	0.500	3.143	0.472	0.142	0.300	0.724	2.506	Velocity OK	3.143	0.142	355	Capacity OK	F7-F8
F8.1-F8.0	0.013	80	225	OK	29	0.128	1.466	0.165	0.012	0.072	0.533	1.515	Velocity OK	1.466	0.012	18	Capacity OK	F8.1-F8.0
F8-F9	0.005	200	300	OK	170	0.565	3.403	0.511	0.165	0.323	0.712	2.487	Velocity OK	3.403	0.165	410	Capacity OK	F8-F9
F9-F10	0.005	200	300	OK	203	0.677	3.864	0.580	0.204	0.351	0.743	2.623	Velocity OK	3.864	0.204	534	Capacity OK	F9-F10
F10.2-F10.1	0.013	80	225	OK	51	0.228	1.990	0.224	0.027	0.122	0.691	2.122	Velocity OK	1.990	0.027	58	Capacity OK	F10.2-F10.1
F10.1-F10	0.008	120	225	OK	87	0.389	2.693	0.303	0.057	0.189	0.703	2.292	Velocity OK	2.693	0.057	131	Capacity OK	F10.1-F10
F10-Fout	0.005	200	375	OK	193	0.514	3.199	0.600	0.229	0.382	0.774	2.762	Velocity OK	3.199	0.229	632	Capacity OK	F10-Fout

Schedule of Accommodation

		1 Bed	2 Bed	3 Bed	4 Bed	Total Beds	No. of App	PE
Block 2 - Type D	GF	2	5					
	Fl 1	1	6					
	Fl 2	1	6					
	Fl 3	1	6					
	Fl 4	1	6					
	Fl 5	1	6					
	Fl 6	1	6					
	Fl 7	1	6					
	Fl 8	1	6					
	Fl 9	1	3					
	Fl 10	1	2					
	Fl 11							
	Fl 12							
	Fl 13							
	Fl 14							
	Fl 15							
	Sub totals	12	58	0	0	128	70	192
Block 3 - Typc C	GF	5	7					
	Fl 1	3	9					
	Fl 2	3	9					
	Fl 3	3	9					
	Fl 4	3	9					
	Fl 5	3	9					
	Fl 6	3	9					
	Fl 7	3	5					
	Fl 8	3	5					
	Sub totals	29	71	0	0	171	100	257
Block 4 - Type A	GF	4	3					
	Fl 1	3	4					
	Fl 2	3	4					
	Fl 3	3	4					
	Fl 4	3	4					
	Fl 5	3	4					
	Fl 6	1	2					
	Sub totals	20	25	0	0	70	45	105
Block 5 - Type B	GF	5	5					
	Fl 1	4	6					
	Fl 2	4	6					
	Fl 3	4	6					
	Fl 4	4	6					
	Fl 5	4	6					
	Fl 6	4	2					
	Sub totals	29	37	0	0	103	66	155
Block 6 - Type A	GF	4	3					
	Fl 1	3	4					
	Fl 2	3	4					
	Fl 3	3	4					
	Fl 4	3	4					
	Fl 5	3	4					
	Fl 6	1	2					
	Sub totals	20	25	0	0	70	45	105
Block 7 - Type B	GF	5	5					
	Fl 1	4	6					
	Fl 2	4	6					
	Fl 3	4	6					
	Fl 4	4	6					
	Fl 5	4	6					
	Fl 6	4	2					
	Sub totals	29	37	0	0	103	66	155
Community Créche		m2						
	GF	472						15.73
	Fl 1	472						15.73
	Fl 2	393						13.10
	Subtotals	1337						44.57
Block 1 / Student Accommodation	GF		3	3	3			
	Fl 1			6	6			
	Fl 2		2	10	4			
	Fl 3		2	8	2			
	Fl 4		2	6				
	Fl 5			4				
	Café	145						
	Retail 2	87						
	Retail 3	87						
	Retail 4	87						
	Reception	305						
	Subtotals		9	37	15	189	61	284

Appendix B – Storm Sewer Network Design

Storm Line	Contributing Areas									Total	Eq Area
	Block	Block	Roads	Roads	Roads	Roads	Green	Green	Green	m²	m²
S1-S2	**1055**	**314.5**	**177**	**292**	**264**		**203**	**357**		2662.5	**2197.2**
S2.1-S2			**449**				**628**			1077	**592.5**
S2-S3			**333**				**197**	**183**		713	**413.7**
										0	**0**
S3-S4	**781**		**480**				**315**	**43**		1619	**1320.4**
S4.1-S4	**805**	**805**	**686**	**512**			**392**			3200	**2805.8**
S4-S5	**206**						**200**			406	**266**
S5.1-S5	**802**	**113**	**342**	**232**	**265**		**173**	**1272**		3199	**2103.6**
S5-S6			**355**				**228**			583	**387.9**
S6.1-S6	**466**	**314.5**	**211**	**292**	**255**		**231**	**334**		2103.5	**1632.2**
S6-S7	**800**		**130**	**374**			**173**	**372**		1849	**1417.1**
											0
S7.2-S7.1	**596**		**187**				**797**	**487**		2067	**1149.5**
S7.1-S7			**136**				**322**			458	**219**
S7-S8	**314.5**		**183**				**130**	**422**		1049.5	**644.8**
S8-S9											**0**
											0
S9.3-S9.2	**702**									702	**702**
S9.2-S9.1										0	**0**
											0
S9.1.1-9.1	**1225**		**513**				**354**	**251**		2343	**1868.2**
S9.1-S9	**508**									508	**508**
										0	**0**
										0	**0**

Total Contributing Area = **24540**

Total Equivalent Paved Area (100%Roofs + 90%Roads + 30%Greens) = **18228**

Site Area = **40251**

Cv = 0.74

Storm Sewer Design

PIPE LAYOUT

Design Parameters				Pumping Requirements		
Pipe Material	Polypipe	Density(kg/m3)	1000	Flow per Day		
Viscosity(Pa s)	0.0012	Limiting V(m/s)	1.0 - 3.0m/s	Sump invert		
Roughness(m)	0.00030	Storm event	1 in 5 yr	Manhole Invert		
Gravity(m/s2)	9.81			Rise Height		

Section	Grd Lvl US	Grd Lvl DS	Inv US	Inv DS	Cover US	Cover DS	ΔH	Plan Length	Pipe Length	Gradient	Gradient	Diameter	Cover Check		Section
	m	m	m	m	m	m	m	m	m	dec	1 in	m	US >1.2m	DS >1.2	
S1-S2	6.100	5.600	4.675	3.998	1.20	1.38	0.68	54.19	54.19	0.013	80	0.225	*U.S OK*	*D.S OK*	**S1-S2**
S2.1-S2	6.100	5.600	4.975	4.462	0.90	0.91	0.51	35.94	35.94	0.014	70	0.225	*U.S FAIL*	*D.S FAIL*	S2.1-S2
S2-S3	5.60	5.60	3.998	3.772	1.30	1.53	0.23	45.12	45.12	0.005	200	0.300	*U.S OK*	*D.S OK*	**S2-S3**
S3-S4	0.00	5.40	3.772	3.623	-4.15	1.40	0.15	44.72	44.72	0.003	300	0.375	*U.S FAIL*	*D.S OK*	**S3-S4**
S4.1-S4	5.75	5.40	4.250	3.713	1.20	1.39	0.54	80.60	80.60	0.007	150	0.300	*U.S OK*	*D.S OK*	S4.1-S4
S4-S5	5.40	5.27	3.623	3.556	1.40	1.34	0.07	20.10	20.10	0.003	300	0.375	*U.S OK*	*D.S OK*	**S4-S5**
S5.1-S5	4.70	5.27	3.734	3.247	0.67	1.72	0.49	69.70	69.70	0.007	143	0.300	*U.S FAIL*	*D.S OK*	S5.1-S5
S5-S6	5.27	5.50	3.247	3.175	1.65	1.95	0.07	25.18	25.18	0.003	350	0.375	*U.S OK*	*D.S OK*	**S5-S6**
S6.1-S6	5.90	5.50	4.475	4.000	1.20	1.28	0.48	57.04	57.04	0.008	120	0.225	*U.S OK*	*D.S OK*	S6.1-S6
S6-S7	5.50	5.18	3.175	3.080	1.87	1.64	0.09	37.96	37.96	0.003	400	0.450	*U.S OK*	*D.S OK*	**S6-S7**
S7.2-S7.1	4.80	5.20	3.675	3.324	0.90	1.65	0.35	28.09	28.09	0.013	80	0.225	*U.S FAIL*	*D.S OK*	S7.2-S7.1
S7.1-S7	5.08	5.20	3.324	3.147	1.38	1.68	0.18	35.35	35.35	0.005	200	0.375	*U.S OK*	*D.S OK*	S7.1-S7
S7-S8	5.18	5.60	3.080	2.991	1.64	2.16	0.09	35.85	35.85	0.003	400	0.450	*U.S OK*	*D.S OK*	**S7-S8**
S8-S9	5.60	5.80	2.991	2.958	2.16	2.39	0.03	12.90	12.90	0.003	400	0.450	*U.S OK*	*D.S OK*	**S8-S9**
S9.3-S9.2	5.80	5.80	4.375	4.244	1.20	1.33	0.13	26.15	26.15	0.005	200	0.225	*U.S OK*	*D.S OK*	S9.3-S9.2
S9.2-S9.1	5.80	5.80	4.244	4.038	1.33	1.54	0.21	41.21	41.21	0.005	200	0.225	*U.S OK*	*D.S OK*	S9.2-S9.1
S9.1.1-9.1	5.30	5.80	3.800	3.639	1.20	1.86	0.16	32.18	32.18	0.005	200	0.300	*U.S OK*	*D.S OK*	S9.1.1-9.1
S9.1-S9	5.80	5.80	3.639	3.376	1.86	2.12	0.26	52.64	52.64	0.005	200	0.300	*U.S OK*	*D.S OK*	S9.1-S9
S9-PI	5.80	5.50	2.958	2.935	2.32	2.04	0.02	9.25	9.250	0.003	400	0.525	*U.S OK*	*D.S OK*	**S9-PI**
PI-S10	5.50	5.00	2.835	2.801	2.14	1.67	0.03	13.76	13.760	0.003	400	0.525	*U.S OK*	*D.S OK*	**PI-S10**
S10-SOut	5.00	4.00	2.801	2.764	1.67	0.71	0.04	14.56	14.560	0.003	400	0.525	*U.S OK*	*D.S FAIL*	**S10-SOut**

Storm Sewer Design

CAPACITY CHECK

Design Parameters					
Pipe Material	Polypipe	Density(kg/m3)	1000	Te min	4.00
Viscosity(Pa s)	0.0012	Limiting V(m/s)	1.0 - 3.0m/s	Cv	0.74
Roughness(m)	0.00030				
Gravity(m/s2)	9.81				

Return Period	Time of Entry (te) (min)
1	4 – 8
2	4 – 7
5	3 - 6
>5	2 - 4

Times of Entry (t_e) typically used for design purposes

Section	A	2gdi	Velocity	Check	ToF	ToC Section	ToC Used	Intensity	Imp Area	Imp Area	Q Section	Q Cumul	Capacity	Capacity Check	Section
	m2		m/s		min	min	min	mm/hr	m2	ha	l/s	l/s	l/s		
S1-S2	0.04	0.2349	1.59	Velocity OK	0.57	4.57	4.57	80.23	2197	0.220	47.27	47.27	63.18	Capacity OK	S1-S2
S2.1-S2	0.04	0.2511	1.70	Velocity OK	0.35	4.35	4.35	82.95	593	0.059	13.18	13.18	67.62	Capacity OK	S2.1-S2
S2-S3	0.07	0.1716	1.20	Velocity OK	0.63	5.20	5.20	73.43	414	0.041	8.15	68.59	84.56	Capacity OK	S2-S3
S3-S4	0.11	0.1566	1.12	Velocity OK	0.67	5.86	5.86	67.59	1320	0.132	23.93	92.53	123.72	Capacity OK	S3-S4
S4.1-S4	0.07	0.1981	1.39	Velocity OK	0.97	4.97	4.97	75.72	2806	0.281	56.97	56.97	97.92	Capacity OK	S4.1-S4
S4-S5	0.11	0.1566	1.12	Velocity OK	0.30	6.16	6.16	65.32	266	0.027	4.66	97.19	123.72	Capacity OK	S4-S5
S5.1-S5	0.07	0.2028	1.42	Velocity OK	0.82	4.82	4.82	77.34	2104	0.210	43.63	43.63	100.29	Capacity OK	S5.1-S5
S5-S6	0.11	0.1450	1.04	Velocity OK	0.41	6.57	6.57	62.52	388	0.039	6.50	103.69	114.33	Capacity OK	S5-S6
S6.1-S6	0.04	0.1918	1.29	Velocity OK	0.74	4.74	4.74	78.27	1632	0.163	34.26	34.26	51.39	Capacity OK	S6.1-S6
S6-S7	0.16	0.1486	1.08	Velocity OK	0.58	7.15	7.15	58.97	1417	0.142	22.41	126.10	172.55	Capacity OK	S6-S7
S7.2-S7.1	0.04	0.2349	1.59	Velocity OK	0.29	4.29	4.29	83.71	1150	0.115	25.80	25.80	63.18	Capacity OK	S7.2-S7.1
S7.1-S7	0.11	0.1918	1.38	Velocity OK	0.43	4.72	4.72	78.42	219	0.022	4.61	30.41	152.16	Capacity OK	S7.1-S7
S7-S8	0.16	0.1486	1.08	Velocity OK	0.55	7.70	7.70	56.04	645	0.064	9.69	135.79	172.55	Capacity OK	S7-S8
S8-S9	0.16	0.1486	1.08	Velocity OK	0.20	7.90	7.90	55.07	0	0.000	0.00	135.79	172.55	Capacity OK	S8-S9
S9.3-S9.2	0.04	0.1486	1.00	Velocity OK	0.44	4.44	4.44	81.84	702	0.070	15.41	15.41	39.58	Capacity OK	S9.3-S9.2
S9.2-S9.1	0.04	0.1486	1.00	Velocity OK	0.69	5.13	5.13	74.11	0	0.000	0.00	15.41	39.58	Capacity OK	S9.2-S9.1
S9.1.1-9.1	0.07	0.1716	1.20	Velocity OK	0.45	4.45	4.45	81.71	1868	0.187	40.93	40.93	84.56	Capacity OK	S9.1.1-9.1
S9.1-S9	0.07	0.1716	1.20	Velocity OK	0.73	5.18	5.18	73.58	508	0.051	10.02	66.36	84.56	Capacity OK	S9.1-S9
S9-PI	0.22	0.1605	1.20	Velocity OK	0.13	8.03	8.03	54.46	0	0.000	0.00	202.15	258.76	Capacity OK	S9-PI
PI-S10	0.22	0.1605	1.20	Velocity OK	0.19	8.22	8.22	53.59	0	0.000	0.00	202.15	258.76	Capacity OK	PI-S10
S10-SOut	0.22	0.1605	1.20	Velocity OK	0.20	8.42	8.42	52.70	0	0.000	0.00	202.15	258.76	Capacity OK	S10-SOut

	Network Capacity		Attenuation A Inv =		3.00	m AOD		
			Base Depth =		0.3	m		
			Arch Height =		1.14	m		
			Cover Depth =		0.3	m		
			Top Water Level =		4.74	m AOD		
Section	**Pipe Length**	**Diameter**	**Volume**	**Cum Vol**	**US MH**	**Dia**	**Vol to TWL**	**Total Vol**
	m	m	m3	m3	m AOD	m	m3	m3
S1-S2	54.2	0.225	2.15	2.15	4.675	1.2	-0.18	1.97
S2.1-S2	35.9	0.225	1.43	1.43	4.975	1.2	-0.52	0.91
S2-S3	45.1	0.3	3.19	6.77	3.998	1.2	0.50	7.27
S3-S4	44.7	0.375	4.94	11.71	3.772	1.2	0.67	12.88
S4.1-S4	80.6	0.3	5.70	5.70	4.250	1.2	0.21	5.91
S4-S5	20.1	0.375	2.22	19.63	3.623	1.2	0.84	21.85
S5.1-S5	69.7	0.3	4.93	4.93	3.734	1.2	0.80	5.73
S5-S6	25.2	0.375	2.78	27.34	3.247	1.2	1.26	31.63
S6.1-S6	57.0	0.225	2.27	2.27	4.475	1.2	0.05	2.31
S6-S7	38.0	0.45	6.04	35.64	3.175	1.2	1.26	41.24
S7.2-S7.1	28.1	0.225	1.12	1.12	3.675	1.2	0.95	2.07
S7.1-S7	35.3	0.375	3.90	5.02	3.324	1.2	1.18	7.15
S7-S8	35.9	0.45	5.70	46.37	3.080	1.2	1.37	55.46
S8-S9	12.9	0.45	2.05	48.42	2.991	1.2	1.47	58.98
S9.3-S9.2	26.1	0.225	1.04	1.04	4.375	1.2	0.16	1.20
S9.2-S9.1	41.2	0.225	1.64	2.68	4.244	1.2	0.31	3.14
S9.1.1-9.1	32.2	0.3	2.27	2.27	3.800	1.2	0.72	3.00
S9.1-S9	52.6	0.3	3.72	8.67	3.639	1.2	0.91	10.30
S9-PI	9.3	0.525	2.00	59.10	2.958	1.2	1.42	73.17
PI-S10	13.8	0.525	2.98	62.07	2.835	1.2	1.56	77.71
S10-SOut	14.6	0.525	3.15	65.23	2.801	1.2	1.60	**82.46**

Appendix C – Met Eireann Rainfall Return Data

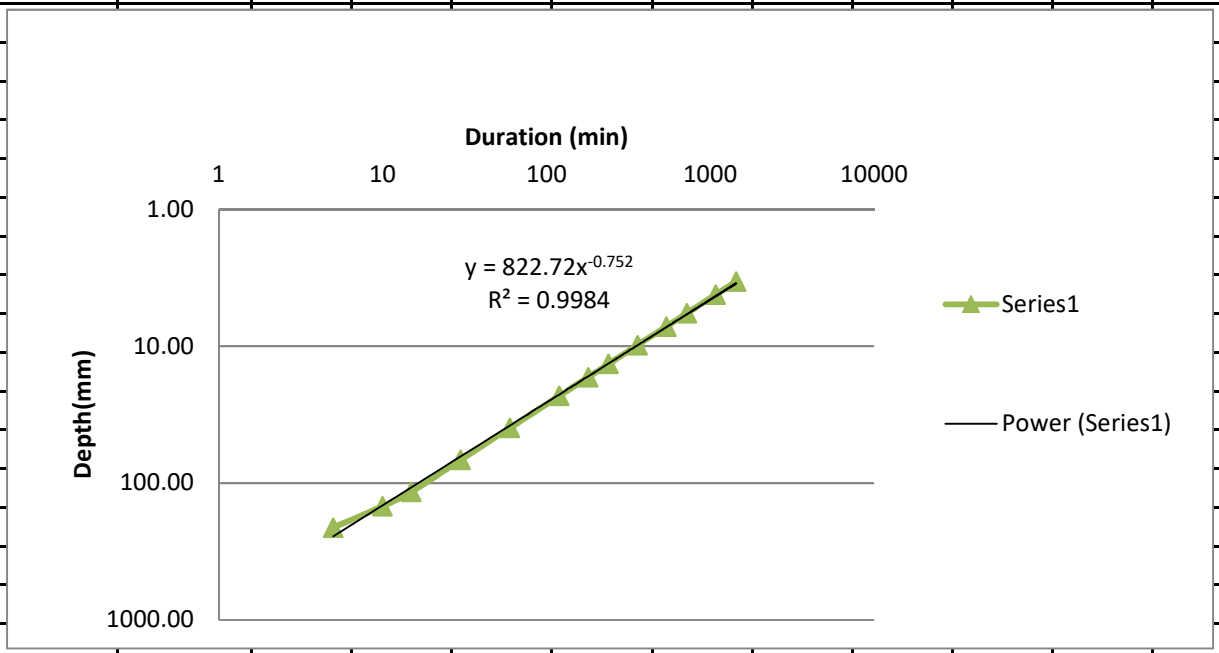
Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 158740, Northing: 157556,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.7,	3.9,	4.6,	5.7,	6.4,	6.9,	8.8,	10.9,	12.3,	14.4,	16.2,	17.6,	19.9,	21.6,	23.1,	N/A ,
10 mins	3.8,	5.5,	6.4,	7.9,	8.9,	9.7,	12.2,	15.2,	17.2,	20.0,	22.6,	24.6,	27.7,	30.1,	32.1,	N/A ,
15 mins	4.4,	6.5,	7.6,	9.3,	10.4,	11.4,	14.4,	17.9,	20.2,	23.6,	26.6,	28.9,	32.6,	35.4,	37.8,	N/A ,
30 mins	5.8,	8.2,	9.5,	11.5,	12.9,	14.0,	17.5,	21.4,	24.1,	27.8,	31.2,	33.8,	37.8,	40.9,	43.5,	N/A ,
1 hours	7.5,	10.4,	12.0,	14.3,	15.9,	17.2,	21.2,	25.7,	28.7,	32.9,	36.6,	39.4,	43.9,	47.3,	50.1,	N/A ,
2 hours	9.6,	13.2,	15.1,	17.8,	19.7,	21.1,	25.7,	30.8,	34.2,	38.8,	42.9,	46.1,	50.9,	54.6,	57.7,	N/A ,
3 hours	11.2,	15.2,	17.2,	20.3,	22.3,	23.8,	28.8,	34.3,	37.9,	42.8,	47.2,	50.5,	55.5,	59.4,	62.6,	N/A ,
4 hours	12.5,	16.7,	18.9,	22.2,	24.3,	26.0,	31.2,	37.0,	40.7,	45.9,	50.4,	53.8,	59.1,	63.1,	66.4,	N/A ,
6 hours	14.5,	19.2,	21.7,	25.2,	27.5,	29.3,	35.0,	41.1,	45.1,	50.6,	55.3,	59.0,	64.5,	68.7,	72.1,	N/A ,
9 hours	16.9,	22.1,	24.8,	28.6,	31.1,	33.1,	39.2,	45.8,	50.0,	55.8,	60.8,	64.6,	70.3,	74.7,	78.3,	N/A ,
12 hours	18.8,	24.4,	27.2,	31.3,	34.0,	36.0,	42.4,	49.3,	53.7,	59.8,	64.9,	68.9,	74.8,	79.3,	83.0,	N/A ,
18 hours	21.9,	28.0,	31.1,	35.6,	38.5,	40.6,	47.5,	54.9,	59.5,	65.9,	71.3,	75.4,	81.6,	86.3,	90.1,	N/A ,
24 hours	24.3,	30.9,	34.2,	38.9,	42.0,	44.3,	51.5,	59.2,	64.0,	70.6,	76.2,	80.5,	86.8,	91.6,	95.5,	108.7,
2 days	31.2,	38.6,	42.2,	47.4,	50.6,	53.1,	60.7,	68.6,	73.6,	80.3,	85.9,	90.1,	96.4,	101.1,	104.9,	117.7,
3 days	37.2,	45.3,	49.3,	54.7,	58.2,	60.8,	68.9,	77.2,	82.3,	89.1,	94.9,	99.2,	105.6,	110.4,	114.2,	127.0,
4 days	42.8,	51.5,	55.7,	61.5,	65.2,	67.9,	76.3,	85.0,	90.3,	97.4,	103.3,	107.7,	114.2,	119.1,	123.0,	135.9,
6 days	53.0,	62.8,	67.4,	73.8,	77.9,	80.9,	89.9,	99.2,	104.9,	112.3,	118.6,	123.2,	130.0,	135.0,	139.0,	152.3,
8 days	62.6,	73.2,	78.3,	85.2,	89.6,	92.8,	102.4,	112.2,	118.2,	126.0,	132.6,	137.4,	144.4,	149.6,	153.8,	167.4,
10 days	71.7,	83.2,	88.6,	96.0,	100.6,	104.0,	114.2,	124.5,	130.7,	138.9,	145.6,	150.6,	157.9,	163.3,	167.6,	181.6,
12 days	80.5,	92.8,	98.5,	106.3,	111.1,	114.7,	125.4,	136.1,	142.6,	151.1,	158.1,	163.2,	170.7,	176.2,	180.6,	195.0,
16 days	97.6,	111.2,	117.5,	126.0,	131.3,	135.2,	146.7,	158.2,	165.2,	174.1,	181.6,	187.0,	194.9,	200.7,	205.3,	220.2,
20 days	114.2,	129.0,	135.8,	144.9,	150.6,	154.7,	167.0,	179.2,	186.5,	195.9,	203.7,	209.4,	217.6,	223.6,	228.4,	243.9,
25 days	134.6,	150.6,	158.0,	167.8,	173.9,	178.3,	191.4,	204.3,	212.0,	222.0,	230.1,	236.0,	244.6,	250.9,	255.9,	271.9,

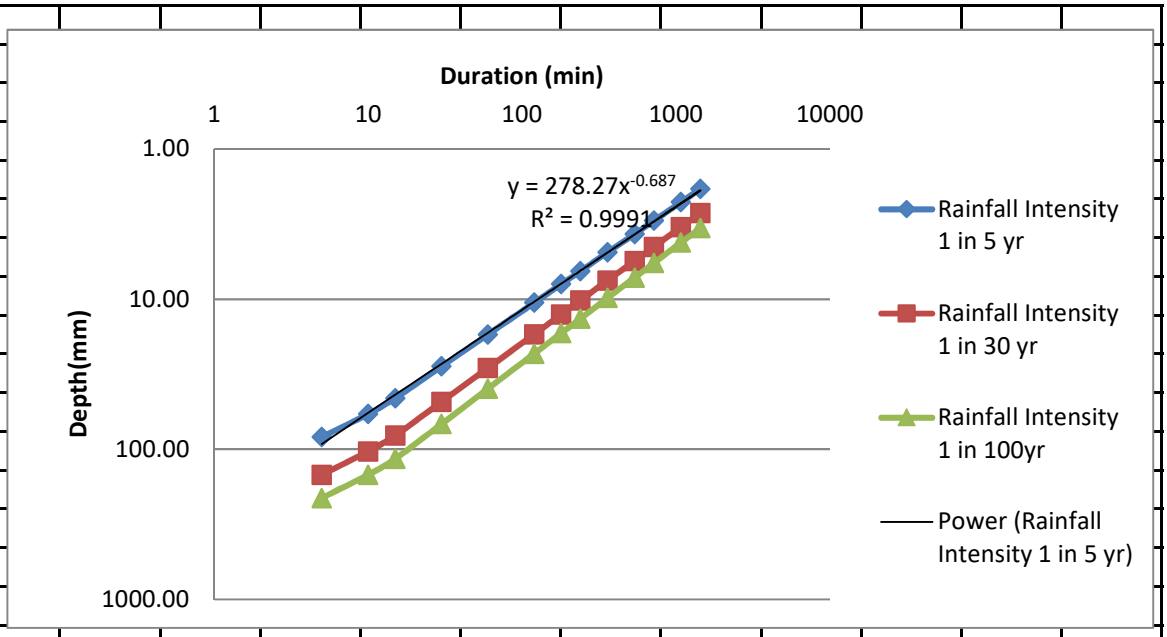
NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

Met Eireann Record

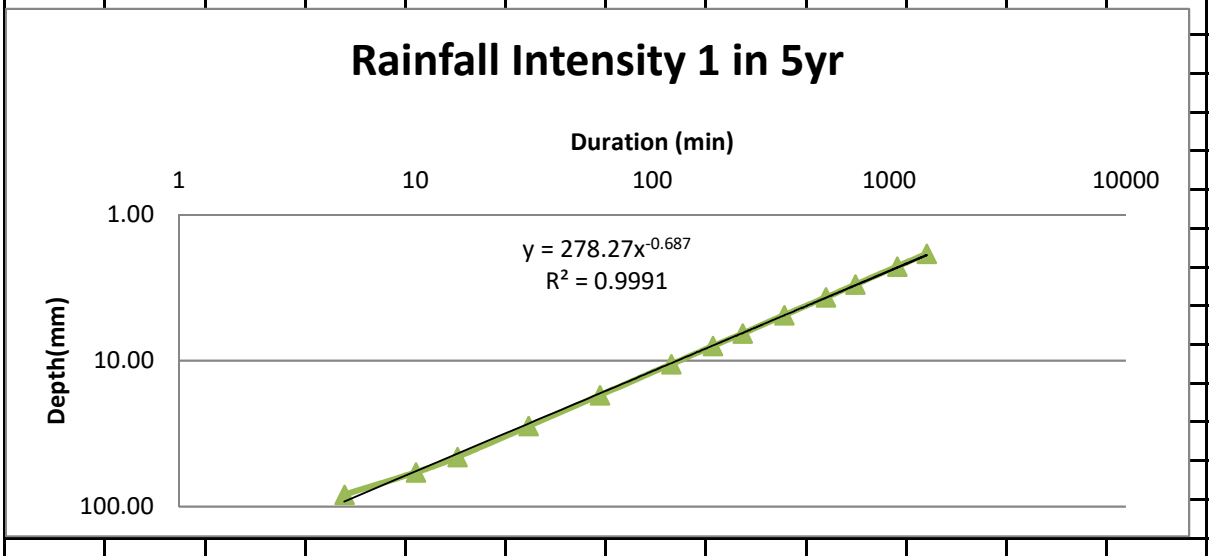
Depth											
Return period		**2**	**3**	**4**	**5**	**10**	**20**	**30**	**50**	**75**	**100**
Duration											
5					6.9			12.3			17.6
10					9.7			17.2			24.6
15					11.4			20.2			28.9
30					14			24.1			33.8
60					17.2			28.7			39.4
120					21.1			34.2			46.1
180					23.8			37.9			50.5
240					26			40.7			53.8
360					29.3			45.1			59
540					33.1			50			64.6
720					36			53.7			68.9
1080					40.6			59.5			75.4
1440					44.3			64			80.5
2880					53.1			73.6			90.1
4320					60.8			82.3			99.2
5760					67.9			90.3			107.7
8640					80.9			104.9			123.2
11520					82.8			118.2			137.4
14400					104			130.7			150.6
17280					114.7			142.6			163.2
23040					135.2			165.2			187
28800					154.7			186.5			209.4
360000					178.3			212			236



		AAR =	995	mm							



Depth											
Return period		2	3	4	5	10	20	30	50	75	100
Duration											
5	12.00	0.00	0.00	0.00	82.80	0.00	0.00	147.60	0.00	0.00	211.20
10	6.00	0.00	0.00	0.00	58.20	0.00	0.00	103.20	0.00	0.00	147.60
15	4.00	0.00	0.00	0.00	45.60	0.00	0.00	80.80	0.00	0.00	115.60
30	2.00	0.00	0.00	0.00	28.00	0.00	0.00	48.20	0.00	0.00	67.60
60	1.00	0.00	0.00	0.00	17.20	0.00	0.00	28.70	0.00	0.00	39.40
120	0.50	0.00	0.00	0.00	10.55	0.00	0.00	17.10	0.00	0.00	23.05
180	0.33	0.00	0.00	0.00	7.93	0.00	0.00	12.62	0.00	0.00	16.82
240	0.25	0.00	0.00	0.00	6.50	0.00	0.00	10.18	0.00	0.00	13.45
360	0.17	0.00	0.00	0.00	4.86	0.00	0.00	7.49	0.00	0.00	9.79
540	0.11	0.00	0.00	0.00	3.68	0.00	0.00	5.56	0.00	0.00	7.18
720	0.08	0.00	0.00	0.00	3.00	0.00	0.00	4.47	0.00	0.00	5.74
1080	0.06	0.00	0.00	0.00	2.26	0.00	0.00	3.31	0.00	0.00	4.19
1440	0.04	0.00	0.00	0.00	1.85	0.00	0.00	2.67	0.00	0.00	3.35
2880	0.02	0.00	0.00	0.00	1.10	0.00	0.00	1.53	0.00	0.00	1.87



Appendix D – Attenuation Calculation

Proposed Development at Pa Healy Road, Limerick

30 Year Annual Agerage Rainfall

DURATION (min)		Met.ie Rainfall Record Depth (mm)	Average Rainfall Intensity (mm/hr)	Climate Change Allowance 20%	Predicted Rainfall Intensity (mm/hr)
30	min	24.1	48.2	1.2	57.8
60	min	28.7	28.7	1.2	34.4
2	hrs	34.2	17.1	1.2	20.5
4	hrs	40.7	10.2	1.2	12.2
12	hrs	53.7	4.5	1.2	5.4
24	hrs	64	2.7	1.2	3.2
48	hrs	73.6	1.5	1.2	1.8

100 Year Annual Agerage Rainfall

DURATION (min)		Met.ie Rainfall Record Depth (mm)	Average Rainfall Intensity (mm/hr)	Climate Change Allowance 20%	Predicted Rainfall Intensity (mm/hr)
30	min	33.8	67.6	1.2	81.1
60	min	39.4	39.4	1.2	47.3
2	hrs	46.1	23.1	1.2	27.7
4	hrs	53.8	13.5	1.2	16.1
12	hrs	68.9	5.7	1.2	6.9
24	hrs	80.5	3.4	1.2	4.0
48	hrs	90.1	1.9	1.2	2.3

Proposed Development at Pa Healy Road, Limerick

SURFACE WATER STORAGE CALCULATIONS

COPAS Formula $C = (Q * ts) - [P(ts + tc) + P(P * tc / Q)]$

C = Storage requirment	(m^3)
Q = Discharge	(m^3/min) or (l/s)
ts = Storm Duration	(min)
P = Permitted outfall rate	(m^3/min) or (l/s)
tc = Time of concentration	(min)
R = Rainfall Intensity	(mm/hr)
A(Imp) = Impermeable area of site	(ha)
A = Site Area	(ha)

tc =	8.42	min	
P =	0.48	m^3/min	2.00 l/s/ha
A (Imp) =	1.850	ha	
A =	4.02	ha	

Hydro Q	**8.04**	**l/s**

Proposed Development at Pa Healy Road, Limerick

30 year storm ts = 30 min

	ts	30	min
	R	57.8	mm/hr
	Q	297.47	l/s
		17.85	m^3/min
QBAR Rural (Large)	**C**	**508.8**	**m^3**
QBAR Rural (Small)	**C**	**509.8**	**m^3**
QBAR (GDSDS)	**C**	**516.8**	**m^3**

30 year storm ts = 60 min

	ts	60	min
	R	34.4	mm/hr
	Q	177.12	l/s
		10.63	m^3/min
QBAR Rural (Large)	**C**	**590.2**	**m^3**
QBAR Rural (Small)	**C**	**591.9**	**m^3**
QBAR (GDSDS)	**C**	**604.5**	**m^3**

30 year storm ts = 120 min

	ts	120	min
	R	20.5	mm/hr
	Q	105.53	l/s
		6.33	m^3/min
QBAR Rural (Large)	**C**	**670.9**	**m^3**
QBAR Rural (Small)	**C**	**674.1**	**m^3**
QBAR (GDSDS)	**C**	**697.6**	**m^3**

30 year storm ts =240 min

	ts	240	min
	R	12.2	mm/hr
	Q	62.80	l/s
		3.77	m^3/min
QBAR Rural (Large)	**C**	**732.3**	**m^3**
QBAR Rural (Small)	**C**	**738.5**	**m^3**
QBAR (GDSDS)	**C**	**783.9**	**m^3**

Proposed Development at Pa Healy Road, Limerick

30 year storm ts =12hr

	ts	720	min
	R	5.4	mm/hr
	Q	27.62	l/s
		1.66	m^3/min
QBAR Rural (Large)	**C**	**689.5**	**m^3**
QBAR Rural (Small)	**C**	**707.7**	**m^3**
QBAR (GDSDS)	**C**	**840.5**	**m^3**

30 year storm ts =24hr

	ts	1440	min
	R	3.2	mm/hr
	Q	16.46	l/s
		0.99	m^3/min
QBAR Rural (Large)	**C**	**421.4**	**m^3**
QBAR Rural (Small)	**C**	**457.4**	**m^3**
QBAR (GDSDS)	**C**	**721.2**	**m^3**

30 year storm ts =48hr

	ts	2880	min
	R	1.8	mm/hr
	Q	9.46	l/s
		0.57	m^3/min
QBAR Rural (Large)	**C**	**-359.0**	**m^3**
QBAR Rural (Small)	**C**	**-287.2**	**m^3**
QBAR (GDSDS)	**C**	**238.4**	**m^3**

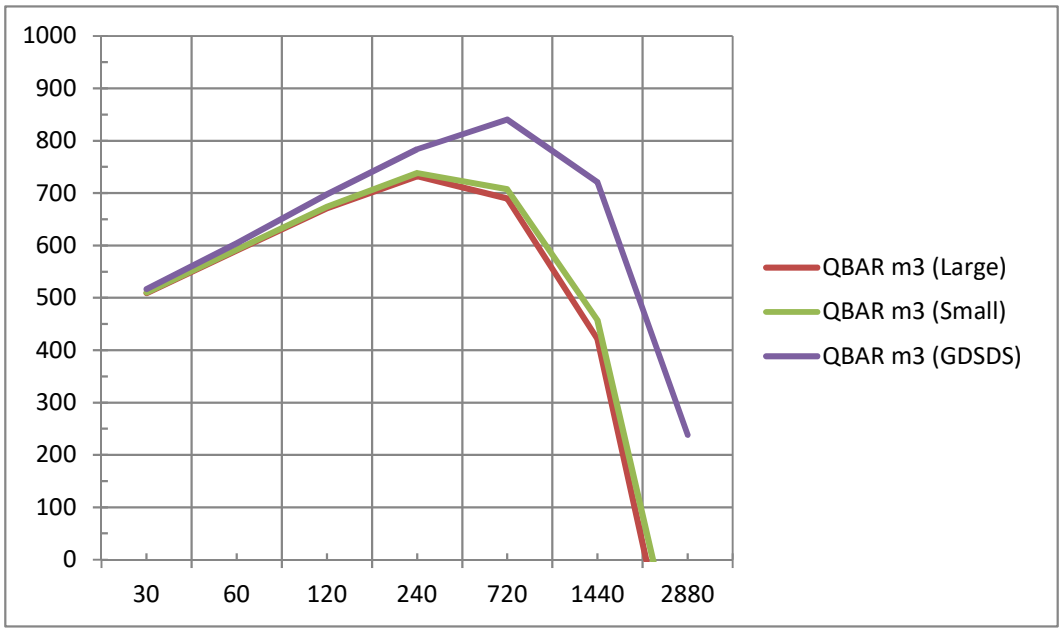
Q_{BAR} = Mean Annual Peak Flow (m^3/s)
SAAR = Standard Annual Average Rainfall (mm)
SOIL = Soil Index
AREA = Total Area of Site (km^2)

$Q_{BAR} = 0.00108*(AREA)^{0.89}*(SAAR)^{1.17}*(SOIL)^{2.17}$

AREA =	0.5	km^2	Ha =	50
SAAR =	995	mm		
SOIL =	0.3			

Q_{BAR} Rural (Large)	0.143	m^3/s	=	142.6	l/s	2.85 l/s/ha
	8.557	m^3/min		2.85	l/s/ha	0.171 $m^3/min/ha$
	0.69	m^3/min	Site			
Q_{BAR} Rural (Small)	0.138	m^3/s	=	137.5	l/s	2.75 l/s/ha
	8.250	m^3/min		2.75	l/s/ha	0.165 $m^3/min/ha$
	0.66	m^3/min	Site			
Q_{BAR} (GDSDS)	0.1	m^3/s	=	100.0	**l/s**	2 l/s/ha
	6.000	m^3/min		2.00	l/s/ha	0.120 $m^3/min/ha$
	0.48	m^3/min	Site			

Storm T Hr	**Storm T** Min	**Q_{BAR} m^3** (Large)	**Q_{BAR} m^3** (Small)	**Q_{BAR} m^3** (GDSDS)
0.5	30	508.8	509.8	516.8
1	60	590.2	591.9	604.5
2	120	670.9	674.1	697.6
4	240	732.3	738.5	783.9
12	**720**	**689.5**	**707.7**	**840.5**
24	1440	421.4	457.4	721.2
48	2880	-359.0	-287.2	238.4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QBAR m3 (Large)
QBAR m3 (Small)
QBAR m3 (GDSDS)

Proposed Development at Pa Healy Road, Limerick

SURFACE WATER STORAGE CALCULATIONS

COPAS Formula $C = (Q * ts) - [P(ts + tc) + P(P * tc / Q)]$

C = Storage requirment	(m^3)
Q = Discharge	(m^3/min) or (l/s)
ts = Storm Duration	(min)
P = Permitted outfall rate	(m^3/min) or (l/s)
tc = Time of concentration	(min)
R = Rainfall Intensity	(mm/hr)
A(Imp) = Impermeable area of site	(ha)
A = Site Area	(ha)

tc =	8.42	min	
P =	0.48	m^3/min	2.00 l/s/ha
A(Imp) =	1.850	ha	
A =	4.02	ha	

Proposed Development at Pa Healy Road, Limerick

100 year storm ts = 30 min

	ts	30	min
	R	81.1	mm/hr
	Q	417.20	l/s
		25.03	m^3/min
QBAR Rural (Large)	**C**	**724.4**	**m^3**
QBAR Rural (Small)	**C**	**725.3**	**m^3**
QBAR (GDSDS)	**C**	**732.3**	**m^3**

100 year storm ts = 60 min

	ts	60	min
	R	47.3	mm/hr
	Q	243.16	l/s
		14.59	m^3/min
QBAR Rural (Large)	**C**	**828.0**	**m^3**
QBAR Rural (Small)	**C**	**829.7**	**m^3**
QBAR (GDSDS)	**C**	**842.2**	**m^3**

100 year storm ts = 120 min

	ts	120	min
	R	27.7	mm/hr
	Q	142.26	l/s
		8.54	m^3/min
QBAR Rural (Large)	**C**	**935.4**	**m^3**
QBAR Rural (Small)	**C**	**938.6**	**m^3**
QBAR (GDSDS)	**C**	**962.1**	**m^3**

100 year storm ts =240 min

	ts	240	min
	R	16.1	mm/hr
	Q	83.01	l/s
		4.98	m^3/min
QBAR Rural (Large)	**C**	**1023.6**	**m^3**
QBAR Rural (Small)	**C**	**1029.8**	**m^3**
QBAR (GDSDS)	**C**	**1075.1**	**m^3**

Proposed Development at Pa Healy Road, Limerick

100 year storm ts =12hr

	ts	720	min
	R	6.9	mm/hr
	Q	35.44	l/s
		2.13	m^3/min
QBAR Rural (Large)	**C**	**1027.8**	**m^3**
QBAR Rural (Small)	**C**	**1045.9**	**m^3**
QBAR (GDSDS)	**C**	**1178.5**	**m^3**

100 year storm ts =24hr

	ts	1440	min
	R	4.0	mm/hr
	Q	20.70	l/s
		1.24	m^3/min
QBAR Rural (Large)	**C**	**788.8**	**m^3**
QBAR Rural (Small)	**C**	**824.8**	**m^3**
QBAR (GDSDS)	**C**	**1088.2**	**m^3**

100 year storm ts =48hr

	ts	2160	min
	R	2.3	mm/hr
	Q	11.58	l/s
		0.70	m^3/min
QBAR Rural (Large)	**C**	**3.8**	**m^3**
QBAR Rural (Small)	**C**	**57.7**	**m^3**
QBAR (GDSDS)	**C**	**452.5**	**m^3**

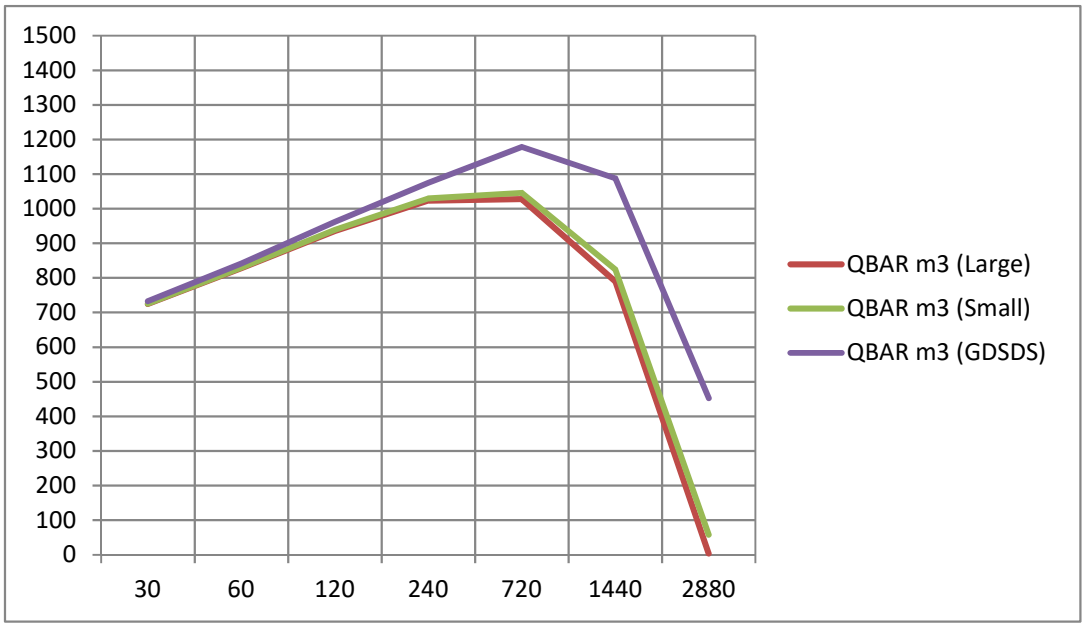
Q_{BAR} = Mean Annual Peak Flow (m^3/s)
SAAR = Standard Annual Average Rainfall (mm)
SOIL = Soil Index
AREA = Total Area of Site (km^2)

$Q_{BAR} = 0.00108*(AREA)^{0.89}*(SAAR)^{1.17}*(SOIL)^{2.17}$

AREA =	0.5	km^2	Ha =	50
SAAR =	995	mm		
SOIL =	0.3			

Q_{BAR} Rural (Large)	0.143	m^3/s	=	142.6	l/s	2.85 l/s/ha
	8.557	m^3/min		2.85	l/s/ha	0.171 m^3/min/ha
	0.69	m^3/min	Site			
Q_{BAR} Rural (Small)	0.138	m^3/s	=	137.5	l/s	2.75 l/s/ha
	8.250	m^3/min		2.75	l/s/ha	0.165 m^3/min/ha
	0.66	m^3/min	Site			
Q_{BAR} (GDSDS)	0.100	m^3/s	=	100.0	l/s	2 l/s/ha
	6.000	m^3/min		2.00	l/s/ha	0.120 m^3/min/ha
	0.48	m^3/min	Site			

Storm T Hr	**Storm T** Min	**Q_{BAR} m^3** (Large)	**Q_{BAR} m^3** (Small)	**Q_{BAR} m^3** (GDSDS)
30	30	724.4	725.3	732.3
1	60	828.0	829.7	842.2
2	120	935.4	938.6	962.1
4	240	1023.6	1029.8	1075.1
12	**720**	**1027.8**	**1045.9**	**1178.5**
24	1440	788.8	824.8	1088.2
48	2880	3.8	57.7	452.5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QBAR m3 (Large)
QBAR m3 (Small)
QBAR m3 (GDSDS)

Proposed Development at Pa Healy Road, Limerick

SURFACE WATER STORAGE CALCULATIONS

COPAS Formula $C = (Q * ts) - [P(ts + tc) + P(P * tc / Q)]$

C = Storage requirment	(m^3)
Q = Discharge	(m^3/min) or (l/s)
ts = Storm Duration	(min)
P = Permitted outfall rate	(m^3/min) or (l/s)
tc = Time of concentration	(min)
R = Rainfall Intensity	(mm/hr)
A(Imp) = Impermeable area of site	(ha)
A = Site Area	(ha)

tc =	8.12	min	
P =	0.00	m^3/min	0.00 l/s/ha
A(Imp) =	1.850	ha	
A =	4.02	ha	

Hydro Q	**0 l/s**

Proposed Development at Pa Healy Road, Limerick

30 year storm ts = 30 min

	ts	30	min
	R	42.0	mm/hr
	Q	216.01	l/s
		12.96	m^3/min
QBAR Rural (Large)	**C**	**362.3**	**m^3**
QBAR Rural (Small)	**C**	**363.2**	**m^3**
QBAR (GDSDS)	**C**	**388.8**	**m^3**

30 year storm ts = 60 min

	ts	60	min
	R	25.4	mm/hr
	Q	130.84	l/s
		7.85	m^3/min
QBAR Rural (Large)	**C**	**423.7**	**m^3**
QBAR Rural (Small)	**C**	**425.4**	**m^3**
QBAR (GDSDS)	**C**	**471.0**	**m^3**

30 year storm ts = 120 min

	ts	120	min
	R	15.4	mm/hr
	Q	79.31	l/s
		4.76	m^3/min
QBAR Rural (Large)	**C**	**482.0**	**m^3**
QBAR Rural (Small)	**C**	**485.3**	**m^3**
QBAR (GDSDS)	**C**	**571.0**	**m^3**

30 year storm ts =240 min

	ts	240	min
	R	9.4	mm/hr
	Q	48.14	l/s
		2.89	m^3/min
QBAR Rural (Large)	**C**	**521.2**	**m^3**
QBAR Rural (Small)	**C**	**527.4**	**m^3**
QBAR (GDSDS)	**C**	**693.2**	**m^3**

Proposed Development at Pa Healy Road, Limerick

30 year storm ts =12hr

	ts	720	min
	R	4.2	mm/hr
	Q	21.81	l/s
		1.31	m^3/min
QBAR Rural (Large)	**C**	**438.1**	**m^3**
QBAR Rural (Small)	**C**	**456.3**	**m^3**
QBAR (GDSDS)	**C**	**942.0**	**m^3**

30 year storm ts =24hr

	ts	1440	min
	R	2.6	mm/hr
	Q	13.24	l/s
		0.79	m^3/min
QBAR Rural (Large)	**C**	**143.1**	**m^3**
QBAR Rural (Small)	**C**	**179.2**	**m^3**
QBAR (GDSDS)	**C**	**1144.2**	**m^3**

30 year storm ts =48hr

	ts	2880	min
	R	1.5	mm/hr
	Q	7.80	l/s
		0.47	m^3/min
QBAR Rural (Large)	**C**	**-646.6**	**m^3**
QBAR Rural (Small)	**C**	**-574.7**	**m^3**
QBAR (GDSDS)	**C**	**1348.6**	**m^3**

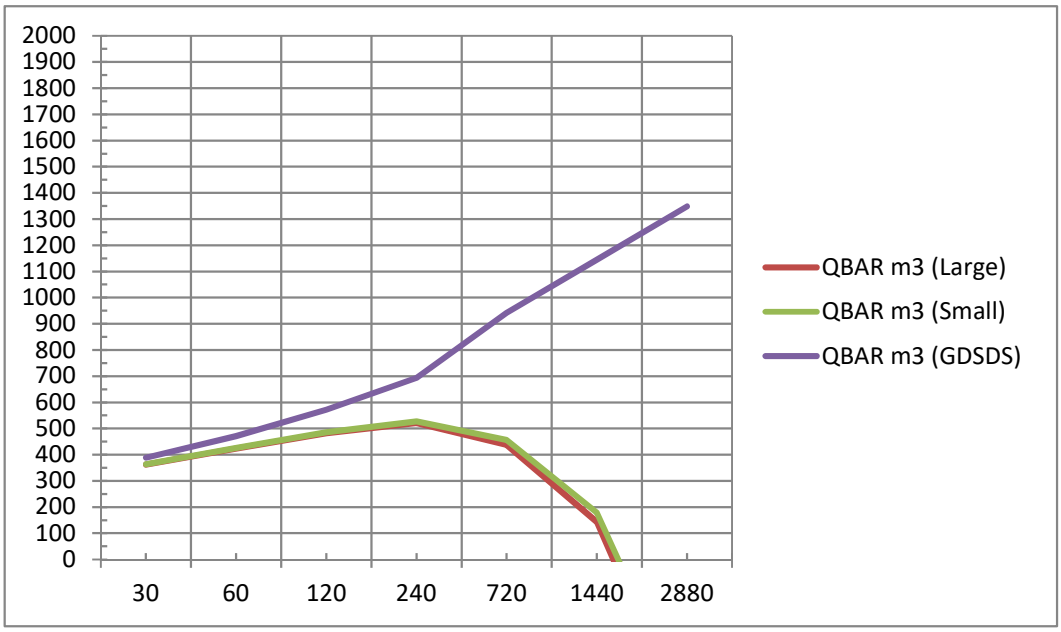
Q_{BAR} = Mean Annual Peak Flow (m^3/s)
SAAR = Standard Annual Average Rainfall (mm)
SOIL = Soil Index
AREA = Total Area of Site (km^2)

$Q_{BAR} = 0.00108*(AREA)^{0.89}*(SAAR)^{1.17}*(SOIL)^{2.17}$

AREA =	0.5	km^2	Ha =	50
SAAR =	995	mm		
SOIL =	0.3			

Q_{BAR} Rural (Large)	0.143	m^3/s	=	142.6	l/s	2.85 l/s/ha
	8.557	m^3/min		2.85	l/s/ha	0.171 $m^3/min/ha$
	0.69	m^3/min	Site			
Q_{BAR} Rural (Small)	0.138	m^3/s	=	137.5	l/s	2.75 l/s/ha
	8.250	m^3/min		2.75	l/s/ha	0.165 $m^3/min/ha$
	0.66	m^3/min	Site			
Q_{BAR} (GDSDS)	0.0	m^3/s	=	0.0	**l/s**	0 l/s/ha
	0.000	m^3/min		0.00	l/s/ha	0.000 $m^3/min/ha$
	0.00	m^3/min	Site			

Storm T Hr	**Storm T** Min	**Q_{BAR} m^3** (Large)	**Q_{BAR} m^3** (Small)	**Q_{BAR} m^3** (GDSDS)
0.5	30	362.3	363.2	388.8
1	60	423.7	425.4	471.0
2	120	482.0	485.3	571.0
4	**240**	**521.2**	**527.4**	**693.2**
12	720	438.1	456.3	942.0
24	1440	143.1	179.2	1144.2
48	2880	-646.6	-574.7	1348.6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QBAR m3 (Large)
QBAR m3 (Small)
QBAR m3 (GDSDS)

Proposed Development at Pa Healy Road, Limerick

SURFACE WATER STORAGE CALCULATIONS

COPAS Formula $C = (Q * ts) - [P(ts + tc) + P(P * tc / Q)]$

C = Storage requirment	(m^3)
Q = Discharge	(m^3/min) or (l/s)
ts = Storm Duration	(min)
P = Permitted outfall rate	(m^3/min) or (l/s)
tc = Time of concentration	(min)
R = Rainfall Intensity	(mm/hr)
A(Imp) = Impermeable area of site	(ha)
A = Site Area	(ha)

tc =	8.12	min	
P =	0.00	m^3/min	0.00 l/s/ha
A(Imp) =	1.850	ha	
A =	4.02	ha	

Hydro Q	**0 l/s**

Proposed Development at Pa Healy Road, Limerick

30 year storm ts = 30 min

	ts	30	min
	R	57.8	mm/hr
	Q	297.47	l/s
		17.85	m^3/min
QBAR Rural (Large)	**C**	**509.0**	**m^3**
QBAR Rural (Small)	**C**	**510.0**	**m^3**
QBAR (GDSDS)	**C**	**535.4**	**m^3**

30 year storm ts = 60 min

	ts	60	min
	R	34.4	mm/hr
	Q	177.12	l/s
		10.63	m^3/min
QBAR Rural (Large)	**C**	**590.4**	**m^3**
QBAR Rural (Small)	**C**	**592.1**	**m^3**
QBAR (GDSDS)	**C**	**637.6**	**m^3**

30 year storm ts = 120 min

	ts	120	min
	R	20.5	mm/hr
	Q	105.53	l/s
		6.33	m^3/min
QBAR Rural (Large)	**C**	**671.1**	**m^3**
QBAR Rural (Small)	**C**	**674.3**	**m^3**
QBAR (GDSDS)	**C**	**759.8**	**m^3**

30 year storm ts =240 min

	ts	240	min
	R	12.2	mm/hr
	Q	62.80	l/s
		3.77	m^3/min
QBAR Rural (Large)	**C**	**732.5**	**m^3**
QBAR Rural (Small)	**C**	**738.7**	**m^3**
QBAR (GDSDS)	**C**	**904.3**	**m^3**

Proposed Development at Pa Healy Road, Limerick

30 year storm ts =12hr

	ts	720	min
	R	5.4	mm/hr
	Q	27.62	l/s
		1.66	m^3/min
QBAR Rural (Large)	**C**	**689.8**	**m^3**
QBAR Rural (Small)	**C**	**708.0**	**m^3**
QBAR (GDSDS)	**C**	**1193.1**	**m^3**

30 year storm ts =24hr

	ts	1440	min
	R	3.2	mm/hr
	Q	16.46	l/s
		0.99	m^3/min
QBAR Rural (Large)	**C**	**421.7**	**m^3**
QBAR Rural (Small)	**C**	**457.8**	**m^3**
QBAR (GDSDS)	**C**	**1421.9**	**m^3**

30 year storm ts =48hr

	ts	2880	min
	R	1.8	mm/hr
	Q	9.46	l/s
		0.57	m^3/min
QBAR Rural (Large)	**C**	**-358.6**	**m^3**
QBAR Rural (Small)	**C**	**-286.8**	**m^3**
QBAR (GDSDS)	**C**	**1635.2**	**m^3**

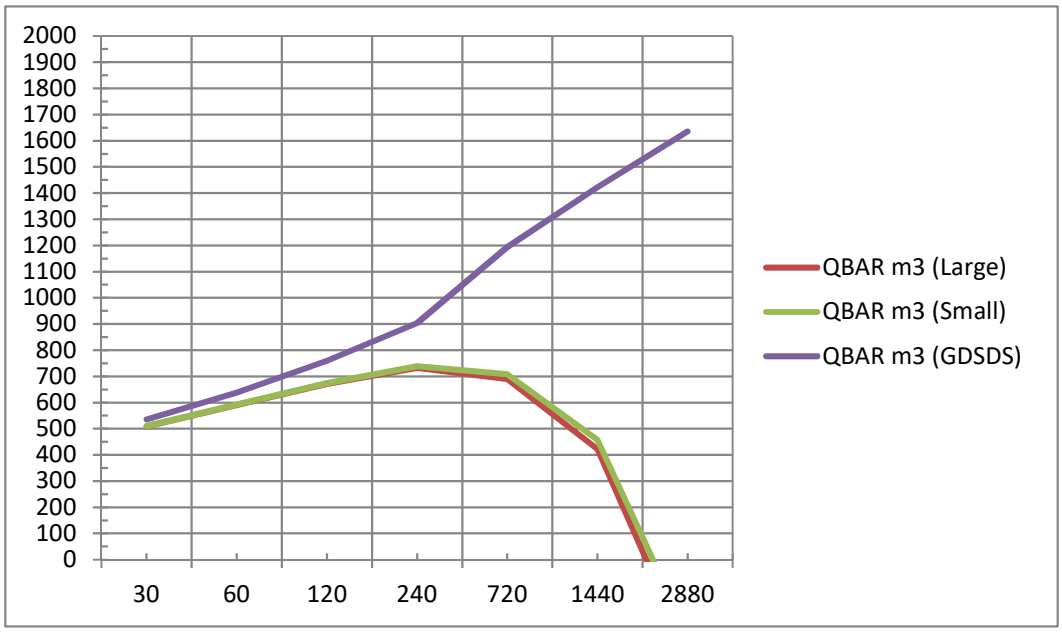
Q_{BAR} = Mean Annual Peak Flow (m^3/s)
SAAR = Standard Annual Average Rainfall (mm)
SOIL = Soil Index
AREA = Total Area of Site (km^2)

$Q_{BAR} = 0.00108*(AREA)^{0.89}*(SAAR)^{1.17}*(SOIL)^{2.17}$

AREA =	0.5	km^2	Ha =	50
SAAR =	995	mm		
SOIL =	0.3			

Q_{BAR} Rural (Large)	0.143	m^3/s	=	142.6	l/s	2.85 l/s/ha
	8.557	m^3/min		2.85	l/s/ha	0.171 $m^3/min/ha$
	0.69	m^3/min	Site			
Q_{BAR} Rural (Small)	0.138	m^3/s	=	137.5	l/s	2.75 l/s/ha
	8.250	m^3/min		2.75	l/s/ha	0.165 $m^3/min/ha$
	0.66	m^3/min	Site			
Q_{BAR} (GDSDS)	0.0	m^3/s	=	0.0	**l/s**	0 l/s/ha
	0.000	m^3/min		0.00	l/s/ha	0.000 $m^3/min/ha$
	0.00	m^3/min	Site			

Storm T Hr	**Storm T** Min	**Q_{BAR} m^3** (Large)	**Q_{BAR} m^3** (Small)	**Q_{BAR} m^3** (GDSDS)
0.5	30	509.0	510.0	535.4
1	60	590.4	592.1	637.6
2	120	671.1	674.3	759.8
4	**240**	**732.5**	**738.7**	**904.3**
12	720	689.8	708.0	1193.1
24	1440	421.7	457.8	1421.9
48	2880	-358.6	-286.8	1635.2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QBAR m3 (Large)
QBAR m3 (Small)
QBAR m3 (GDSDS)

Proposed Development at Pa Healy Road, Limerick

SURFACE WATER STORAGE CALCULATIONS

COPAS Formula $C = (Q * ts) - [P(ts + tc) + P(P * tc / Q)]$

C = Storage requirment	(m^3)
Q = Discharge	(m^3/min) or (l/s)
ts = Storm Duration	(min)
P = Permitted outfall rate	(m^3/min) or (l/s)
tc = Time of concentration	(min)
R = Rainfall Intensity	(mm/hr)
A(Imp) = Impermeable area of site	(ha)
A = Site Area	(ha)

tc =	8.42	min	
P =	0.00	m^3/min	0.00 l/s/ha
A(Imp) =	1.850	ha	
A =	4.02	ha	

Proposed Development at Pa Healy Road, Limerick

100 year storm ts = 30 min

	ts	30	min
	R	81.1	mm/hr
	Q	417.20	l/s
		25.03	m^3/min
QBAR Rural (Large)	**C**	**724.4**	**m^3**
QBAR Rural (Small)	**C**	**725.3**	**m^3**
QBAR (GDSDS)	**C**	**751.0**	**m^3**

100 year storm ts = 60 min

	ts	60	min
	R	47.3	mm/hr
	Q	243.16	l/s
		14.59	m^3/min
QBAR Rural (Large)	**C**	**828.0**	**m^3**
QBAR Rural (Small)	**C**	**829.7**	**m^3**
QBAR (GDSDS)	**C**	**875.4**	**m^3**

100 year storm ts = 120 min

	ts	120	min
	R	27.7	mm/hr
	Q	142.26	l/s
		8.54	m^3/min
QBAR Rural (Large)	**C**	**935.4**	**m^3**
QBAR Rural (Small)	**C**	**938.6**	**m^3**
QBAR (GDSDS)	**C**	**1024.2**	**m^3**

100 year storm ts =240 min

	ts	240	min
	R	16.1	mm/hr
	Q	83.01	l/s
		4.98	m^3/min
QBAR Rural (Large)	**C**	**1023.6**	**m^3**
QBAR Rural (Small)	**C**	**1029.8**	**m^3**
QBAR (GDSDS)	**C**	**1195.3**	**m^3**

Proposed Development at Pa Healy Road, Limerick

100 year storm ts =12hr

	ts	720	min
	R	6.9	mm/hr
	Q	35.44	l/s
		2.13	m^3/min
QBAR Rural (Large)	**C**	**1027.8**	**m^3**
QBAR Rural (Small)	**C**	**1045.9**	**m^3**
QBAR (GDSDS)	**C**	**1530.8**	**m^3**

100 year storm ts =24hr

	ts	1440	min
	R	4.0	mm/hr
	Q	20.70	l/s
		1.24	m^3/min
QBAR Rural (Large)	**C**	**788.8**	**m^3**
QBAR Rural (Small)	**C**	**824.8**	**m^3**
QBAR (GDSDS)	**C**	**1788.5**	**m^3**

100 year storm ts =48hr

	ts	2160	min
	R	2.3	mm/hr
	Q	11.58	l/s
		0.70	m^3/min
QBAR Rural (Large)	**C**	**3.8**	**m^3**
QBAR Rural (Small)	**C**	**57.7**	**m^3**
QBAR (GDSDS)	**C**	**1501.4**	**m^3**

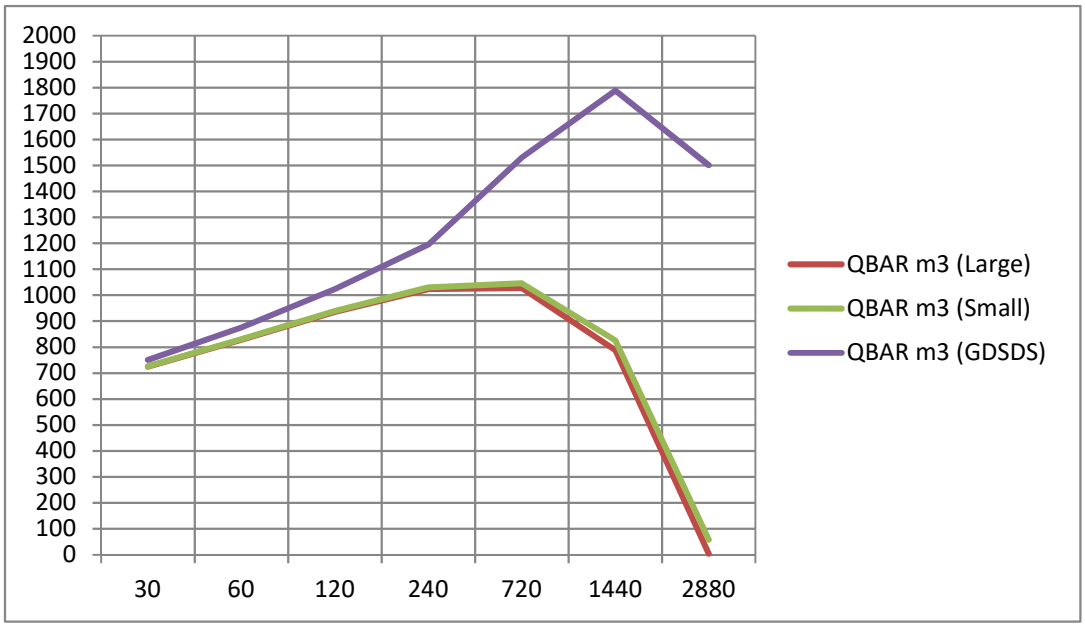
Q_{BAR} = Mean Annual Peak Flow (m^3/s)
SAAR = Standard Annual Average Rainfall (mm)
SOIL = Soil Index
AREA = Total Area of Site (km^2)

$Q_{BAR} = 0.00108*(AREA)^{0.89}*(SAAR)^{1.17}*(SOIL)^{2.17}$

AREA =	0.5	km^2	Ha =	50
SAAR =	995	mm		
SOIL =	0.3			

Q_{BAR} Rural (Large)	0.143	m^3/s	=	142.6	l/s	2.85 l/s/ha
	8.557	m^3/min		2.85	l/s/ha	0.171 m^3/min/ha
	0.69	m^3/min	Site			
Q_{BAR} Rural (Small)	0.138	m^3/s	=	137.5	l/s	2.75 l/s/ha
	8.250	m^3/min		2.75	l/s/ha	0.165 m^3/min/ha
	0.66	m^3/min	Site			
Q_{BAR} (GDSDS)	0.000	m^3/s	=	0.0	l/s	0 l/s/ha
	0.000	m^3/min		0.00	l/s/ha	0.000 m^3/min/ha
	0.00	m^3/min	Site			

Storm T Hr	**Storm T** Min	**Q_{BAR} m^3** (Large)	**Q_{BAR} m^3** (Small)	**Q_{BAR} m^3** (GDSDS)
30	30	724.4	725.3	751.0
1	60	828.0	829.7	875.4
2	120	935.4	938.6	1024.2
4	**240**	**1023.6**	**1029.8**	**1195.3**
12	720	1027.8	1045.9	1530.8
24	1440	788.8	824.8	1788.5
48	2880	3.8	57.7	1501.4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1900
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200
100
0
30
60
120
240
720
1440
2880
QBAR m3 (Large)
QBAR m3 (Small)
QBAR m3 (GDSDS)

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	No
Project Name:	Canal Bank - Attenuation A
Engineer:	Philip O'Regan
Project Location:	
Measurement Type:	Metric
Required Storage Volume:	312.00 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	300 mm.
Stone Above Chambers:	300 mm.
Average Cover Over Chambers:	600 mm.
Design Constraint Dimensions:	(9.20 m. x 33.00 m.)

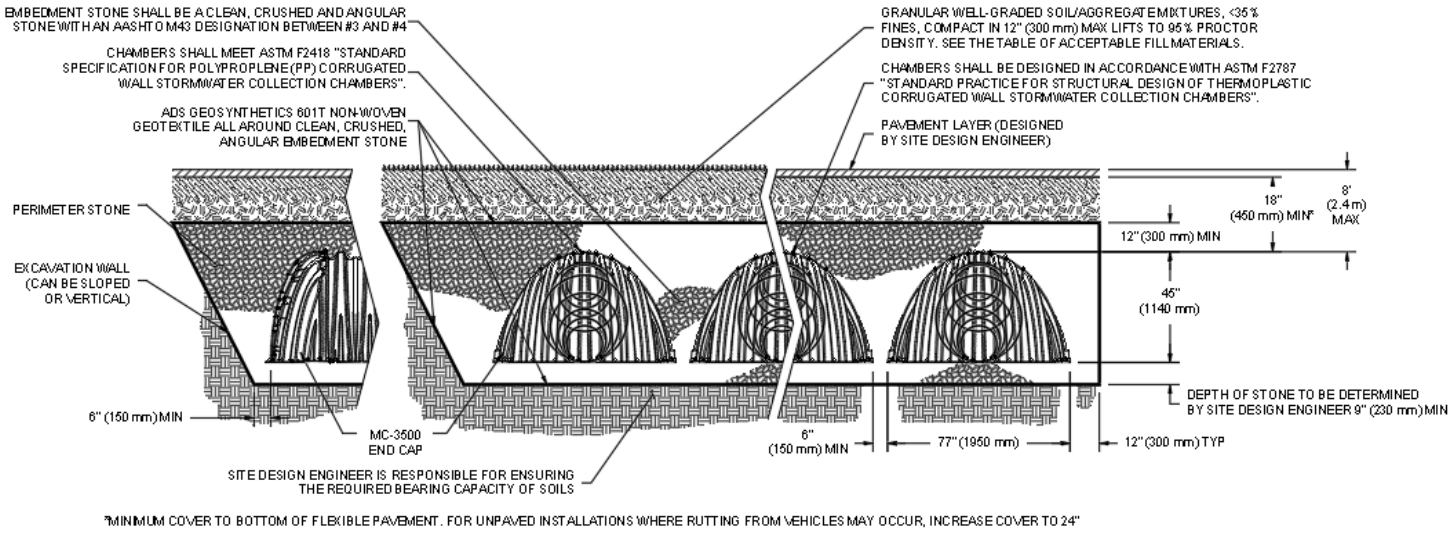
Results

System Volume and Bed Size

Installed Storage Volume:	314.80 cubic meters.
Storage Volume Per Chamber:	3.11 cubic meters.
Number of Chambers Required:	56
Number of End Caps Required:	8
Chamber Rows:	4
Maximum Length:	33.59 m.
Maximum Width:	8.89 m.
Approx. Bed Size Required:	298.65 square meters.

System Components

Amount Of Stone Required:	342.87 cubic meters
Volume of Excavation (Not Including Fill):	520.51 cubic meters
Total Non-woven Geotextile Required:	894.46 square meters
Woven Geotextile Required (excluding Isolator Row):	41.96 square meters
Woven Geotextile Required (Isolator Row):	101.53 square meters
Total Woven Geotextile Required:	143.50 square meters



PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

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CANAL BANK - ATTENUATION A

LIMERICK, IRELAND

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS, AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED, AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER, 2) MAXIMUM PERMANENT (75-YR) COVER LOAD, AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, A) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN., B) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLOURS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUB-GRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm).
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUB-SURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILISED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

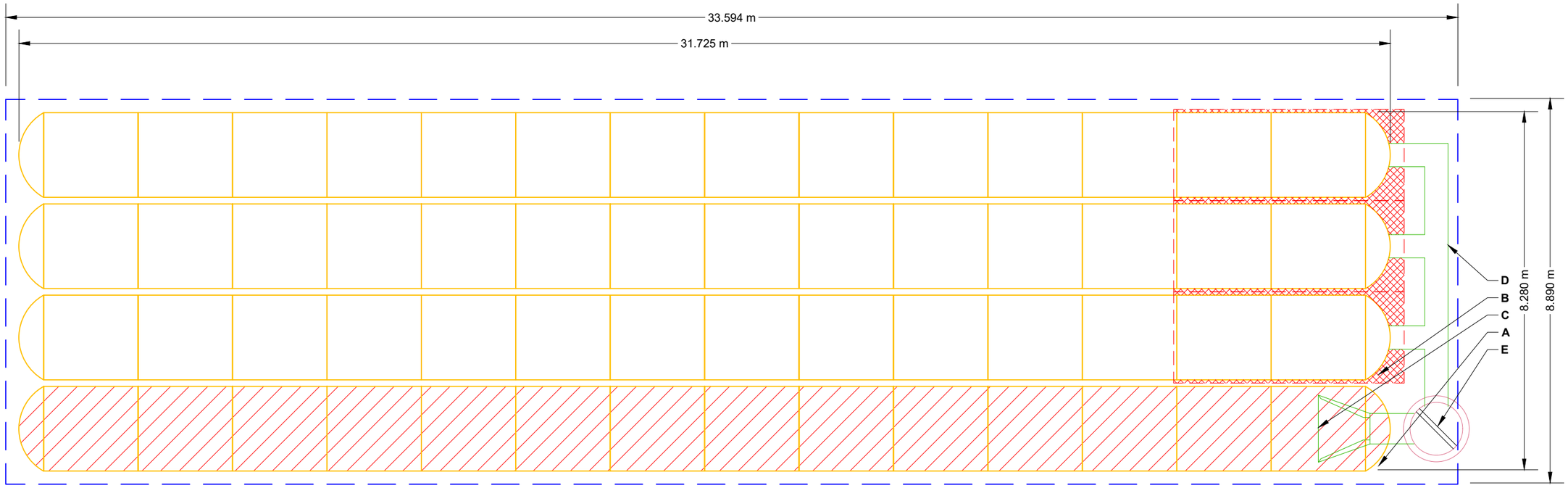
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

ISOLATOR ROW PLUS COMPONENTS SHOWN ON THIS DESIGN MAY NOT BE AVAILABLE IN THE SPECIFIED PROJECT REGION. PLEASE CONTACT YOUR LOCAL ADS REPRESENTATIVE OR E-MAIL ADSINTERNATIONAL@ADS-PIPE.COM FOR FURTHER INFORMATION

PROPOSED LAYOUT		PROPOSED ELEVATIONS	
56	STORMTECH MC-3500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	6.882
8	STORMTECH MC-3500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	5.053
300	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	4.900
300	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	4.900
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	4.900
316.0	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	4.743
		TOP OF MC-3500 CHAMBER:	4.443
		600 mm ISOLATOR ROW PLUS INVERT:	3.352
		450 mm x 450 mm BOTTOM MANIFOLD INVERT:	3.345
298.6	SYSTEM AREA (m^2)	BOTTOM OF MC-3500 CHAMBER:	3.300
85.0	SYSTEM PERIMETER (m)	BOTTOM OF STONE:	3.000

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	600 mm BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	52 mm	
PREFABRICATED END CAP	B	450 mm BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 450 mm BOTTOM CONNECTIONS	45 mm	
FLAMP	C	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: MC350024RAMP		
MANIFOLD	D	450 mm x 450 mm BOTTOM MANIFOLD, ADS N-12	45 mm	
CONCRETE STRUCTURE W/WEIR	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		467 L/s IN



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 5.334 m OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

CANAL BANK - ATTENUATION A
LIMERICK, IRELAND

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REV	DESCRIPTION	CHK	DRW	DATE

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4640 TRUEMAN BLVD
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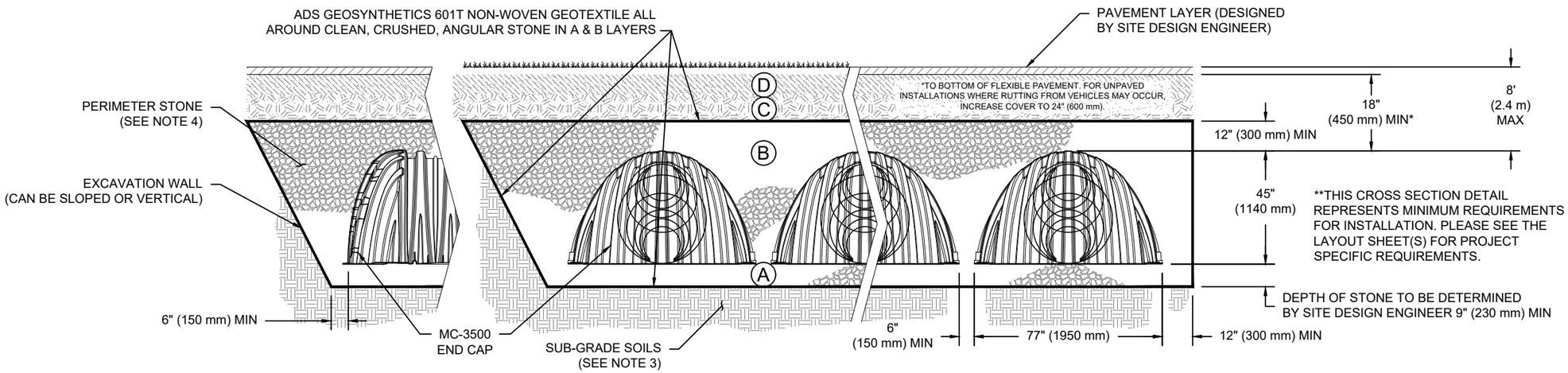
1-800-733-7473

SCALE = 1 : 100

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUB-BASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUB-GRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUB-BASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUB-BASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUB-GRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUB-BASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUB-GRADE SOILS, AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, A) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN., B) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23°, AND C) CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLOURS.

CANAL BANK - ATTENUATION A
LIMERICK, IRELAND
DRAWN: PR
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REV	DESCRIPTION	DRW	CHK

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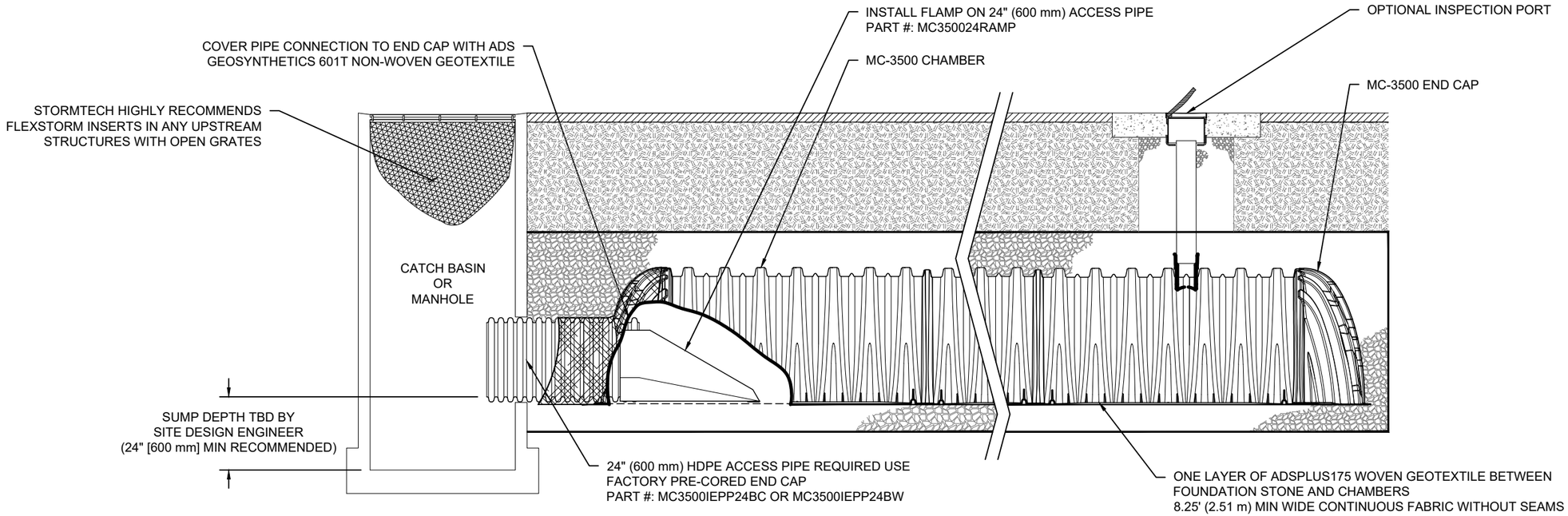

MC-3500 ISOLATOR ROW PLUS DETAIL

NTS

ISOLATOR ROW PLUS COMPONENTS SHOWN ON THIS DESIGN MAY NOT BE AVAILABLE IN THE SPECIFIED PROJECT REGION. PLEASE CONTACT YOUR LOCAL ADS REPRESENTATIVE OR E-MAIL ADSINTERNATIONAL@ADS-PIPE.COM FOR FURTHER INFORMATION

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH-WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

CANAL BANK - ATTENUATION A
LIMERICK, IRELAND
DATE:
DRAWN: PR
PROJECT #:
CHECKED: N/A

REV	DRW	CHK	DESCRIPTION

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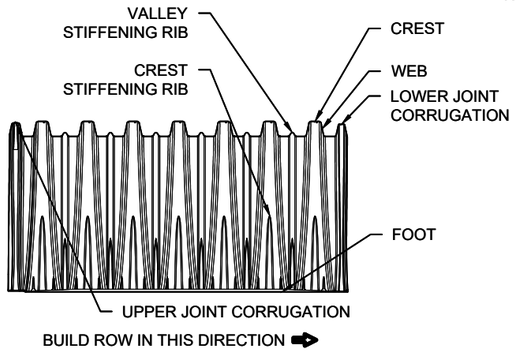
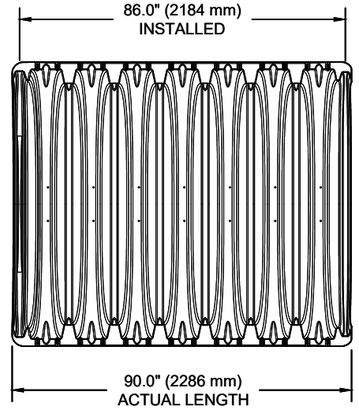
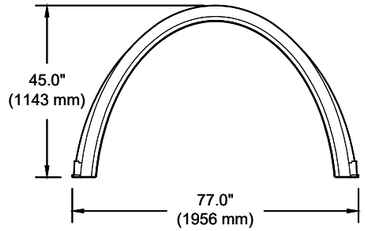
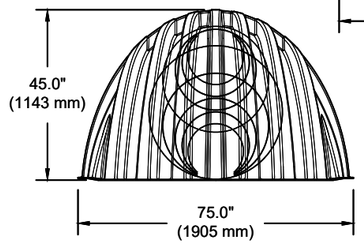
MC-3500 TECHNICAL SPECIFICATION

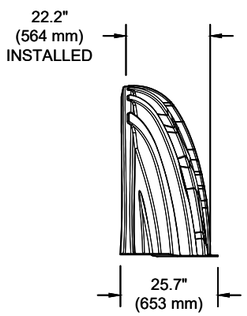
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

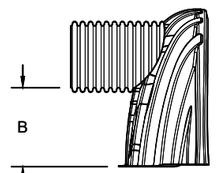
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

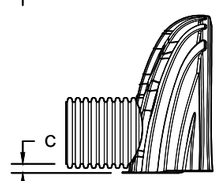
*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL

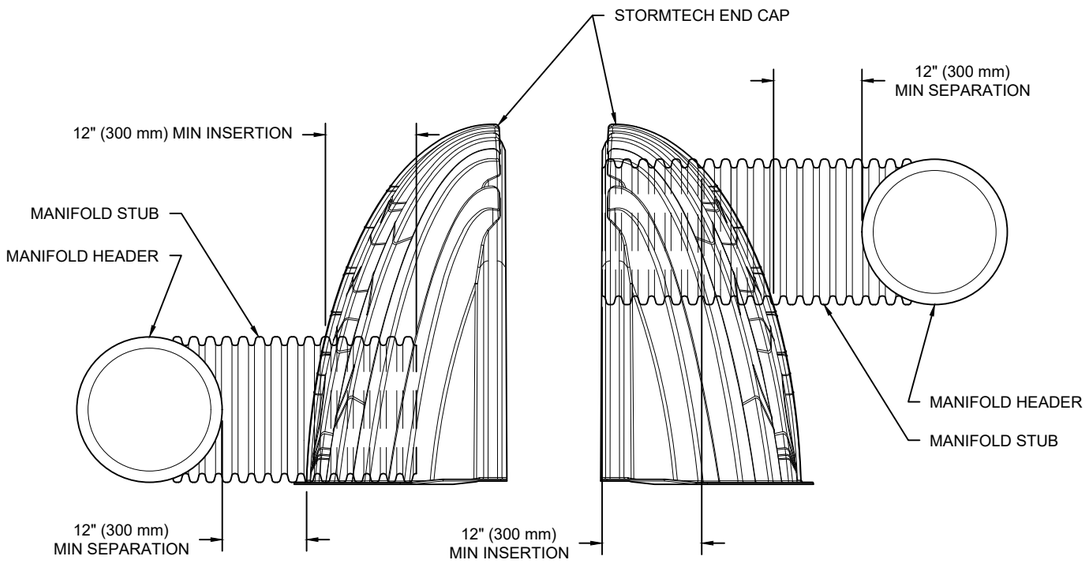




CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

CANAL BANK - ATTENUATION A
LIMERICK, IRELAND

DATE:
DRAWN: PR
PROJECT #:
CHECKED: N/A

REV	DRW	CHK	DESCRIPTION

StormTech®
Chamber System
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4640 TRUEMAN BLVD
HILLIARD, OH 43026
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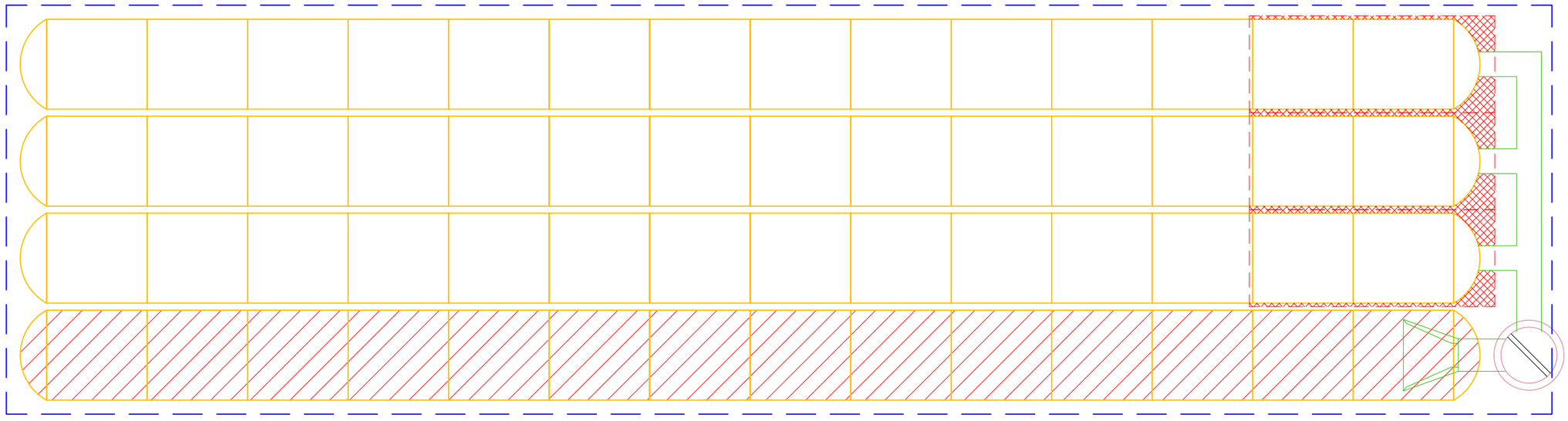


User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	No
Project Name:	Canal Bank - Attenuation B
Engineer:	Philip O'Regan
Project Location:	
Measurement Type:	Metric
Required Storage Volume:	440.00 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	300 mm.
Stone Above Chambers:	300 mm.
Average Cover Over Chambers:	600 mm.
Design Constraint Dimensions:	(9.20 m. x 47.00 m.)

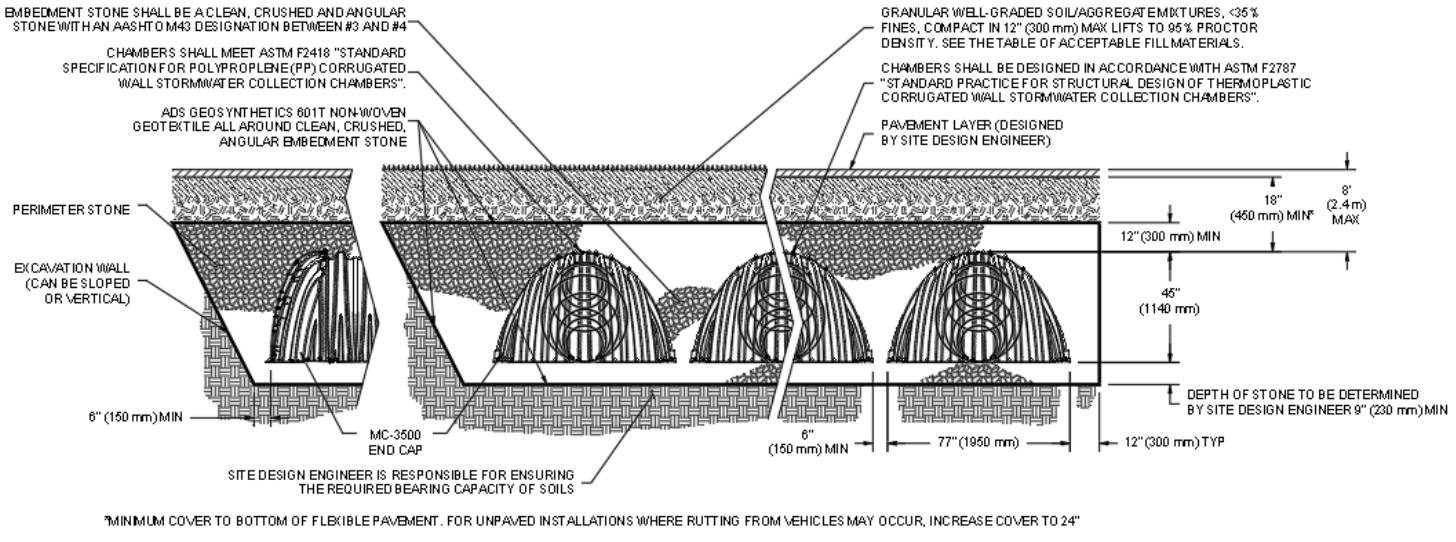
Results

System Volume and Bed Size

Installed Storage Volume:	440.84 cubic meters.
Storage Volume Per Chamber:	3.11 cubic meters.
Number of Chambers Required:	80
Number of End Caps Required:	8
Chamber Rows:	4
Maximum Length:	46.70 m.
Maximum Width:	8.89 m.
Approx. Bed Size Required:	415.16 square meters.

System Components

Amount Of Stone Required:	471.26 cubic meters
Volume of Excavation (Not Including Fill):	723.58 cubic meters
Total Non-woven Geotextile Required:	1228.92 square meters
Woven Geotextile Required (excluding Isolator Row):	41.96 square meters
Woven Geotextile Required (Isolator Row):	143.48 square meters
Total Woven Geotextile Required:	185.44 square meters



PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

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CANAL BANK - ATTENUATION B

LIMERICK, IRELAND

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS, AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED, AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER, 2) MAXIMUM PERMANENT (75-YR) COVER LOAD, AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, A) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN., B) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLOURS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUB-GRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm).
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUB-SURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILISED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

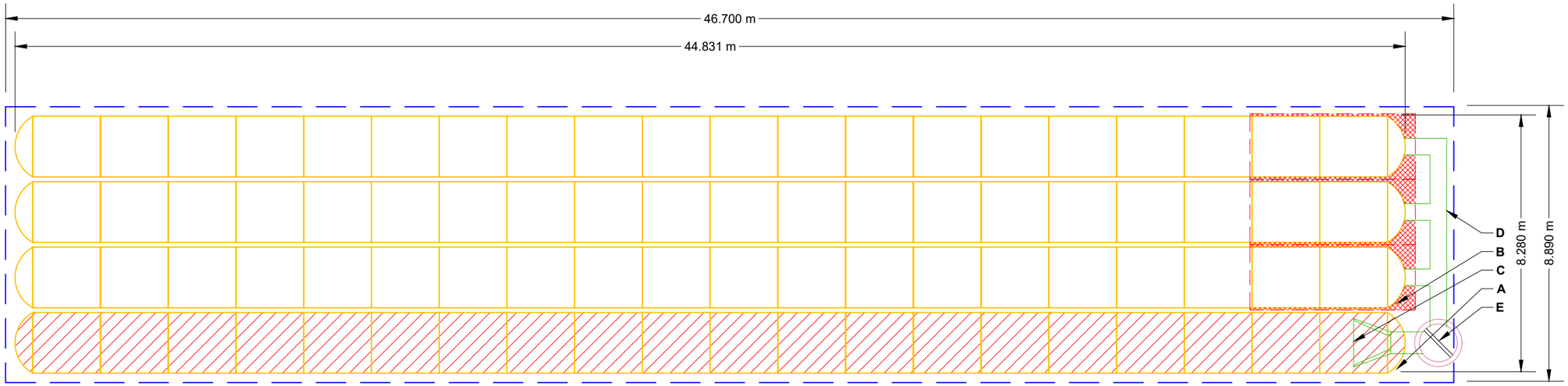
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

ISOLATOR ROW PLUS COMPONENTS SHOWN ON THIS DESIGN MAY NOT BE AVAILABLE IN THE SPECIFIED PROJECT REGION. PLEASE CONTACT YOUR LOCAL ADS REPRESENTATIVE OR E-MAIL ADSINTERNATIONAL@ADS-PIPE.COM FOR FURTHER INFORMATION

PROPOSED LAYOUT		PROPOSED ELEVATIONS	
80	STORMTECH MC-3500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	6.882
8	STORMTECH MC-3500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	5.053
300	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	4.900
300	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	4.900
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	4.900
442.5	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	4.743
		TOP OF MC-3500 CHAMBER:	4.443
		600 mm ISOLATOR ROW PLUS INVERT:	3.352
		450 mm x 450 mm BOTTOM MANIFOLD INVERT:	3.345
415.2	SYSTEM AREA (m^2)	BOTTOM OF MC-3500 CHAMBER:	3.300
111.2	SYSTEM PERIMETER (m)	BOTTOM OF STONE:	3.000

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	600 mm BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	52 mm	
PREFABRICATED END CAP	B	450 mm BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 450 mm BOTTOM CONNECTIONS	45 mm	
FLAMP	C	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: MC350024RAMP		
MANIFOLD	D	450 mm x 450 mm BOTTOM MANIFOLD, ADS N-12	45 mm	
CONCRETE STRUCTURE W/WEIR	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		467 L/s IN



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 5.334 m OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

CANAL BANK - ATTENUATION B
LIMERICK, IRELAND

DRAWN: PR
DATE:
CHECKED: N/A
PROJECT #:

REV	DRW	CHK	DESCRIPTION

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Chamber System
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ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

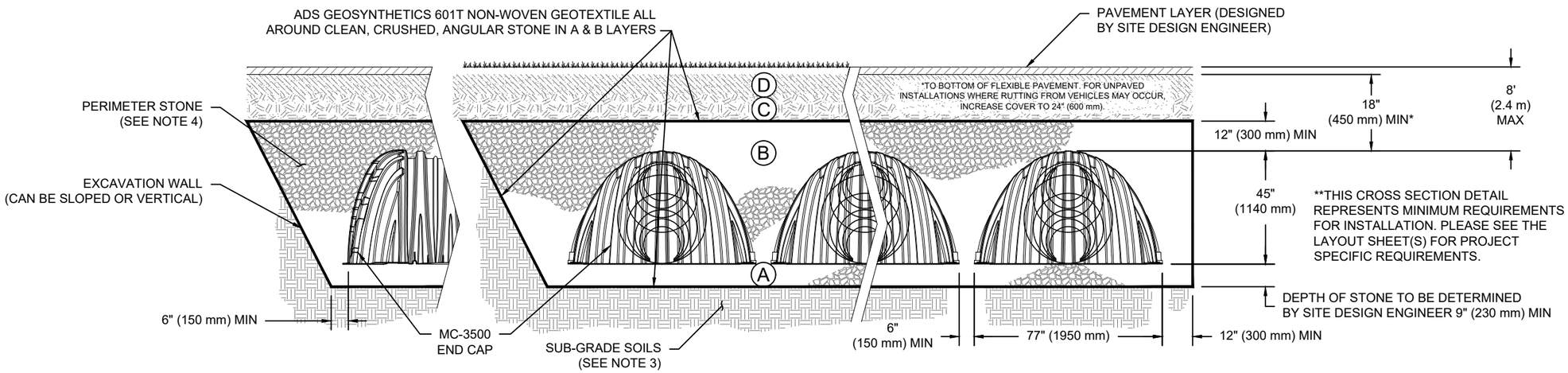
SCALE = 1 : 150

SHEET
2 OF 5

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUB-BASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUB-GRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUB-BASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUB-BASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUB-GRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUB-BASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUB-GRADE SOILS, AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, A) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN., B) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23°, AND C) CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLOURS.

CANAL BANK - ATTENUATION B
LIMERICK, IRELAND
DRAWN: PR
CHECKED: N/A
DATE:
PROJECT #:

REV	DESCRIPTION	DRW	CHK

StormTech® Chamber System
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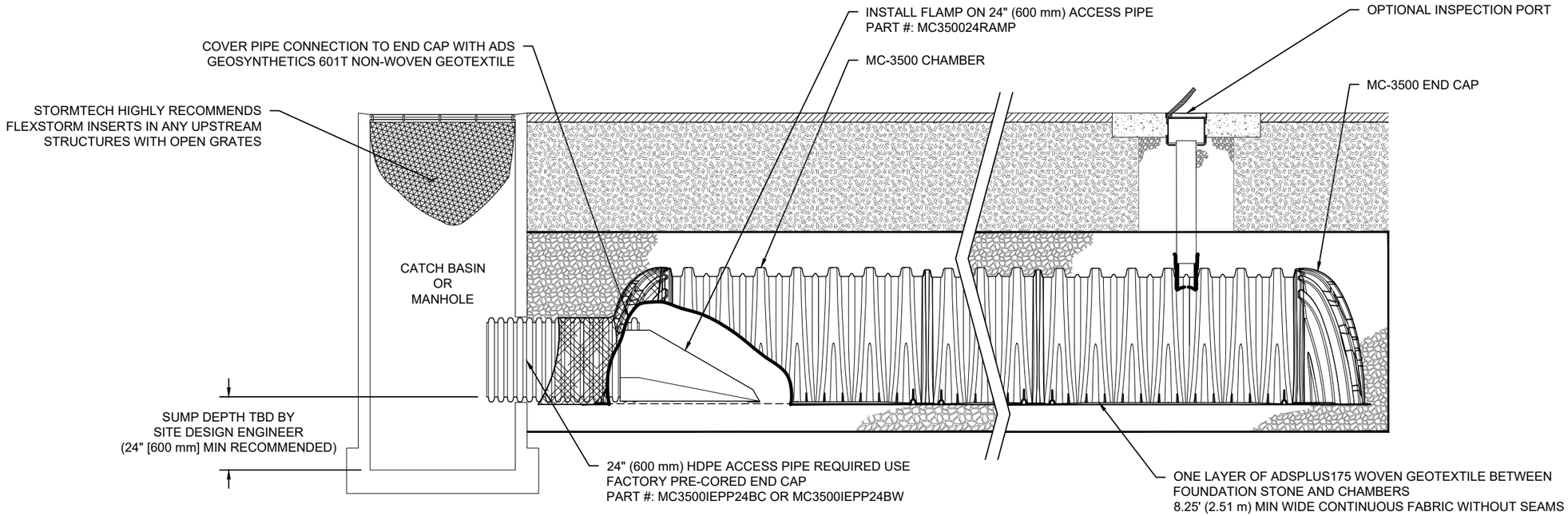
1-800-733-7473



MC-3500 ISOLATOR ROW PLUS DETAIL

NTS

ISOLATOR ROW PLUS COMPONENTS SHOWN ON THIS DESIGN MAY NOT BE AVAILABLE IN THE SPECIFIED PROJECT REGION. PLEASE CONTACT YOUR LOCAL ADS REPRESENTATIVE OR E-MAIL ADSINTERNATIONAL@ADS-PIPE.COM FOR FURTHER INFORMATION

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH-WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

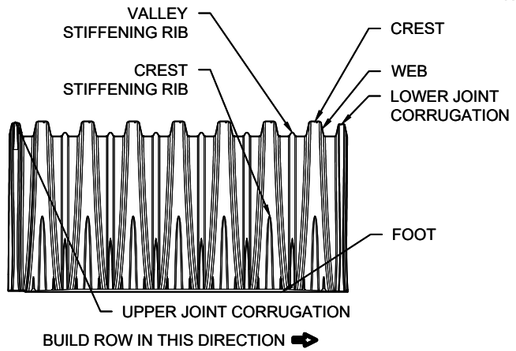
CANAL BANK - ATTENUATION B
LIMERICK, IRELAND
DATE:
DRAWN: PR
PROJECT #:
CHECKED: N/A

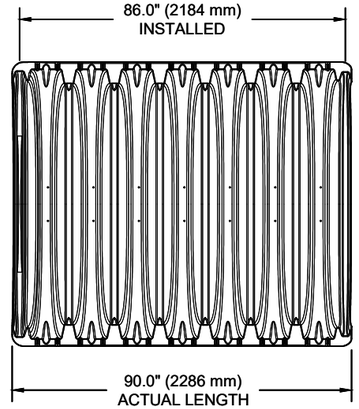
REV	DRW	CHK	DESCRIPTION

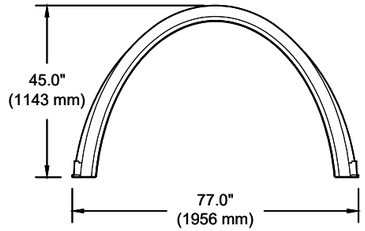
StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

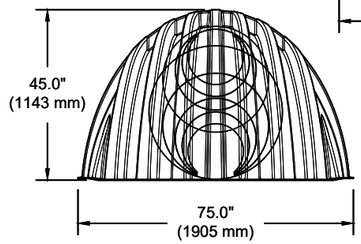
MC-3500 TECHNICAL SPECIFICATION

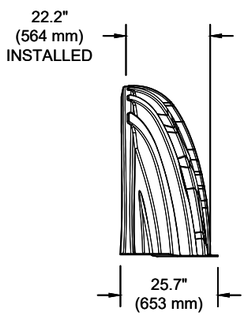
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

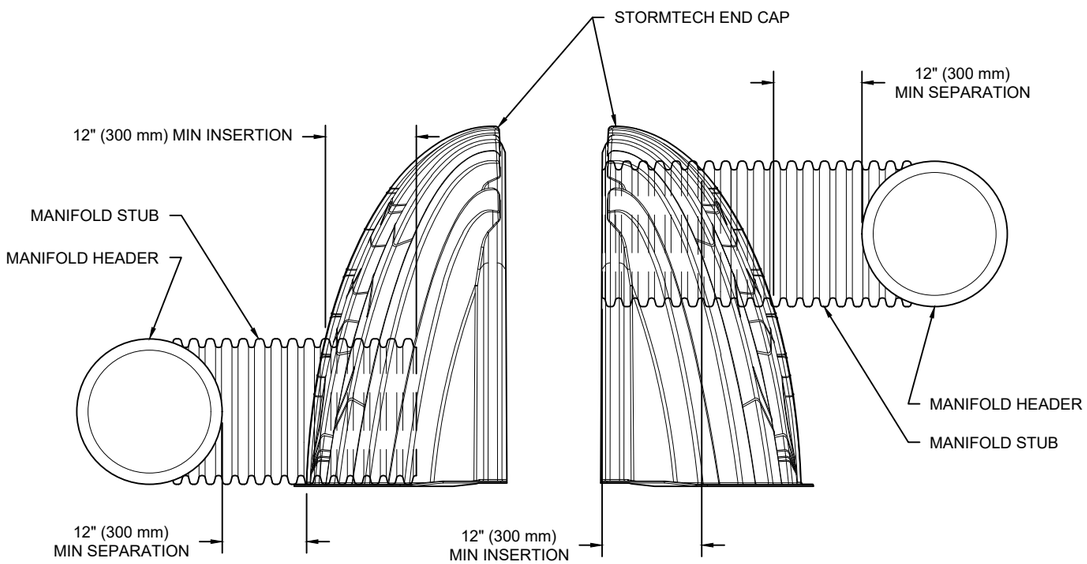
NOMINAL END CAP SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

MC-SERIES END CAP INSERTION DETAIL

NTS

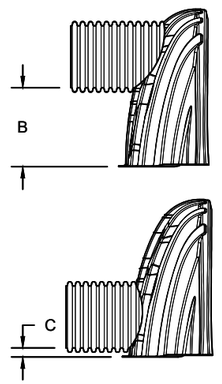


NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



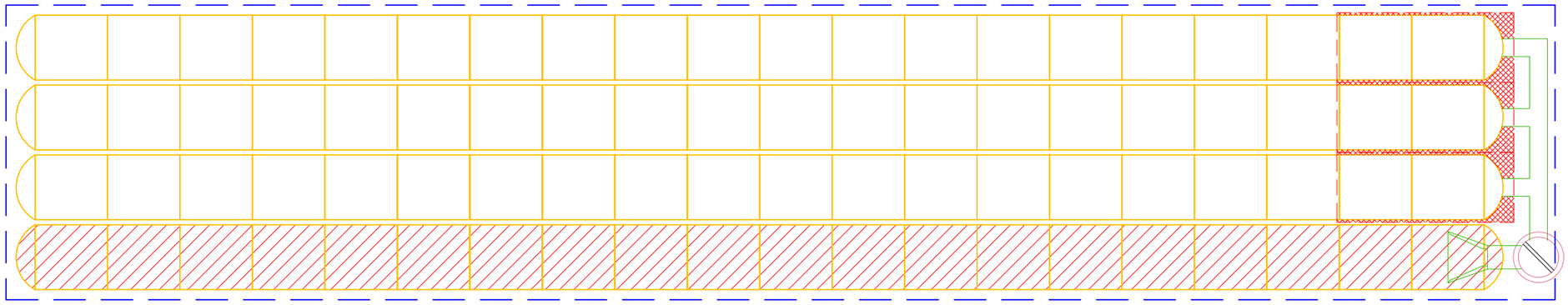
CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

CANAL BANK - ATTENUATION B
LIMERICK, IRELAND

DATE:
DRAWN: PR
PROJECT #:
CHECKED: N/A

REV	DRW	CHK	DESCRIPTION

StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473
ADS.



Appendix E – Hydrobrake Design

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.939	8.040
Flush-Flo™	0.450	7.958
Kick-Flo®	1.011	5.934
Mean Flow		6.904

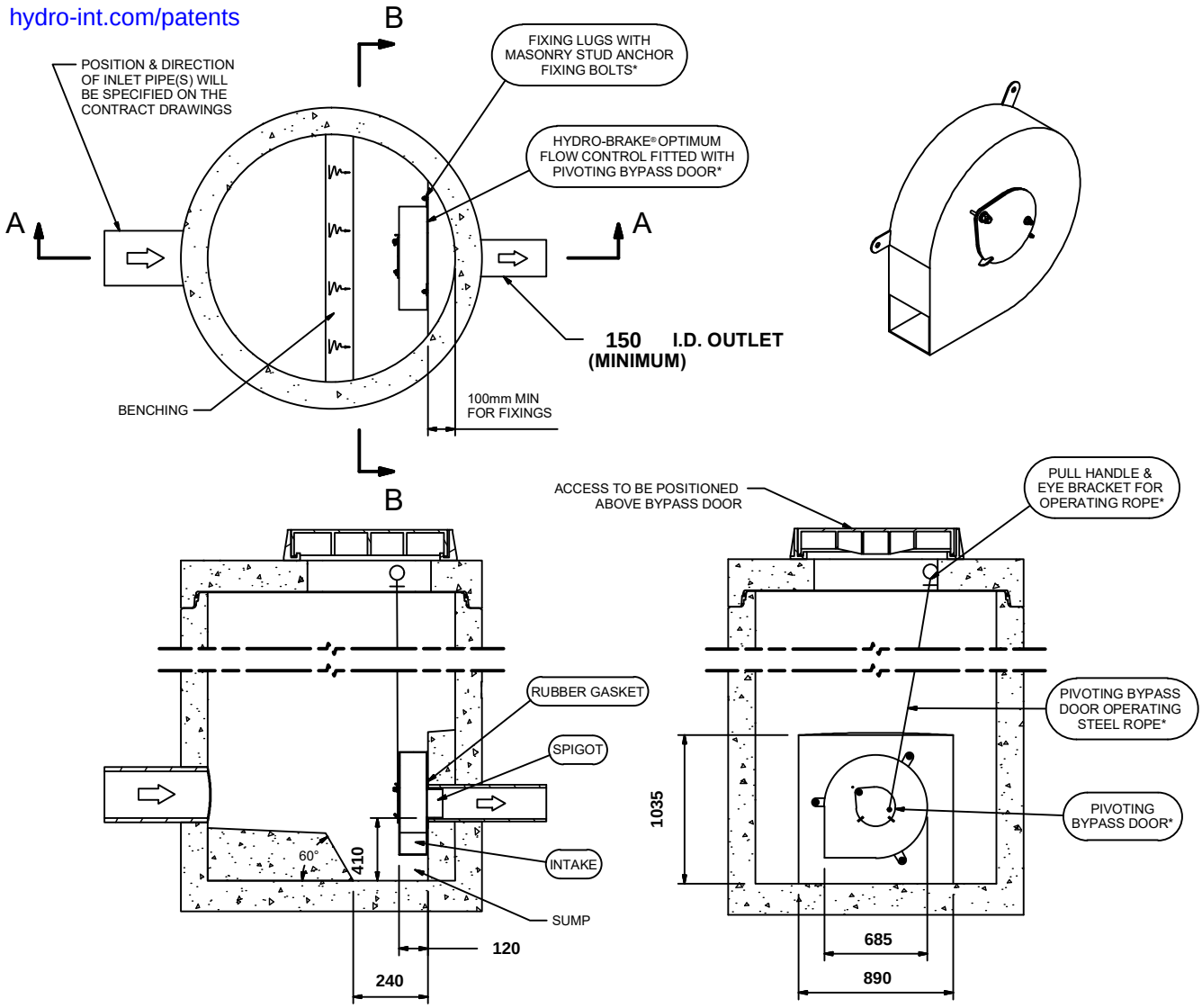
Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRc Approved PT/329/0412

hydro-int.com/patents



SECTION A-A

SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this SCL-0113-8040-1939-8040 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	11/1/2021 6:48 PM
SITE	Canal Bank
DESIGNER	Philip O'Regan
REF	108-96

SCL-0113-8040-1939-8040

Hydro-Brake® Optimum

philip.oregan@phm.ie

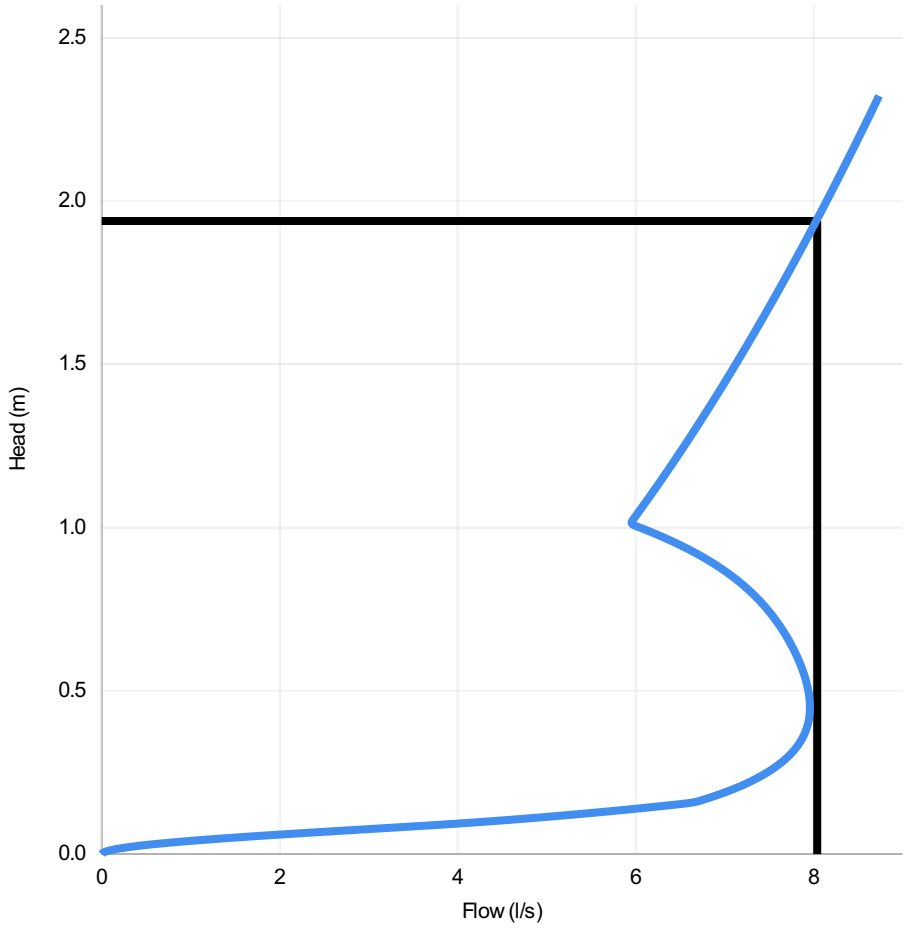
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.939	8.040
Flush-Flo	0.450	7.958
Kick-Flo®	1.011	5.934
Mean Flow		6.904

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.067	2.409
0.134	5.804
0.201	7.111
0.267	7.574
0.334	7.826
0.401	7.938
0.468	7.956
0.535	7.910
0.602	7.819
0.669	7.691
0.735	7.521
0.802	7.296
0.869	6.991
0.936	6.576
1.003	6.021
1.070	6.091
1.137	6.264
1.204	6.432
1.270	6.595
1.337	6.754
1.404	6.908
1.471	7.059
1.538	7.207
1.605	7.351
1.672	7.492
1.738	7.630
1.805	7.765
1.872	7.898
1.939	8.028

DESIGN ADVICE

The head/flow characteristics of this SCL-0113-8040-1939-8040 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

! **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International®

DATE	01/11/2021 18:48
Site	Canal Bank
DESIGNER	Philip O'Regan
Ref	108-96

SCL-0113-8040-1939-8040

Hydro-Brake Optimum®

Appendix F – Petrol Interceptor

SEPARATORS

A RANGE OF FUEL/OIL SEPARATORS
FOR PEACE OF MIND

Kingspan

Klargester

60 YEARS OF
Expertise &
1955–2015 Innovation

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 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.

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

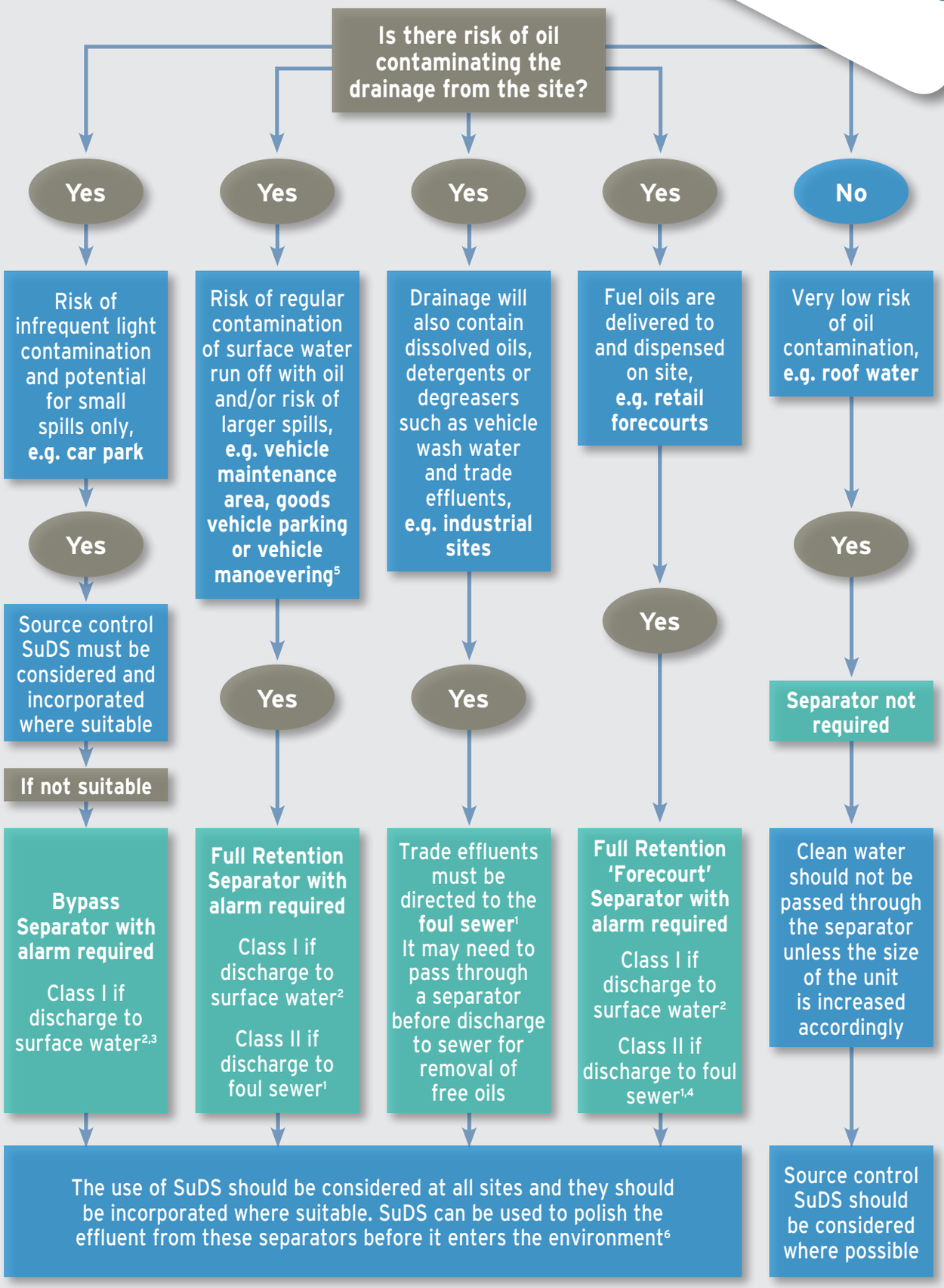
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size 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.

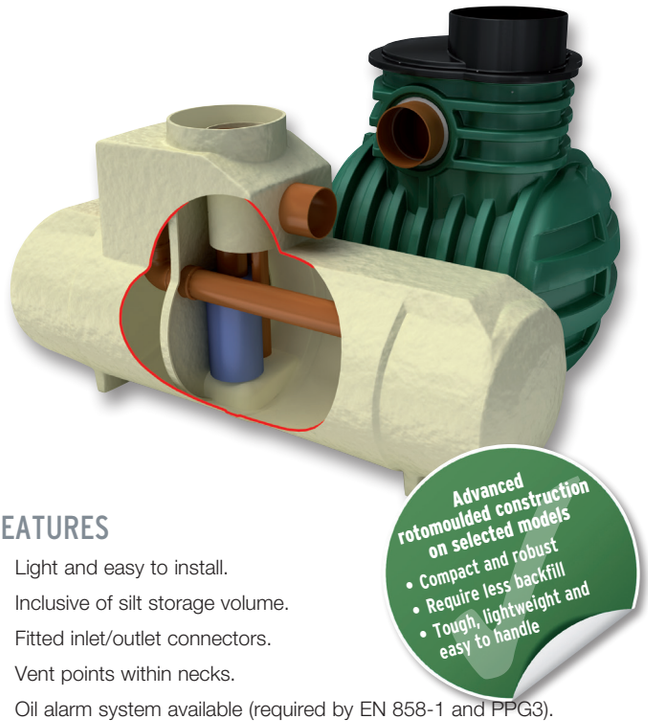
For further detailed information, please consult the Environment Agency Pollution Prevention Guideline 03 (PPG 3) 'Use and design of oil separators in surface water drainage systems' available from their website.

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



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 Kingspan Klargester Bypass 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.
- Oil storage volume.
- Silt storage capacity.
- 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.

FEATURES

- Light and easy to install.
- 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 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) SILT	OIL	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.
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.

Full Retention NSF RANGE

APPLICATION

Full retention separators are used in high risk spillage areas such as:

- Fuel distribution depots.
- Vehicle workshops.
- Scrap Yards

PERFORMANCE

Kingspan Klargester were the first UK manufacturer to have the required range (3-30 l/sec) certified to EN 858-1 in the UK. The NSF number denotes the flow at which the separator operates.

The British Standards Institute (BSI) have witnessed the performance tests of the required range of separators and have certified their performance, in relation to their flow and process performance to ensure that they met the effluent quality requirements of EN 858-1. Larger separator designs have been determined using the formulas extrapolated from the test range.

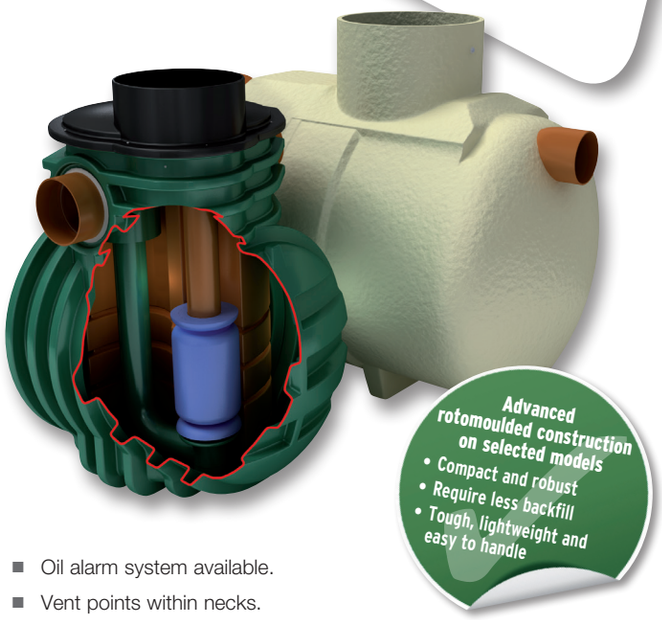
Each full retention separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Automatic closure device.
- Oil storage volume.
- Coalescer (Class I units only).

Klargester full retention separators treat the whole of the specified flow.

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- 3-30 l/sec range independently tested and performance sampled, certified by the BSI.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.



- Oil alarm system available.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

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

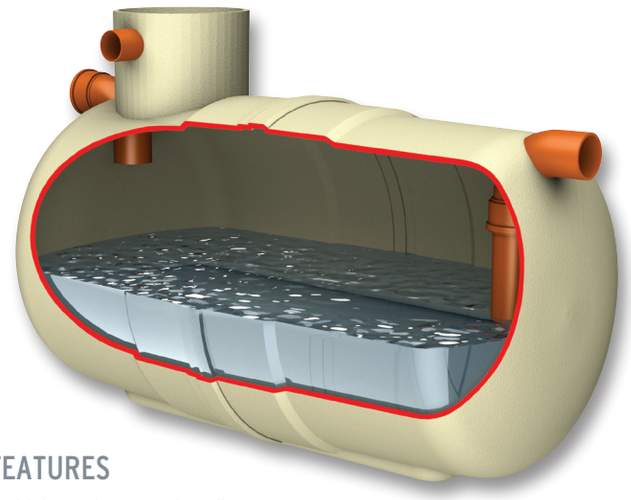
- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the influent is not pumped.
- The required discharge standard. This will decide whether 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)	DRAINAGE AREA (m^2) PPG-3 (0.018)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	MIN. INLET INLET (mm)	STANDARD PIPEWORK DIA. (mm)
NSFP003	3	170	300	30	1700	1350	1420	1345	500	160
NSFP006	6	335	600	60	1700	1350	1420	1345	500	160
NSFA010	10	555	1000	100	2610	1225	1050	1000	500	200
NSFA015	15	835	1500	150	3910	1225	1050	1000	500	200
NSFA020	20	1115	2000	200	3200	2010	1810	1760	1000	315
NSFA030	30	1670	3000	300	3915	2010	1810	1760	1000	315
NSFA040	40	2225	4000	400	4640	2010	1810	1760	1000	315
NSFA050	50	2780	5000	500	5425	2010	1810	1760	1000	315
NSFA065	65	3610	6500	650	6850	2010	1810	1760	1000	315
NSFA080	80	4445	8000	800	5744	2820	2500	2450	1000	300
NSFA100	100	5560	10000	1000	6200	2820	2500	2450	1000	400
NSFA125	125	6945	12500	1250	7365	2820	2500	2450	1000	450
NSFA150	150	8335	15000	1500	8675	2820	2550	2450	1000	525
NSFA175	175	9725	17500	1750	9975	2820	2550	2450	1000	525
NSFA200	200	11110	20000	2000	11280	2820	2550	2450	1000	600

Rotomoulded chamber construction GRP chamber construction

Washdown & Silt



APPLICATION

This unit can be used in areas such as car wash and other cleaning facilities that discharge directly into a foul drain, which feeds to a municipal treatment facility.

If emulsifiers are present the discharge must not be allowed to enter an NS Class I or Class II unit.

- Car wash.
- Tool hire depots.
- Truck cleansing.
- Construction compounds cleansing points.

PERFORMANCE

Such wash down facilities must not be allowed to discharge directly into surface water but must be directed to a foul connection leading to a municipal treatment works as they utilise emulsifiers, soaps and detergents, which can dissolve and disperse the oils.

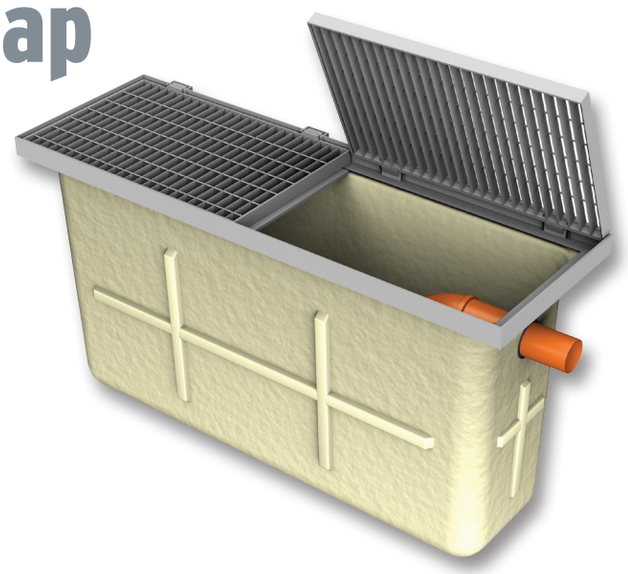
FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.

SIZES AND SPECIFICATIONS

REF.	TOTAL CAPACITY (litres)	MAX. REC. SILT	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STANDARD FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA. (mm)	APPROX EMPTY (kg)
W1/010	1000	500	3	1123	1225	460	1150	1100	50	500	160	60
W1/020	2000	1000	5	2074	1225	460	1150	1100	50	500	160	120
W1/030	3000	1500	8	2952	1225	460	1150	1100	50	500	160	150
W1/040	4000	2000	11	3898	1225	460	1150	1100	50	500	160	180
W1/060	6000	3000	16	4530	1440	600	1360	1310	50	500	160	320
W1/080	8000	4000	22	3200	2020	600	2005	1955	50	500	160	585
W1/100	10000	5000	27	3915	2020	600	2005	1955	50	500	160	680
W1/120	12000	6000	33	4640	2020	600	2005	1955	50	500	160	770
W1/150	15000	7500	41	5435	2075	600	1940	1890	50	500	160	965
W1/190	19000	9500	52	6865	2075	600	1940	1890	50	500	160	1200

Car Wash Silt Trap



APPLICATION

Car Wash silt trap is designed for use before a separator in car wash applications to ensure effective silt removal.

FEATURES

- FACTA Class B covers.
- Light and easy to install.
- Maintenance from ground level.

Forecourt

APPLICATION

The forecourt separator is designed for installation in petrol filling station forecourts and similar applications. The function of the separator is to intercept hydrocarbon pollutants such as petroleum and oil and prevent their entry to the drainage system, thus protecting the environment against hydrocarbon contaminated surface water run-off and gross spillage.

PERFORMANCE

Operation ensures that the flow cannot exit the unit without first passing through the coalescer assembly.

In normal operation, the forecourt separator has sufficient capacity to provide storage for separated pollutants within the main chamber, but is also able to contain up to 7,600 litres of pollutant arising from the spillage of a fuel delivery tanker compartment on the petrol forecourt. The separator has been designed to ensure that oil cannot exit the separator in the event of a major spillage, subsequently the separator should be emptied immediately.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- Class I and Class II design.
- Oil storage volume.
- Coalescer (Class I unit only).
- Automatic closure device.
- Oil alarm system available.

INSTALLATION

The unit should be installed on a suitable concrete base slab and surrounded with concrete or pea gravel backfill. See sales drawing for installation.

If the separator is to be installed within a trafficked area, then a suitable cover slab must be designed to ensure that loads are not transmitted to the unit.

The separator should be installed and vented in accordance with Health and Safety Guidance Note HS(G)41 for filling stations, subject to Local Authority requirements.

SIZES AND SPECIFICATIONS

ENVIROCEPTOR CLASS	TOTAL CAP. (litres)	DRAINAGE AREA (m^2)	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STD. FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STD. PIPEWORK (mm)	EMPTY WEIGHT (kg)
I	10000	555	10	3963	1920	600	2110	2060	50	400	160	500
II	10000	555	10	3963	1920	600	2110	2060	50	400	160	500
I	10000	1110	20	3963	1920	600	2110	2060	50	400	200	500
II	10000	1110	20	3963	1920	600	2110	2060	50	400	200	500

Alarm Systems

British European Standard EN 858-1 and Environment Agency Pollution Prevention Guideline PPG3 requires that all separators are to be fitted with an oil level alarm system and that it should be installed and calibrated by a suitably qualified technician so that it will respond to an alarm condition when the separator requires emptying.

- Easily fitted to existing tanks.
- Excellent operational range.
- Visual and audible alarm.
- Additional telemetry option.

PROFESSIONAL INSTALLERS

Kingspan 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.kingspanenviro.com/klargester

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® & ENVIROSAFE**
  HIGH PERFORMANCE SEWAGE TREATMENT SYSTEMS
- PACKAGE PUMP STATIONS
- **PUMPSTOR24** PUMPING SYSTEMS
- OIL/WATER SEPARATORS
- BELOW GROUND STORAGE TANKS
- GREASE & SILT TRAPS

RAINWATER SOLUTIONS

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

Klargester

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Tel: +44 (0) 1296 633000 Fax: +44 (0) 1296 633001 Scottish Office: Tel: +44 (0) 1355 248484
email: klargester@kingspan.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: klargesterinfo@kingspan.com

Visit our website **www.kingspanenviro.com/klargester**

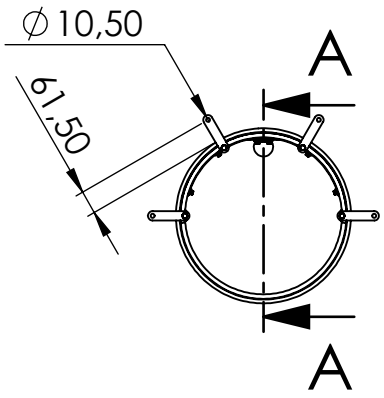
Part of Kingspan Environmental

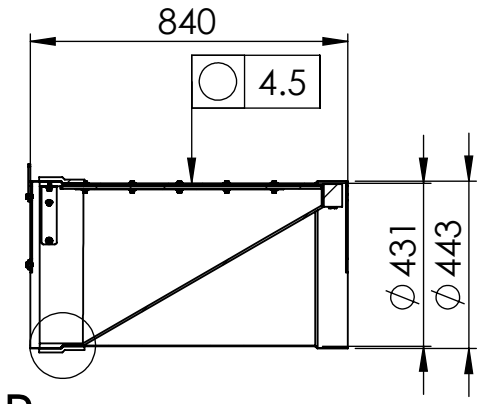
Certificate No. FM 575486

Certificate No. OHS 575489

Issue No. 21: September 2015

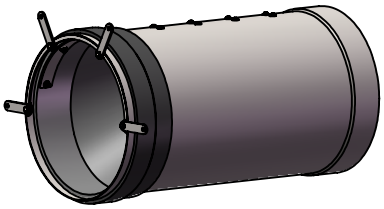
Appendix G – Check Valve Details

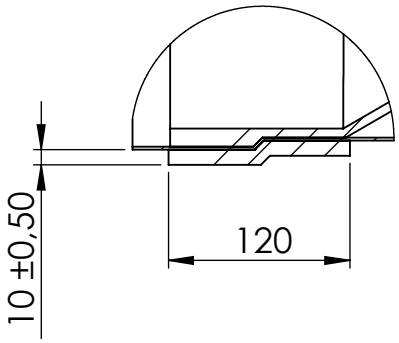




B SECTION A-A

DETAIL B
SCALE 1 : 5





Designed By	Approved By	Created Date	Units	General Tolerance	Scale
PM	PM	2015-06-26	[mm]	SS-ISO 2768-1 m	1:20

Material	Comments	Project Number
EN 1.4301 / EN 1.4404		

Weight [kg]	Box Volume [m³]
26,6	0,163

Description

Wastop DN450

Mounting tabs and rubber seal

WAPRO
www.wapro.com

Article Number	Rev	Sheet
WS440-55/65/75-304/316		1 (1)

Wastop Inline Check Valve Technical Specification
Stainless Steel AISI 304/316 Series

Art. No: WS440-55-XXX / WS440-65-XXX / WS440-75-XXX
Nominal size: DN 450
Material
Pipe: Stainless Steel AISI 304/316
Membrane: Polyurethane
Fasteners: Marine grade stainless steel (AISI 316)

Technical data:	Soft (55)	Standard (65)	Hard (75)
Max. back pressure [1]:	3 mH_2O	5 mH_2O	8 mH2O
Horizontal opening pressure [1]:	200 mmH_2O	220 mmH_2O	250 [2] mmH_2O
Horizontal closing pressure [1]:	125 mmH_2O	145 mmH_2O	165 [2] mmH2O
Submerged opening pressure [1]:	125 [2] mmH_2O	145 [2] mmH_2O	160 [2] mmH_2O
Submerged closing pressure [1]:	65 [2] mmH_2O	75 [2] mmH_2O	85 [2] mmH_2O
Vertical opening pressure [1]:	350 [2] mmH_2O	385 [2] mmH_2O	425 [2] mmH_2O
Vertical closing pressure [1]:	210 [2] mmH_2O	230 [2] mmH_2O	255 [2] mmH_2O

[1)] *+/- 15%* [2)] *Modeled value*

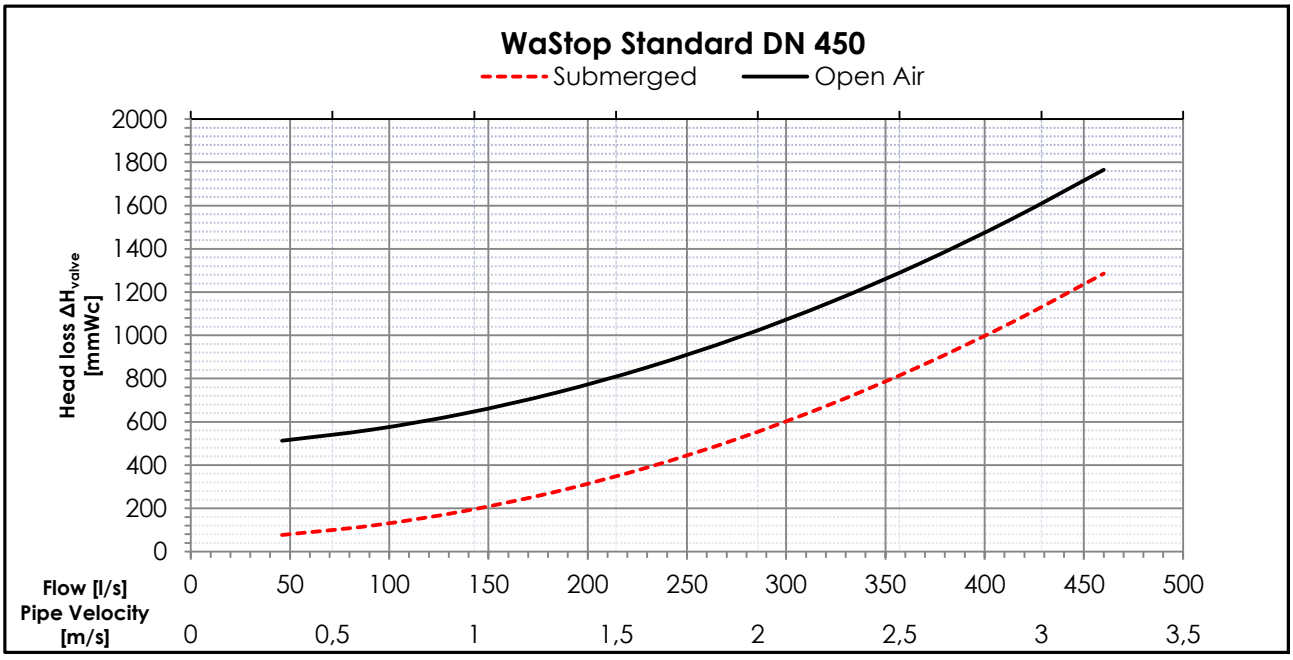
- Values measured from bottom of pipe.

- Tests performed at room temperature (16-20°C).

Max. flow	m/s	l/s
	3	477

-Higher flows requires custom valve, contact Wapro

-Flange installation is highly recommended at flows above 2m/s



- Modeled headloss

Wapro AB
Munkahusvägen 103
SE-374 31 Karlshamn
Sweden

Tel: +46 454 185 10
Fax: +46 454 123 38
Email: wapro@wapro.com
Website: www.wapro.com

Reg.no 556 352 14 66
VAT no SE 556 352 146604
Office: Karlshamn Sweden

Opening Pressures

Opening pressure [*mmH2O /inH2O*] is the difference between the water level upstream and the water level downstream in the submerged case and to the invert of the pipe in the open air case. The opening pressure data presented in the technical specifications is measured with reference points according to *Fig.1*. Testing of the opening pressure is performed at room temperature.

Head Loss

The head loss diagram presents an empirical model with test data from a third party institute. The reference points for the head loss tests are the same as the horizontal opening pressure. The head loss presented includes all head loss associated with the WaStop installed in an outlet either open air- or submerged outflow. In the case when the head loss of a particular outlet is known before the installation this head loss could be subtracted from the head loss presented in the technical specification for an accurate estimate of the head loss for the outlet after installation of a WaStop check valve. For more information about head loss contact Wapro.

Maximum Flow Velocity

Maximum flow velocity is a recommendation that yields the longest service life. Both velocity and volume flow refers to the flow in the pipe in which the WaStop is installed. Since the flow area of the WaStop is slightly smaller than the pipe, the actual max flow velocity through the WaStop is higher than the max flow velocity stated in the technical specification. If an application demands higher flow than stated in the technical specifications contact Wapro.

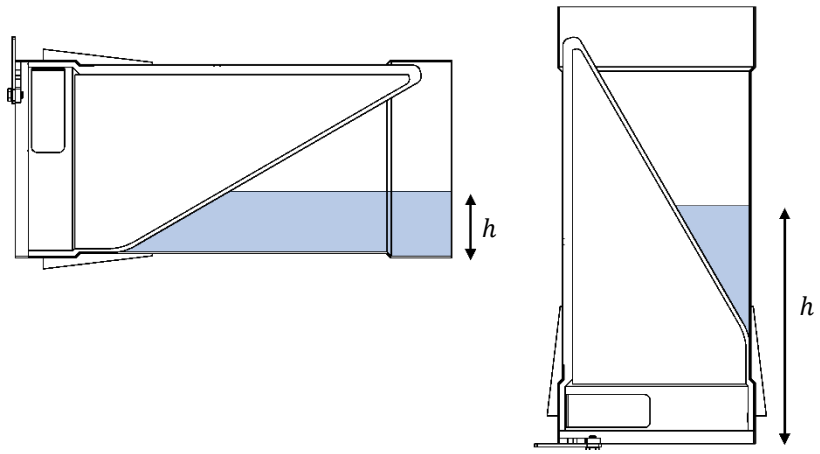


Figure 1. Reference point opening pressure horizontal and vertical.

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Munkahusvägen 103
S-374 31 Karlshamn
Sweden

Tel: +46 454 185 10
Fax: +46 454 123 38
Email: wapro@wapro.com
Website: www.wapro.com

Reg.no 556 352 14 66
VAT no SE 556 352 146604
Office: Karlshamn Sweden

Appendix H – Irish Water Correspondence

PHM Consulting

c/o Philip O'Regan,

11 Mallow Street, Limerick

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

21 September 2021

Re: 1000859459 pre-connection enquiry - Subject to contract | Contract denied

Connection for Mixed Use Development of 361 unit(s) at Pa Healy Road, Rhebogue, Limerick

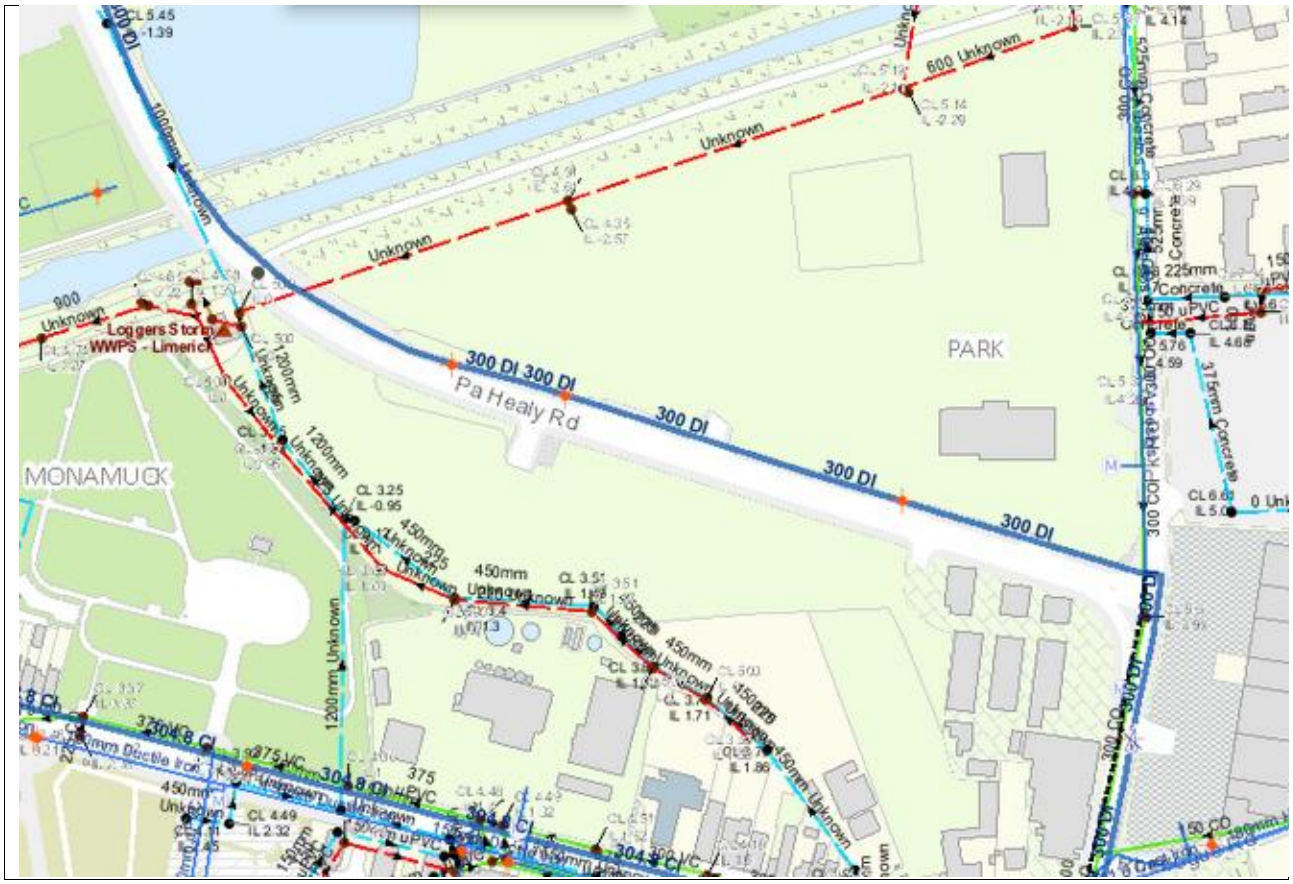
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Pa Healy Road, Rhebogue, Limerick (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	This Confirmation of Feasibility to connect to the Irish Water infrastructure also does not extend to your fire flow requirements. In order to determine the potential flow that could be delivered during normal operational conditions, an on site assessment of the existing network is required. Please note that Irish Water cannot guarantee a flow rate to meet fire flow requirements and in order to guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development.
Wastewater Connection	The Limerick Main Drainage Foul Sewer traverses the site of the proposed development. Irish Water records indicate the sewer is located to the north of the proposed site, adjacent to the boundary of the canal. Diversion of this existing sewer closer to canal is not acceptable. Any

	diversion proposal shall require a submission to diversions@water.ie and subsequent approval by Irish Water.
Strategic Housing Development	**<u>Strategic Housing Development</u>** Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. Therefore: A. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services. B. You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed and appropriate connection fee paid at a later date.
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

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

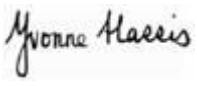


General Notes:

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 John Hennessy from the design team on 022 52256 or email jhennessy@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

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Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

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

www.water.ie

PHM Consulting
C/o Philip O'Regan
11 Mallow Street
Limerick

30 March 2020

Re: Design Submission for Strategic Housing Development at Pa Healy Road, Rhebogue, Limerick (the "Development") (the "Design Submission") / 1000859459.

Dear Philip O'Regan,

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: John Hennessy
Phone: 02252256
Email: jhennessy@water.ie

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

Appendix A

Document Title & Revision

- [Watermains – General Arrangement] 108-96-30-D3-A1
- [Drainage – General Arrangement] 108-96-201-A1
- [Drainage – Longitudinal Sections Sheet 1 of 5] 108-96-210-A1
- [Drainage – Longitudinal Sections Sheet 2 of 5] 108-96-211-A1
- [Drainage – Longitudinal Sections Sheet 3 of 5] 108-96-212-A1
- [Drainage – Longitudinal Sections Sheet 4 of 5] 108-96-213-A1
- [Drainage – Longitudinal Sections Sheet 5 of 5] 108-96-214-A1

*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.

Philip O'Regan

From: John Hennessy <jhennessy@water.ie>
Sent: Tuesday 21 September 2021 14:16
To: Philip O'Regan
Subject: RE: CDS1000859459 - Pa Healy Road, Rhebogue, Limerick
Attachments: 1000859459 - Pa Healy Road, Rhebogue, Limerick Bespoke Confirmation of Feasibility (COF) - PCE 21-09-2021 13-38-30.pdf

Hi Philip,

Please see attached a revised Confirmation of Feasibility as requested.

In respect of a revised SODA, unless there has been a design change, the original SODA should suffice. The drawings which the SODA is based on are referenced in the document, so a revised SODA is only required if these drawings are amended or the drawing title changed. In order to receive a revised/updated SODA, a design submission will need to be made and re-assessed.

Revised,
John

From: Philip O'Regan <philip.oregan@phm.ie>
Sent: Thursday 9 September 2021 11:57
To: John Hennessy <jhennessy@water.ie>
Subject: CDS1000859459 - Pa Healy Road, Rhebogue, Limerick

John,

We are currently preparing a fresh SHD Application to ABP particular to the proposed development at the above.

As the previous Application was refused on AA, NIS grounds there are no alterations proposed to the previous scheme design – Unit numbers, water/wastewater.

The attached CoD and SoDA remain unchanged.

Given the dates – 23 May 2019 & 30 March 2020 respectively, would it be possible to re-issue same with current dates.

As there is no amendment to the scheme design there will be no pre-app submission or tripartite consultation. SHD Application to ABP to be submitted by September end.

Regards,

Philip O'Regan ***Dip Eng NCEA***
Director
Tel.:+353 (0)61 576020
Mob.: +353 (0)86 8344613

For and on behalf of PHM Consulting

PHM Consulting
Civil - Structural - Environmental

Office
11 Mallow Street, Limerick, Ireland V94 WRN4

E-mail: info@phm.ie **Web.**: www.phm.ie

PHM Consulting Engineers Ltd. T/A **PHM Consulting**
Registered in ROI No.: 477520

chun comhlíonadh le polasaithe agus le caighdeáin Uisce Éireann a chinntiú agus chun ár ngnó a chosaint. Fochuideachta gníomhaíochta de chuid Ervia is ea Uisce Éireann atá faoi theorainn scaireanna, de bhun fhorálacha an tAcht um Sheirbhísí Uisce 2013, a bhfuil a bpríomh ionad gnó ag 24-26 Teach Colvill, Sráid na Talbóide, BÁC 1.

Go raibh maith agat as d'aird a thabhairt.