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RESIDENTIAL DEVELOPMENT AT LANDS AT CAPDOO & ABBEYLANDS, CLANE, CO. KILDARE

INFRASTRUCTURE DESIGN REPORT

05th Nov. 2019 – Rev. 04

Job Title: Residential Development of 305 units at

Capdoo & Abbeylands, Clane, Co Kildare.

Job Number: 18002

Report Title: Infrastructure Design Report

Report Reference: 18002-REV-004

Author: Brian Connolly

Date: 05th Nov. 2019

Distribution: Planning
Client
File

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1.0 INTRODUCTION

1.1 Background

This infrastructure design report is to accompany a planning submission for a residential development of 305 dwellings and a crèche at Capdoo & Abbeylands, Clane, Co. Kildare.

The lands are zoned "C1 : New Residential" in the Clane Local Area Plan 2017-2023.

This application comprises 305 residential units and crèche and will provide infrastructure comprising a road layout, footpaths, cycle-track, foul, surface water and water supply services in accordance with the Clane Local Area Plan and the Kildare County Development Plan (2017-2023).

This report aims to consider the revised development's main infrastructure elements, including the following;

- Surface water strategy and servicing.
- Foul sewer strategy and servicing.
- Water supply and servicing.
- Preliminary flood risk assessment.
- Road Layout/Site access.

1.2 Location

The subject site, of some 10.36 hectares (25.44 acres), is located at the north eastern extent of the village of Clane. The site has the benefit of abutting the River Liffey. The site is bounded by existing residential developments to the south and west and access to the site is via Brooklands residential development and Alexandra Walk residential scheme, see Figure 1.1.

The development lands are identified as KDA 1 in the Clane Local Area Plan 2017-2023 and are zoned "C –New Residential/Infill".

The site is currently used for Agriculture. Existing boundaries within the site are predominantly hedgerows, walls and fencing.

Figure 1.1 Site Location.

1.3.1 Topography

The proposed development site rises from the river Liffey to the centre of the site and then drops back towards the existing Brooklands Residential development at an average gradient of approximately 1.4% as shown in Figure 1.2. A topographical survey of the Site is provided as drawing 18002-110A.

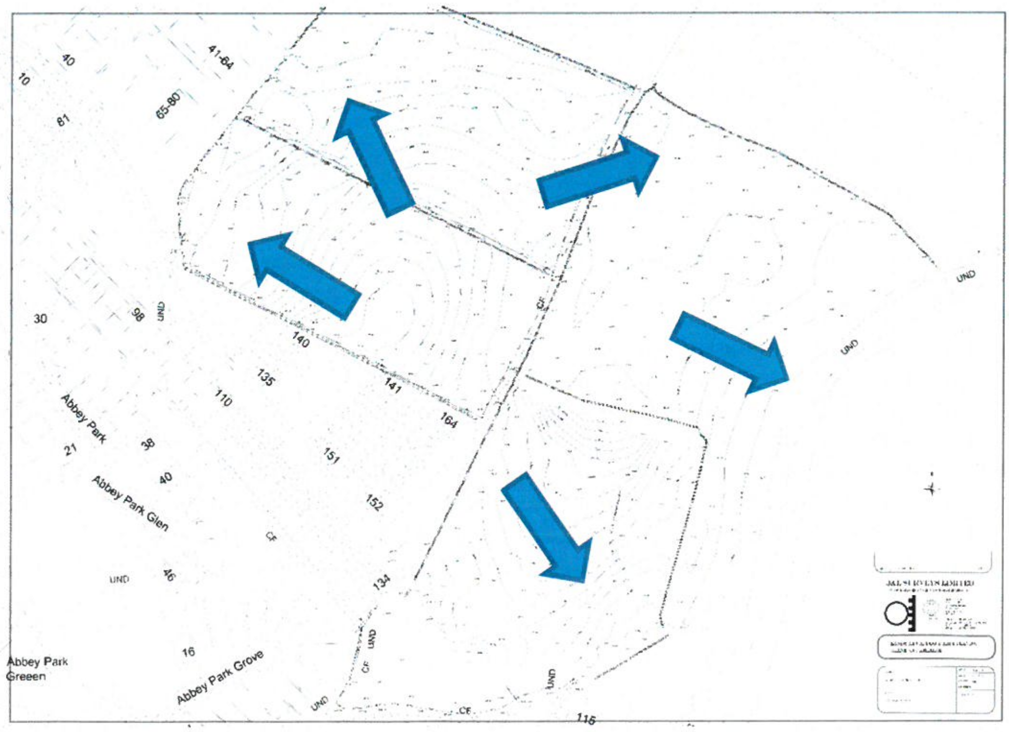


Figure 1.2 Site Topography.

1.4 Proposed Development

It is proposed to construct 305 residential units and crèche on the Site together with associated access roads, footpaths and infrastructure/services. A linear park is also proposed along the river Liffey.

1.5 Flood Risk

A separate Site Specific Flood Risk Assessment has been prepared by Consult.IE as part of the application.

2.0 ACCESS AND ROADS

2.1 Overall Road and Access Layout

The proposed development will be accessed via Brooklands Residential Scheme from the R403. A secondary entrance is also provided via Alexandra Walk with access off the Clane relief road.

The development layout has been designed with speed reduction bends to provide traffic calming together with a combination of road vertical and horizontal geometry and forward sight visibility to reduce speeds. Design speed limits of 30km/hr are applied throughout the development as per Design Manual for Urban Roads and Streets (DMURS).

2.2 Road Layout Design

The proposed development's road layout and hierarchy is shown on drawings 18002-307, 308 & Fig. 1.3. The standard road cross-sections and construction details are also shown on this drawing and comprise the following;

- Main Access Road – 6.0m wide carriageway with a 1.0m planting strip/verge and 2m footway.
- Development Local Streets – typically 5.5m wide carriageway with 2.0m footpaths.

Maximum road corner radii of 5m are provided within the local streets and on the main access road as per DMURS.

2.3 Pavement Design Standards

The main internal access roads are designed in accordance with the Design Manual for Urban Roads and Streets (DMURS) and Local Authority requirements. Refer to drawing 18002-307 for the proposed road construction thicknesses based on an assumed existing ground minimum design CBR of 3%. Actual CBRs and ground conditions will be confirmed by site investigations prior to construction.

2.4 Vehicle Tracking

The proposed development has been tracked to show that the development's proposed turning heads will accommodate a large refuse vehicle as shown on drawings 18002-308.

2.5 Driveway Access

All houses have access driveways set to accommodate a targeted maximum 1:20 driveway gradient. All driveways are permeable paving within private curtilage. Entrances to driveways in public footpaths comprise drop kerbs with 150mm deep concrete pavement.

Figure 1.3 Connections and Road Hierarchy.

2.6 Electric vehicle charge points

Ducting will be provided to allow for the installation of e-charging points

3.0 SURFACE WATER DRAINAGE

3.1 Existing Surface Water

The existing site is greenfield and the site rises from the river Liffey to the centre of the site and then drops back towards the existing Brooklands Residential development at an average gradient of approximately 1.4%, to an open drain that ultimately discharges to the River Liffey downstream.

3.2 General Design

The surface water drainage system will collect storm-water run-off generated from the proposed residential development using traditional pipe-work and manholes laid along the main access roads collecting run-off from impermeable road surfaces via gullies and adjoining areas. SUDS will also be incorporated to reduce run-off volumes and improve run-off water quality as described in Section 3.3 below.

The surface water drainage system for the residential development has been designed with two catchments as shown on drawings 18002-303-10. The surface water will be attenuated in underground "stormtech" systems before discharging to the open drain at a controlled flow rate.

3.2.1 Compliance with Surface Water Policy

Surface water management for the proposed development is designed to comply with the Greater Dublin Strategic Drainage Study (GDSDS) policies and guidelines and the requirements of Kildare County Council. The guidelines require the following four main criteria to be provided by the development's surface water design;

- Criterion 1: River Water Quality Protection – satisfied by providing interception storage using permeable paving in driveways, treatment of run-off within the SUDS features e.g. permeable paving for driveways/parking bays, within the attenuation storage system and oil separators on the main surface water outfalls from the development.
- Criterion 2: River Regime Protection – satisfied by attenuating run-off with flow control devices prior to discharge to the outfall.
- Criterion 3: Level of Service (flooding) for the site – satisfied by the Site being outside the 1000 year coastal and fluvial flood zones, (See Flood Risk Assessment). Pluvial flood risk addressed by development designed to accommodate a 100 year storm as per GDSDS. Planned flood routing for storms greater than 100 year level, considered in design, the development has been designed to provide an overland flood route from the development towards the surface water outfall.

- Criterion 4: River flood protection – attenuation and long term storage provided within the SUDS features e.g. permeable paving construction and attenuation facility.

3.2.2 Surface Water Design

In accordance with SUDS principals, permeable paving is provided for all driveways which will also collect run-off from adjacent private footpaths and run-off from house roofs. Permeable paving will provide "in curtilage" attenuation, storage and soakage for run- off.

Surface water discharge rates from the surface water network will be controlled by a Hydrobrake flow control device at each attenuation storage area.

Surface water attenuation storage for the development will be provided within stormtech attenuation tanks in accordance with the GDSDS. The tanks will provide storage for the 100 year storm for the catchment. The layout of the attenuation tank is shown on drawing 1802-303-10 with typical details on 1802-303-14

3.2.3 Ground Investigation

Preliminary site investigation was undertaken by IGSL on the Subject Site which included trial pits and infiltration tests. Infiltration tests in accordance with BRE Digest 365 were carried out at different locations throughout the site The infiltration tests carried out resulted in a soakage rate of f = 3.8662E-05 m/sec to f =1.05119E-06 m/sec. The lowest rate was used in the design of the permeable paving. The benefit of infiltration results of pit 6 and 7 were used in the design of the attenuation tanks. The results of Pit 6 & Pit 7 conclude the stormtech chambers must be wrapped in Bentonite. The Site Investigation report is attached in Appendix F.

3.3 SUDS

In accordance with the GDSDS it is proposed to use Sustainable Urban Drainage systems (SUDS) for managing storm-water for the proposed development. The aim of the SUDS strategy for the site will be to;

- Attenuate storm-water runoff.
- Reduce storm-water runoff.
- Reduce pollution impact.
- Replicate the natural characteristics of rainfall runoff for the site.
- Recharge the groundwater profile

The proposed layout of the drainage and SUDS is detailed on drawings 18001-303-10

An assessment of the potential SUDS that could be incorporated within the site was conducted using the site investigation data, www.uksuds.com/irish suds/index.htm website and the SUDS Manual. A SUDS evaluation report is provided in *Appendix A*. Since the proposed development drainage will be constructed to a taking in charge standard, the range of SUDS features available are restricted but include the following;

1. Extents of impermeable areas reduced where allowable.
2. Permeable, self-draining areas incorporated in landscaped areas.
3. All driveways to be permeable paving. Run-off from these permeable paving areas is allowed to infiltrate to the sub-soil and provide attenuation, storage and soakage for run-off generated by adjacent impermeable surfaces.
4. Down pipes from roof surfaces to rain water butts.
5. A petrol interceptor to be provided before the attenuation tank.

3.4 Attenuation Calculations

Run-off from the proposed development will be limited/attenuated using vortex flow control devices (Hydrobrake or equivalent) limiting discharge to greenfield runoff rates (Q_{bar}) in accordance with the GDSDS for the total area of the site within the catchment of the new drainage networks (Total area 10.36 Ha).

The calculated allowable discharge for the development catchment was calculated as per www.uksuds.com/irish_suds/index.htm website and the SUDS Manual.

Attenuation volumes have been designed using Microdrainage Windes analysis software taking account of design invert levels, ground levels and depth and type of system. In total 1,742m^3 of storm-water storage is provided within the attenuation facilities.

Discharge rates from the Site are in-line with the GDSDS recommendations; refer to design run-off calculations in *Appendix B*.

Surface water storage volumes to accommodate a 100 year storm include for climate change, refer to Appendix B for Windes attenuation calculations. Typical details and cross-sections of the proposed surface water attenuation facilities are provided on drawings 1802-303-14. Details of the "in curtilage" SUDS proposed includes the permeable driveways as shown on drawing 1802-303-10.

3.5 Interception Volume

To prevent pollutants or sediments discharging into water courses the GDSDS requires "interception storage" to be incorporated into the development. This interception storage is designed to receive the run-off for rainfall depths of 5mm up to 10mm if possible. The SUDS features including permeable driveways and attenuation facilities will provide the necessary interception volume required by the GDSDS. Petrol Interceptors are also provided at the entrance to both of the attenuation tanks.

3.6 Design Standards

Drainage is designed in accordance with the Greater Dublin Regional Code of Practice for Drainage Works. Surface water pipe-work was sized using the following parameters:

• Return period for pipe work	2 years, check 30 year 15 minute, no flooding. check 100 year 15 minute, flooding in designated areas.
• Time of entry	4 minutes
• Discharge Limit	24.33 l/s @ 100 years for Tank 1 and 51.0 l/sec @ 100 years for tank 2.
• Pipe Friction (Ks)	0.6 mm
• Minimum Velocity	0.7 m/s
• Standard Average Annual Rainfall	838mm (Met Eireann 1km^2 grid)
• M5-60	16.1mm (Met Eireann)
• Ratio r (M5-60/M5-2D)	0.28 (Met Eireann)
• Attenuation Tank Storm Return Event	GDSDS Volume 2, p61, Criterion 3 30 year no flooding on site. 100 year check no internal property flooding. Flood routing plan. FFL freeboard above 100 year flood level. No flooding to adjacent areas.
• Climate Change Allowance	20%
• Factor of Safety for infiltration	2.0
• Runoff from Roads and Footpaths	100%

- Runoff from Roofs (draining via permeable pavement) 60%
- Runoff from Driveways (draining via SuDS feature) 60%

Surface water sewers have been designed in accordance with IS EN 752 and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).

Standard drainage details, as outlined on drawings 1802-303-10 and 1802-303-14, are in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

The minimum pipe diameter for public surface water sewers is 225mm. Private drains within the proposed development will be 100mm as outlined on individual house drawings.

Refer to drawings 1802-303-10 for the proposed surface water layout.

Surface water sewer calculations for the main drainage networks is included in *Appendix C* .

3.7 Climate Change

Surface water calculations for the development made use of rainfall values for Clane, provided by Met Eireann. Rainfall intensities were increased by a factor of 10% (flows factored by 20%) to take account of climate change, as required by the GDSDS for attenuation storage design.

3.8 Pluvial Flooding Provision

The surface water network, attenuation storage and site levels are designed to accommodate a 100 year storm event and includes climate change provision. Floor levels of houses are set above the 100 year flood levels by a minimum of 0.5m for protection. For storms in excess of 100 years, the development has been designed to provide overland flood routes along the various development roads towards the surface water drainage outfall. Refer to Consult.ie Site Specific Flood Risk Assessment for further details.

3.9 Surface Water Quality Impact

Run-off rates from the site are controlled by vortex flow control devices. Surface water management proposals for the development also incorporate the following to reduce its impact;

- Designed in accordance with GDSDS requirements;
- Incorporates SUDS features e.g. permeable paving in high risk parking areas at the front of houses;
- On-line attenuation/infiltration facilities with an oil separator prior to discharge to a public surface water sewer. A Klargester NSBE030 and NSBE040 is recommended for Tank 1 and Tank 2 respectively.

4.0 FOUL DRAINAGE

4.1 Existing Foul Drainage

The subject site is green-field and therefore has no foul loading at present. It is proposed to divide the foul sewer into two catchments, Catchment 1, Western part of site to Abbey Park pumping station via Brooklands and Catchment 2, Eastern part of site through Alexandra Walk. The Abbey Park pumping station is in the control of the applicant while the Alexandra Walk pumping station is taken in Charge by Irish Water. A 225mm diameter foul sewer runs to both pumping stations.

We note the contents of the pre-connection feasibility reply from Irish Water, dated 7 October, 2019 for 230 units initially and the remaining 75 units on completion of the Upper Liffey Valley Sewerage Scheme. A statement of Design Strategy was also received from Irish Water dated 10 October, 2019, see Appendix E.

4.2 Design Strategy

The proposed foul drainage system for the entire site has been designed as two separate catchments (refer to drawing 1802-303-1 Sheet 1 & Sheet 2), based on the topography of the site. 163 units and the crèche predominantly to the West of the site will discharge to the Abbeylands pumping station (capacity calculation included in *Appendix D*) via Brooklands residential scheme with the remaining 142 units discharging to the Alexandra Walk pumping station, (capacity calculations included in *Appendix D*).

Individual houses will connect to the 225mm and 150mm diameter foul drains via individual 100mm diameter house connections, as per Irish Water Code of Practice for Wastewater Infrastructure.

No. of Residential Units	No. of Persons @ 3 per unit & 60 Creche	Dry Weather Flow (Litres/person /day)	Peak Flow - 6 x DWF (l/s)	Daily Demand ($m^{3)}$
305 + Creche	975	305 (Dwelling) 60 (Creche)	12.75	183

4.3 Design Calculations

Foul sewers have been designed in accordance with the Building Regulations and specifically in accordance with the principles and methods set out in the Irish Water

Code of Practice, IS EN752 (2008), IS EN12056: Part 2 (2000) and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).

The following criteria have been applied:

Demand	600l/dwelling/day (based on 3 persons per house and a per capita wastewater flow of 200 litres per head per day.)
Discharge units	14 units per house (as BS8301)
Pipe Friction (Ks)	1.5 mm
Minimum Velocity	0.75 m/s (self-cleansing velocity)
Maximum Velocity	3.0 m/s
Frequency Factor	0.5 for domestic use
Manhole Depths	< 5.0m

Foul sewer design calculations are provided in *Appendix D*.

All foul sewers and manholes will be constructed in accordance with the Irish Water Standard Details and the Irish Water Code of Practice for Wastewater.

Longitudinal sections for the proposed foul sewers are detailed on drawings 18002-303-1-1, 303-1-2 & 303-1-3.

4.4 Compliance with Irish Water Standards

The proposed foul sewer design and layout is in accordance with the Irish Water Code of Practice for Wastewater Infrastructure and The Irish Water Wastewater Infrastructure Standard Details.

4.5 Foul Environmental Impacts

This application comprises 305 residential units. The development will discharge by gravity to a Pumping Station located in the adjoining Abbey Park (in control of applicant) and Alexandra Walk residential scheme, taking in charge by Local Authority & Irish Water.

An Irish Water Pre-Connection Enquiry form has been submitted to Irish Water and an Irish Water Feedback form has been received outlining that a Wastewater connection is possible for the proposed development. Refer to *Appendix E* for a copy of each form. A statement of Design acceptance WAS ISSUED BY Irish Water on 10/10/19 and included also in Appendix E

5.0 WATER SUPPLY AND DISTRIBUTION

5.1 Existing Water supply

An existing 150mm diameter public uPVC watermain passes the subject site on the Brooklands entrance and on the south west boundary of the site. Please refer to Irish Water Map in *Appendix G*.

5.2 Development Water Main Layout

The development's water-main distribution system is indicated on drawings 18002-303-2 Sheet 1 & Sheet 2. A connection will be made to the existing 150 diam watermains at the south-west boundary entrance off Brooklands Housing Scheme, (in control of the applicant) to service the development. A 150mm diameter spine water main will be provided along the main access road through the Subject Site with a number of 100mm diameters looped watermains provided along the Local Streets. A connection is made back to the existing 150mm watermains at Brooklands residential scheme at the bottom south-west corner of the site.

The connection to the public water main will include a metered connection with sluice valve arrangement in accordance with the requirements of Irish Water.

The selected pipe material options for the development will be PE-100.

Individual houses will have their own connections to the distribution main via service connections and boundary boxes. Individual service boundary boxes will be of the type to suit Irish Water and to facilitate domestic meter installation.

Hydrants are provided for fire-fighting at locations to ensure that each dwelling is within the required Building Regulations distance of 46.0m to a hydrant.

5.3 Compliance with Irish Water Standards

The proposed watermain design and layout is in accordance with the Irish Water Code of Practice for Water Infrastructure and The Irish Water, Water Infrastructure Standard Details. A letter of Design Acceptance is included in *Appendix E*

5.4 Water Demand & Conservation

The average daily domestic demand (ADDD) for the proposed development is approximately 123.5m³ and an average day / peak week demand of 154.4m³ has been calculated as outlined in the Irish Water Code of Practice for Water Infrastructure.

The average water demand is estimated to be 1.79 l/s. The peak demand for sizing of the pipe network (5 times the average day, peak week demand) is calculated as 9.0l/s.

Each house will provide 24 hours of cold water storage in the header tank and houses will utilise water saving features for the fittings to reduce water demand.

An Irish Water Pre-Connection Enquiry form, including calculations has been submitted to Irish Water and an Irish Water Feedback form has been received outlining that a Watermain connection is possible for the proposed development.

Appendix A

IRISH SUDS REPORT

Site Drainage Evaluation

Site name: Capdoo Commons
Site location: Clane, Co. Kildare

Report Reference: 1544347714187
Date: 9/12/2018

1. INTRODUCTION

This is a bespoke report providing initial guidance on potential implementation of SuDS for the development site in line with current best practice.

The use of this tool should be supplemented by more detailed guidance on SuDS best practice provided in a number of sources, principally the CIRIA SUDS Manual (2007), other CIRIA documents; the Use of SUDS in High Density Developments, HR Wallingford, (2005) and other HR Wallingford documents.

The objective is to provide some early guidance on the numbers and types of components that might be suitable for consideration within the site design. This may facilitate pre-application discussions with planners and other relevant authorities.

This guidance has been provided prior to the completion of the SUDS standards and the supporting guidance. However the principles of this tool are unlikely to be very different to the aims of the SUDS standards. HR Wallingford is not liable for the use of any output from the use of this tool and the performance of the drainage system. It is recommended that detailed design using appropriately experienced engineers professionals and tools is undertaken before finalising any drainage scheme arrangement for a site.

THE CONTENT OF THE REPORT

This report is split into 8 sections as follows:

2. Generic SuDS Best Practice Principles
3. Runoff Destination
4. Hydraulic Design Criteria
5. Water Quality Design Criteria
6. Site-Specific Drainage Design Considerations
7. SuDS Construction
8. SuDS Components Performance
9. Guidance on The Use of Individual Components

2. GENERIC SuDS BEST PRACTICE PRINCIPLES

To comply with current best practice, the drainage system should:

(i) manage runoff at or close to its source;
(ii) manage runoff at the surface;
(iii) be integrated with public open space areas and contribute towards meeting the objectives of the urban plan;
(iv) be cost-effective to operate and maintain.

The drainage system should endeavour to ensure that, for any particular site:

(i) natural hydrological processes are protected through maintaining Interception of an initial depth of rainfall and prioritising infiltration, where appropriate;
(ii) flood risk is managed through the control of runoff peak flow rates and volumes discharged from the site;
(iii) stormwater runoff is treated to prevent detrimental impacts to the receiving water body as a result of urban contaminants.

In addition, it is desirable to maximise the amenity and ecological benefits associated with the drainage system where there are appropriate opportunities. SuDS are green infrastructure components and can provide health benefits, and reduce the vulnerability of developments to the impacts of climate change.

3. RUNOFF DESTINATION

Introduction

Infiltration should be prioritised as the method of controlling surface water runoff from the development site, unless it can be demonstrated that the use of infiltration would have a detrimental environmental impact.

Groundwater (via Infiltration)
Infiltration may not be appropriate for managing runoff from this site. Robust studies are reqired to confirm the significance of the following constraints to infiltration:

(1) The subsurface geology is primarily impermeable and the use of infiltration is unlikely to be suitable. Where infiltration rates are confirmed via testing to be < 1 x 10-7 m/s, infiltration will be very limited. Where infiltration rates are between 1 x 10-7 and 1 x 10-5 m/s, then soils can still provide Interception and partial infiltration. If rates are confirmed to be > 1 x 10-5 m/s, full infiltration can be considered in the design.

The groundwater beneath the site is designated as , and this designation will define the treatment requirement for any infiltrated water (See Water Quality Design Criteria).

Surface water body
All runoff that cannot be discharged to groundwater will be managed on site and discharged to a surface water body.

The receiving surface water body for runoff from the site is: the *Liffey*. The riparian owner is: .

4. HYDRAULIC DESIGN CRITERIA

Introduction
Best practice criteria for hydraulic control require Interception, runoff and volume control.

Interception
To fulfill the requirements for Interception, there should normally be no runoff from the site for an initial depth of rainfall - usually 5mm. This is achieved through the use of infiltration, evapotranspiration, or rainwater harvesting.

Flow and Volume Control
Local guidance states that there are no additional requirements for peak flow or volume control for this site. Therefore, once Interception requirements have been fulfilled, residual surface runoff can be conveyed directly to the watercourse for this site.

The site is a greenfield development, therefore runoff from the site needs to be constrained to the equivalent greenfield rates and volumes.

Attenuation and hydraulic controls will be used to manage flow rates.

Rainwater harvesting, or the use of Long Term Storage can be used to achieve greenfield runoff volume control. Where volume control is not practicable, flows discharged from the site will be constrained to Qbar or 2 l/s/ha (whichever is the greater).

5. WATER QUALITY DESIGN CRITERIA

Introduction
Current best practice takes a risk-based approach to managing discharges of surface runoff to the receiving environment. The following text provides guidance on the extent of water quality management likely to be appropriate for the site.

Hazard Classification
Runoff from clean roof surfaces (ie not metal roofs, roofs close to polluted atmospheric discharges, or roofs close to populations of flocking birds) is classified as Low in terms of hazard status.

Runoff from roads, parking and other areas of residential, commercial and industrial sites (that are not contaminated with waste, high levels of hydrocarbons, or other chemicals) is classified as Medium in terms of hazard status.

Treatment requirements for disposal to surface water systems
The level of urbanisation of the catchment at the point of the discharge from the site is < 20%, therefore it may be classified as a sensitive receptor.

Roof runoff will require 1 treatment stage prior to discharge.

Runoff from other parts of this site such as roads, parking and other areas will require 3 treatment stages prior to discharge.

6. SITE-SPECIFIC DRAINAGE DESIGN CONSIDERATIONS

The design of SuDS with access to temporary or permanent water should consider public health and safety as well as issues associated with construction and operational management of the structures. Health and safety issues and risk mitigation features are presented in the CIRIA SuDS Manual.

Individual SuDS components should not be treated in isolation, but should be seen together as providing a suite of drainage features which are appropriate in different combinations for varying scales. It is always desirable to have a mix of SuDS components across the site as different components have different capacities for treatment of individual pollutants.

7. SuDS CONSTRUCTION

SuDS are a combination of civil engineering structures and landscaping practice. Due to the limited experience of building SuDS in the water industry, there are a number of key issues which need to be particularly considered as their construction requires a change in approach to some standard construction practices.

• SuDS components should be constructed in line with either the manufacturer's guidelines or best practice methods.
• The construction of SuDS usually only requires the use of fairly standard civil engineering construction and landscaping operations, such as excavation, filling, grading, top-soiling, seeding, planting etc. These operations are specified in various standard construction documents, such as the Civil Engineering Specification for the Water Industry (CESWI).
• Construction of soakaways is regulated by the Buildings Regulations part H (Drainage and waste disposal) which sets out the requirements for drainage of rainwater from the roofs of buildings.
• During construction, any surfaces which are intended to enable infiltration must be protected from compaction. This includes protecting from heavy traffic or storage of materials.
• Water contaminated with silt must not be allowed to enter a watercourse or drain as it can cause pollution. All parts of the drainage system must be protected from construction runoff to prevent silt clogging the system and causing pollution downstream. Measures to prevent this include soil stabilisation, early construction of sediment management basins, channelling run-off away from watercourses and surface water drains, and erosion prevention measures.
• After the end of the construction period and prior to handover to the site owner/operator:
- Subsoil that has been compacted during construction activities should be broken up prior to the re-application of topsoil to garden areas and other areas of public open space to reinstate the natural infiltration performance of the ground;
- Any areas of the SuDs that have been compacted during construction but are intended to permit infiltration must be completely refurbished;
- Checks must be made for blockages or partial blockages of orifices or pipe systems;
- Any silt deposited during the construction must be completely removed;
- Soils must be stabilised and protected from erosion whilst planting becomes established.

Detailed guidance on the construction related issues for SuDS is available in the SuDS Manual and the associated Construction Site handbook (CIRIA, 2007).

8. SuDS COMPONENTS PERFORMANCE

	Interception	Peak flow control: Low	Peak flow control: High	Volume reduction	Volume control	Gross sediments	Fine sediments	Hydrocarbons/ PAHs	Metals	Nutrients
Rainwater Harvesting	Y	Y	S	Y	N	N	N	N	N	N
Pervious Pavement	Y	Y	Y	Y	Y	Y	Y	Y	Y	Var
Filter Strips	Y	N	N	N	N	Y	N	Y	Y	Var
Swales	Y	Y	S	Y(*)	N	Y	Y(+)	Y	Y	Y(-)
Trenches	Y	Y	S	Y(*)	N	N	N	Y	Y	Y(-)
Detention Basins	Y	Y	Y	N	Y	Y	Y(+)	Y	Y	Var
Ponds	N	Y	Y	N	Y	N(~)	Y	Limited	Y	Var
Wetlands	N	Y	S	N	Y	N(~)	Y	Limited	Y	Y
Green Roofs	Y	Y	N	N	N	N	N	Y	N	N
Bioretention Systems	Y	Y	S	Y(*)	N	N(~)	Y	Y	Y	Y
Proprietary Treatment Systems	N	N	N	N	N	Y	Y	Y(!)	Y(!)	Y(!)
Subsurface Storage	N	Y	Y	N	Y	N(~)	N	N	N	N
Subsurface Conveyance Pipes	N	N	N	N	Y	N(~)	N	N	N	N

Notes:

S: Not normally with standard designs, but possible where space is available and designs mitigate impact of high flow rates.
Y(*): Where infiltration is facilitated by the design.
N(~): Gross sediment retention is possible, but not recommended due to negative maintenance and performance implications.
Y(+): Where designs minimise the risk of fine sediment mobilisation during larger events.
Y(!): Where designs specifically promote the trapping and breakdown of oils and PAH based constitutents.
Y("): Where subsurface soil structure facilitates the trapping and breakdown of oils and PAH based constituents.
Var: The nutrient removal performance is variable, and can be negative in some situations.
Y(-): Good nutrient removal performance where subsurface biofiltration systems with a permanently saturated zone included within the design.

9. GUIDANCE ON THE USE OF INDIVIDUAL COMPONENTS

Rainwater Harvesting

• *Roofs*
Rainwater harvesting systems can be used to effectively drain roofs and provide both water supply and stormwater management benefits.

Pervious Pavement

• *Roofs*
Roof water can be drained into pervious pavement areas using diffusers to dissipate the point inflows. Detailed design of the pavement will need to take account of the additional impermeable roof area.

• *Roads*
Some types of pervious pavement can be used for relatively highly trafficked roads and pavement manufacturers should be consulted on the appropriate specification.

• *Car parks/other impermable surfaces*
Pervious pavements provide effective drainage, storage and treatment of car park surfacing,

Filter Strips

• *Roads*
Filter strips can provide treatment for road runoff, upstream of swales or trench components. They can reduce the need for kerbing and runoff collection systems.

• *Car parks/other impermable surfaces*
Filter strips can provide treatment for runoff from impermeable surfaces, upstream of swales or trench components. They can reduce the need for kerbing and runoff collection systems.

• *Site size > 50 ha*
The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

Swales

• *Roofs*
Swales can be used to convey roof water to other parts of the site.

• *Roads*
Swales provide treatment and conveyance of road runoff. There are a range of swale types - standard grass channels, underdrained swales, and wetland swales - depending on drainage requirements.

• *Car parks/other impermable surfaces*
Swales provide treatment and conveyance of runoff from impermeable areas. There are a range of swale types - standard grass channels, underdrained swales, and wetland swales - depending on drainage requirements.

• *Site size > 50 ha*
The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

Trenches

- *Roofs*

Trenches can be used to convey roof water to other parts of the site.

- *Roads*

Trenches can provide treatment and conveyance of road runoff. They require effective pretreatment to minimise the risk of blockage.

- *Car parks/other impermable surfaces*

Trenches can provide treatment and conveyance of runoff for impermeable areas.

- *Site size > 50 ha*

The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

Detention Basins

- *Roofs*

Detention basins can be used to attenuate and treat runoff.

- *Roads*

Detention basins can be used to attenuate and treat runoff.

- *Car parks/other impermable surfaces*

Detention basins can be used to attenuate and treat runoff.

- *Site size > 50 ha*

The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria. A risk assessment should be used to determine the maximum appropriate depth of stored water in the basin.

Ponds

- *Roofs*

Ponds can be used to attenuate and treat roof runoff.

- *Roads*

Ponds can be used to attenuate and treat runoff. However, they are best implemented at the lower end of the treatment train as a 'polishing' component. They should not be used as sediment management devices, as sediment and wet vegetation is relatively costly to extract and dispose of. If poor quality water remains in ponds for extended periods, nutrient concentrations can rise - particularly in the summer months, and the pond can become unattractive with poor amenity and biodiversity potential.

- *Car parks/other impermable surfaces*

Ponds can be used to attenuate and treat runoff. However, they are best implemented at the lower end of the treatment train as a 'polishing' component. They should not be used as sediment management devices, as sediment and wet vegetation is relatively costly to extract and dispose of. If poor quality water remains in ponds for extended periods, nutrient concentrations can rise - particularly in the summer months, and the pond can become unattractive with poor amenity and biodiversity potential.

- *Site size > 50 ha*

The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

- *Other*

Ponds built in permeable soils will require lining to maintain the water level of the permanent pool. The lining may be finished 100 or 200 mm lower than the outlet invert to encourage some infiltration to take place to contribute to interception.

Wetlands

- *Roofs*

Wetlands can be used to attenuate and treat roof runoff.

- *Roads*

Wetlands can be used to attenuate and treat runoff. However, they are best implemented at the lower end of the treatment train as a 'polishing' component. They should not be used as sediment management devices, as sediment and wet vegetation is relatively costly to extract and dispose of. If poor quality water remains in wetlands for extended periods, nutrient concentrations can rise - particularly in the summer months, and the wetland can become unattractive with poor amenity and biodiversity potential.

- *Car parks/other impermable surfaces*

Wetlands can be used to attenuate and treat runoff. However, they are best implemented at the lower end of the treatment train as a 'polishing' component. They should not be used as sediment management devices, as sediment and wet vegetation is relatively costly to extract and dispose of. If poor quality water remains in wetlands for extended periods, nutrient concentrations can rise - particularly in the summer months, and the wetland can become unattractive with poor amenity and biodiversity potential.

• *Site size > 50 ha*
The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

Green Roofs

• *Roofs*
Green roofs can be designed to provide interception, management and treatment of rainfall up to specified rainfall depths.

Bioretention Systems

• *Roofs*
Bioretention systems can be used to attenuate and treat roof runoff.

• *Roads*
Linear bioretention systems (ie biofiltration swales) can be used to attenuate and treat road runoff.

• *Car parks/other impermable surfaces*
Bioretention systems canbe used for car park drainage.

• *Site size > 50 ha*
Bioretention systems will tend to be suitable for managing small areas only.The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

Proprietary Treatment Systems

• *Roads*
Proprietary treatment systems can be used where surface vegetated systems are impracticable. However, regular monitoring needs to be ensured so that they are maintained so that they continue to function effectively.

• *Car parks/other impermable surfaces*
Proprietary treatment systems could be used where surface vegetated systems are impracticable. However, regular monitoring needs to be ensured so that they are maintained so that they continue to function effectively.

• *Site size > 50 ha*
Proprietary treatment systems will tend to be suitable for managing small areas only. The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

Subsurface Storage

• *Roofs*
Subsurface storage can be used to attenuate roof runoff.

• *Roads*
Subsurface storage can be used to attenuate road runoff.

• *Car parks/other impermable surfaces*
Subsurface storage can be used to attenuate car park runoff.

Subsurface Conveyance Pipes

Appendix B

SURFACE WATER DISCHARGE AND ATTENUATION

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Brian Connolly
Site name:	TANK 1 CAPDOO COMMONS
Site location:	CLANE

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

Site Details

Latitude:	53.29506° N
Longitude:	6.67485° W
Reference:	2992356233
Date:	Oct 28 2019 20:47

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 4.3

Methodology

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

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	812	812
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	9.32	9.32
1 in 1 year (l/s):	7.92	7.92
1 in 30 years (l/s):	19.86	19.86
1 in 100 year (l/s):	24.33	24.33
1 in 200 years (l/s):	26.66	26.66

Title:
Housing scheme at Capdoo Commons, Clane

Client: WESTAR INVESTMENTS LTD

Subject: SURFACE WATER PIPE RUN AREAS

Job Ref.:	Calcs. By	Drg. No.
1802	Brian Connolly	P-1802 303-1
sheet 01 of 03		

brian connolly associates
consulting engineers
the studio, wood's way
clane, co. kildare
tel: (045) 892211; fax (045) 892420

RUN	ROOF	DRIVES & Path	ROAD	PATHS NEARSIDE	PATHS FARSIDE	GRASS MARGIN NEARSIDE	GRASS MARGIN FARSIDE	AREA	CUMALATIVE AREA
	percolation factor	percolation factor	percolation factor	percolation factor	percolation factor	percolation factor	percolation factor		
	0.6	0.6	1	1	1	0.95	0.95		
M.H. to M.H.	M^2	M^2	6.0m X Length	2.0m X Length	2.0m X Length	1.0m X Length	1.0m X Length	(Ha)	(Ha)
	80	30	6	2	2	1	1		
1 to 6	3	3	50	50	50	50	50	0.079	0.079
2 to 5	5	5	33	33	33	33	33	0.072	0.072
3 to 4	4	4	20	20	0	20	0	0.044	0.044
4 to 5	6	6	56	6	0	16	0	0.076	0.120
5 to 6	9	9	72	72	72	72	72	0.145	0.417
6 to 7	12	12	60	60	60	60	60	0.151	0.567
7 to 10	6	6	35	35	35	35	35	0.081	0.649
8 to 9	6	6	33	33	33	33	33	0.079	0.079
9 to 10	4	4	38	38	0	38	0	0.060	0.139
10 to 11	8	8	55	55	0	55	0	0.102	0.890
11 to 22	2	2	18	18	0	18	0	0.029	0.919
12 to 13	0	0	28	56	28	56	28	0.042	0.042
13 to 14	0	0	36	72	36	72	36	0.053	0.095
14 to 18	0	0	53	106	53	106	53	0.079	0.174
15 to 16	4	4	41	41	0	41	0	0.063	0.063
16 to 17	5	5	62	62	0	62	0	0.088	0.152
17 to 18	4	4	45	45	45	45	45	0.080	0.232
18 to 20	0	0	20	40	20	40	20	0.030	0.435
19 to 20	4	0	28	56	28	56	28	0.061	0.061
20 to 21	6	6	45	45	45	45	45	0.093	0.589
21 to 22	2	2	20	20	0	20	0	0.031	0.620
22 to 23	0	0	0	0	0	0	0	0.000	1.539

Title: Housing scheme at Capdoo Commons, Clane Client: WESTAR INVESTMENTS LTD Subject: SURFACE WATER PIPE RUN AREAS	Job Ref.: 1802 sheet 02 of 03	Calcs. By: Brian Connolly	Drg. No.: P-	brian connolly associates consulting engineers the studio, wood's way clane, co. kildare tel: (045) 892211; fax (045) 892420

RUN	ROOF	DRIVES & Path	ROAD	PATHS NEARSIDE	PATHS FARSIDE	GRASS MARGIN NEARSIDE	GRASS MARGIN FARSIDE	AREA	CUMALATIVE AREA
	percolation factor	percolation factor	percolation factor	percolation factor	percolation factor	percolation factor	percolation factor		
	0.6	0.6	1	1	1	0.95	0.95		
M.H. to M.H.	M^2	M^2	6.0m X Length	2.0m X Length	2.0m X Length	1.0m X Length	1.0m X Length	(Ha)	(Ha)
	80	30	6	2	2	1	1		
From Brooklands									0.294
30 to 31	2	0	19.5	19.5	0	19.5	0	0.027	0.321
31 to 32	3	5	20	20	0	20	0	0.041	0.362
32 to 38	3	3	16.5	16.5	0	6.5	0	0.034	0.396
33 to 34	2	2	12	12	12	12	12	0.027	0.027
34 to 35	4	4	31	31	0	31	0	0.054	0.082
35 to 36	4	4	24	24	0	24	0	0.048	0.130
36 to 37	0	0	48	48	0	48	0	0.043	0.172
37 to 38	4	6	38	38	0	38	0	0.064	0.236
38 to 39	4	16	75	75	75	75	75	0.137	0.770
39 to 43	4	5	48	48	0	48	0	0.071	0.841
40 to 41	0	0	19.5	19.5	0	19.5	0	0.017	0.017
41 to 42	0	0	32	32	0	32	0	0.029	0.046
42 to 43	0	0	27	27	0	27	0	0.024	0.070
43 to 44	5	5	46	46	0	46	0	0.074	0.985

NOTE an additional area of 0.294 ha Attenuation from Existing Brooklands Residential development

Title: Housing scheme at Capdoo Commons, Clane Client: WESTAR INVESTMENTS LTD Subject: SURFACE WATER PIPE RUN AREAS	Job Ref.: 1802 sheet 03 of 03	Calcs. By Brian Connolly	Drg. No. P-1802 303-1	brian connolly associates consulting engineers the studio, wood's way clane, co. kildare tel: (045) 892211: fax (045) 892420

RUN	ROOF	DRIVES & Path	ROAD	PATHS NEARSIDE	PATHS FARSIDE	GRASS MARGIN NEARSIDE	GRASS MARGIN FARSIDE	AREA	CUMALATIVE AREA
	percolation factor	percolation factor	percolation factor	percolation factor	percolation factor	percolation factor	percolation factor		
	0.6	0.6	1	1	1	0.95	0.95		
M.H. to M.H.	M^2	M^2	6.0m X Length	2.0m X Length	2.0m X Length	1.0m X Length	1.0m X Length	(Ha)	(Ha)
	80	30	6	2	2	1	1		
201 to 202	10	12	70	70	70	70	70	0.153	0.153
202 to 203	5	10	50	50	50	50	50	0.102	0.254
203 to 204	9	9	38	38	38	38	38	0.105	0.359
204 to 205	9	9	38	38	38	38	38	0.105	0.464
205 to 206	5	5	37	37	37	37	37	0.077	0.541
206 to 211	0	0	46.5	46.5	46.5	46.5	46.5	0.055	0.596
207 to 208	4	7	50	50	50	50	50	0.091	0.091
208 to 209	4	9	48	48	48	48	48	0.093	0.184
209 to 210	0	4	38	38	38	38	38	0.052	0.236
210 to 211	0	4	48	48	48	48	48	0.064	0.301
211 to 44	4	4	42.5	42.5	42.5	42.5	42.5	0.077	0.974
44 to 45	0	0	0	0	0	0	0	0.000	1.959

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 200 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	0.478	0.478	0.0	21.1	21.1	240.3	O K
30 min Winter	0.659	0.659	0.0	21.1	21.1	331.4	O K
60 min Winter	0.835	0.835	0.0	21.8	21.8	419.6	O K
120 min Winter	0.981	0.981	0.0	23.1	23.1	493.2	O K
180 min Winter	1.035	1.035	0.0	23.6	23.6	520.6	O K
240 min Winter	1.054	1.054	0.0	23.8	23.8	529.9	O K
360 min Winter	1.066	1.066	0.0	23.9	23.9	536.1	O K
480 min Winter	1.051	1.051	0.0	23.8	23.8	528.6	O K
600 min Winter	1.023	1.023	0.0	23.5	23.5	514.2	O K
720 min Winter	0.987	0.987	0.0	23.2	23.2	496.4	O K
960 min Winter	0.907	0.907	0.0	22.4	22.4	456.1	O K
1440 min Winter	0.740	0.740	0.0	21.2	21.2	372.0	O K
2160 min Winter	0.501	0.501	0.0	21.1	21.1	251.9	O K
2880 min Winter	0.342	0.342	0.0	20.7	20.7	172.2	O K
4320 min Winter	0.224	0.224	0.0	17.2	17.2	112.8	O K
5760 min Winter	0.182	0.182	0.0	14.3	14.3	91.5	O K
7200 min Winter	0.158	0.158	0.0	12.3	12.3	79.4	O K
8640 min Winter	0.142	0.142	0.0	10.8	10.8	71.3	O K
10080 min Winter	0.130	0.130	0.0	9.7	9.7	65.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	80.247	0.0	257.6	25
30 min Winter	56.084	0.0	360.6	38
60 min Winter	36.915	0.0	476.6	66
120 min Winter	23.512	0.0	607.2	120
180 min Winter	17.903	0.0	693.6	174
240 min Winter	14.722	0.0	760.5	206
360 min Winter	11.142	0.0	863.4	278
480 min Winter	9.130	0.0	943.4	356
600 min Winter	7.819	0.0	1009.8	434
720 min Winter	6.886	0.0	1067.3	508
960 min Winter	5.633	0.0	1164.0	654
1440 min Winter	4.243	0.0	1314.9	932
2160 min Winter	3.194	0.0	1486.2	1304
2880 min Winter	2.609	0.0	1618.3	1616
4320 min Winter	1.958	0.0	1821.6	2260
5760 min Winter	1.596	0.0	1981.0	2992
7200 min Winter	1.362	0.0	2112.7	3680
8640 min Winter	1.196	0.0	2226.2	4408
10080 min Winter	1.072	0.0	2326.5	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.264	Longest Storm (mins)	10080
Summer Storms	No	Climate Change %	+20

Time Area Diagram

Total Area (ha) 1.539

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.513	4	8	0.513	8	12	0.513

Model Details

Storage is Online Cover Level (m) 2.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.60
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	838.0	838.0	1.200	0.0	974.2
1.100	838.0	974.2			

Hydro-Brake® Outflow Control

Design Head (m) 1.100 Hydro-Brake® Type Md5 SW Only Invert Level (m) 0.000
Design Flow (l/s) 24.3 Diameter (mm) 195

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.9	1.200	25.2	3.000	39.6	7.000	60.5
0.200	15.7	1.400	27.1	3.500	42.8	7.500	62.7
0.300	20.0	1.600	29.0	4.000	45.8	8.000	64.7
0.400	21.1	1.800	30.7	4.500	48.5	8.500	66.7
0.500	20.9	2.000	32.4	5.000	51.2	9.000	68.7
0.600	20.8	2.200	33.9	5.500	53.7	9.500	70.5
0.800	21.6	2.400	35.5	6.000	56.1		
1.000	23.3	2.600	36.9	6.500	58.3		

ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST by StormTech
FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

TANK1 Capdoo & Abbeylands, Clane

STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740, SC-310, OR APPROVED EQUAL.
2. CHAMBERS SHALL BE MANUFACTURED FROM VIRGIN POLYPROPYLENE OR POLYETHYLENE RESINS.
3. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORT PANELS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
4. 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.
5. CHAMBERS SHALL MEET ASTM F2922 (POLYETHYLENE) OR ASTM F2418 (POLYPROPYLENE), "STANDARD SPECIFICATION FOR THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
6. CHAMBERS SHALL BE DESIGNED AND ALLOWABLE LOADS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
7. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. THE CHAMBER MANUFACTURER SHALL SUBMIT THE FOLLOWING UPON REQUEST TO THE SITE DESIGN ENGINEER FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE:
   a. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES 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 AASHTO FOR THERMOPLASTIC PIPE.
   b. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET. THE 50 YEAR CREEP MODULUS DATA SPECIFIED IN ASTM F2418 OR ASTM F2922 MUST BE USED AS PART OF THE AASHTO STRUCTURAL EVALUATION TO VERIFY LONG-TERM PERFORMANCE.
   c. STRUCTURAL CROSS SECTION DETAIL ON WHICH THE STRUCTURAL EVALUATION IS BASED.
8. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-310/SC-740 SYSTEM

1. STORMTECH SC-310 & SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-310 & SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/SC-780 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 SUBGRADE.
   - 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. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 3/4-2" (20-50 mm).
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-310 & SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-310 & SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

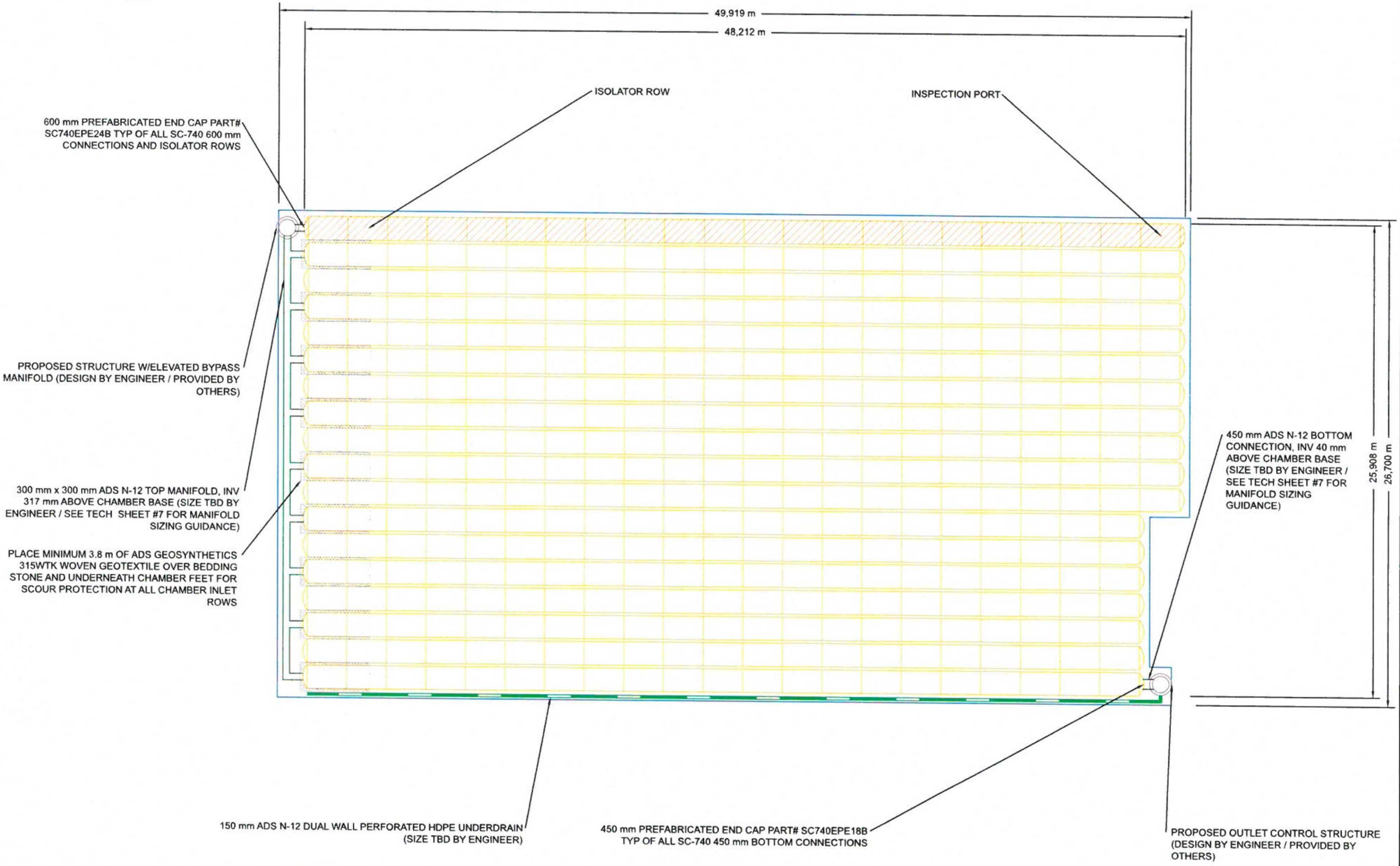
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

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

CONCEPTUAL LAYOUT

(389) STORMTECH SC-740 CHAMBERS
(36) STORMTECH SC-740 END CAPS
INSTALLED WITH 152 mm COVER STONE, 152 mm BASE STONE, 40% STONE VOID
INSTALLED SYSTEM VOLUME: 864 m³
AREA OF SYSTEM: 1313 m²
PERIMETER OF SYSTEM: 156 m

COMPUTER GENERATED CONCEPTUAL LAYOUT - NOT FOR CONSTRUCTION



REV	DRW	CHK	DESCRIPTION

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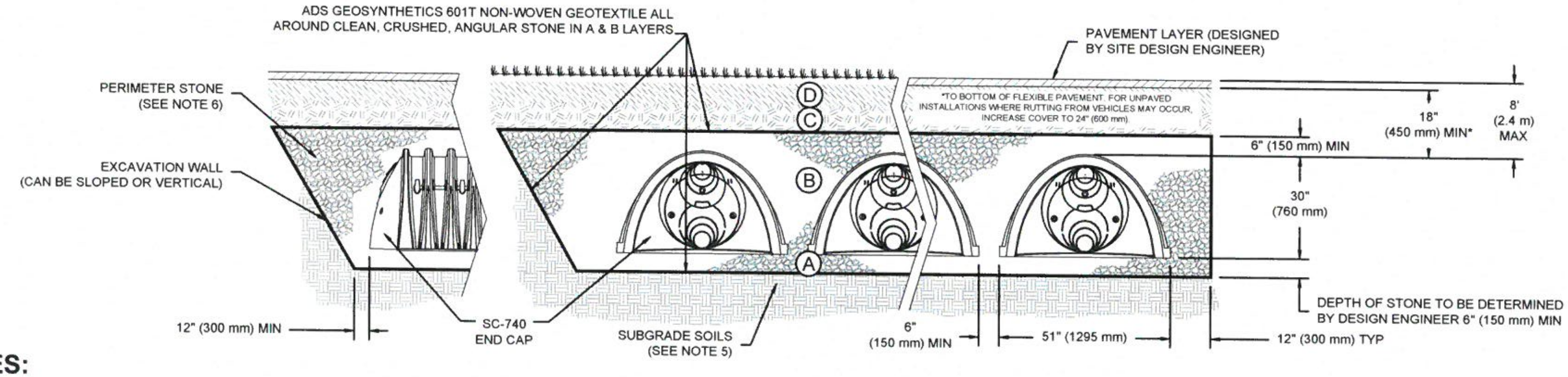
DATE: 09/19/2019 DRAWN: BA
PROJECT #: Tool CHECKED: ---

NOT TO SCALE

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 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 SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE 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 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE 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 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	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 6" (150 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.



NOTES:

1. SC-740 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS", OR ASTM F2922 "STANDARD SPECIFICATION FOR POLYETHYLENE (PE) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE "SITE DESIGN ENGINEER" REFERS TO THE ENGINEER RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE STORMTECH CHAMBERS FOR THIS PROJECT.
5. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
7. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

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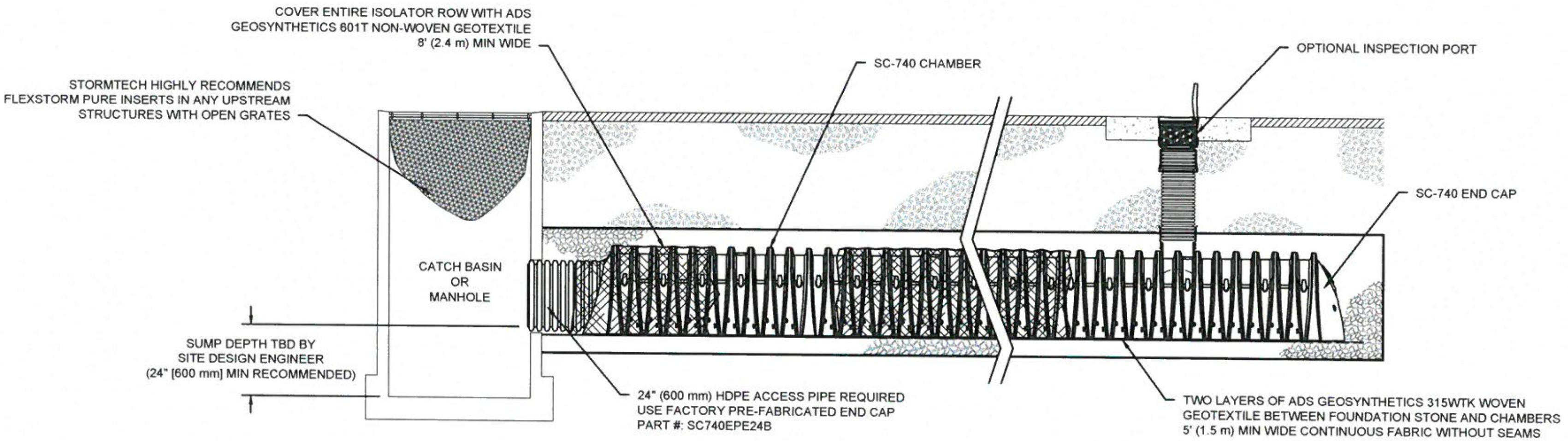
THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.



SC-740 ISOLATOR ROW DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW 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 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 ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW 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.

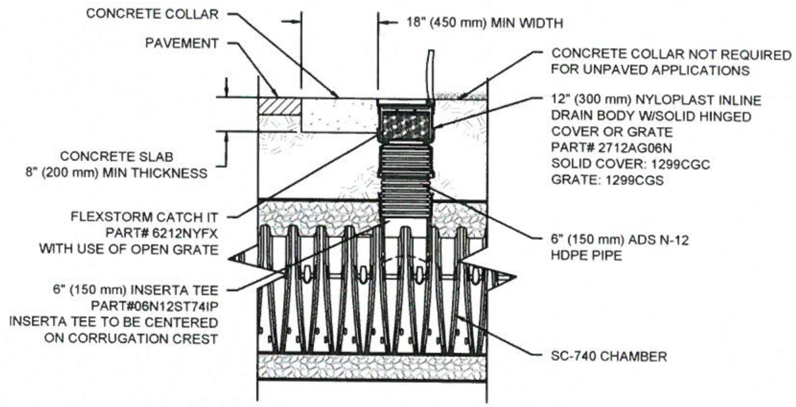
STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

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.



SC-740 6" INSPECTION PORT DETAIL
NTS

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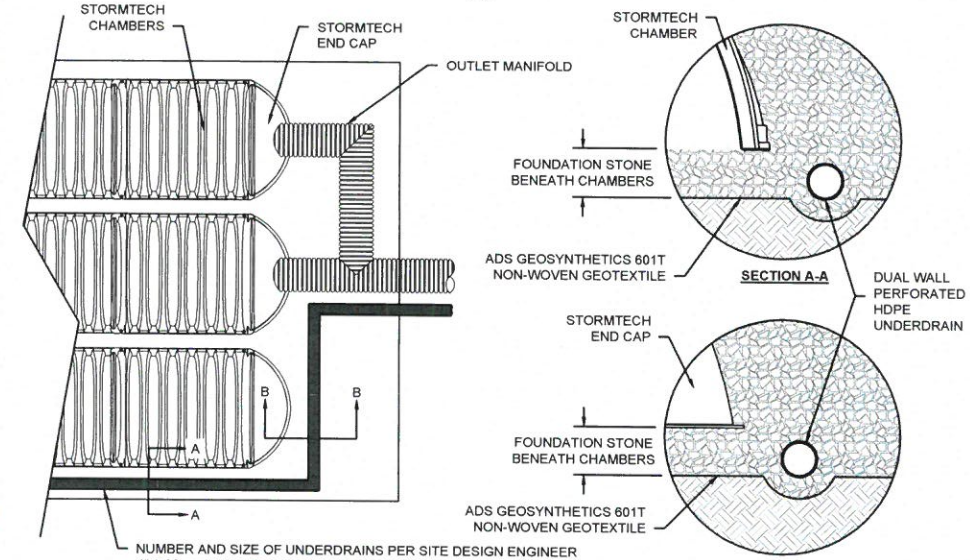
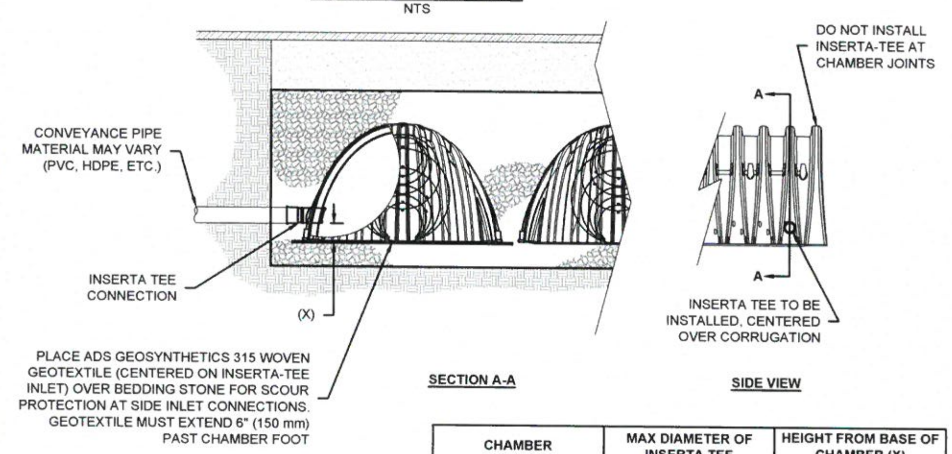
UNDERDRAIN DETAIL
NTS



NUMBER AND SIZE OF UNDERDRAINS PER SITE DESIGN ENGINEER
4" (100 mm) TYP FOR SC-310 SYSTEMS
6" (150 mm) TYP FOR SC-740, DC-780, MC-3500 & MC-4500 SYSTEMS

INSERTA TEE DETAIL
NTS

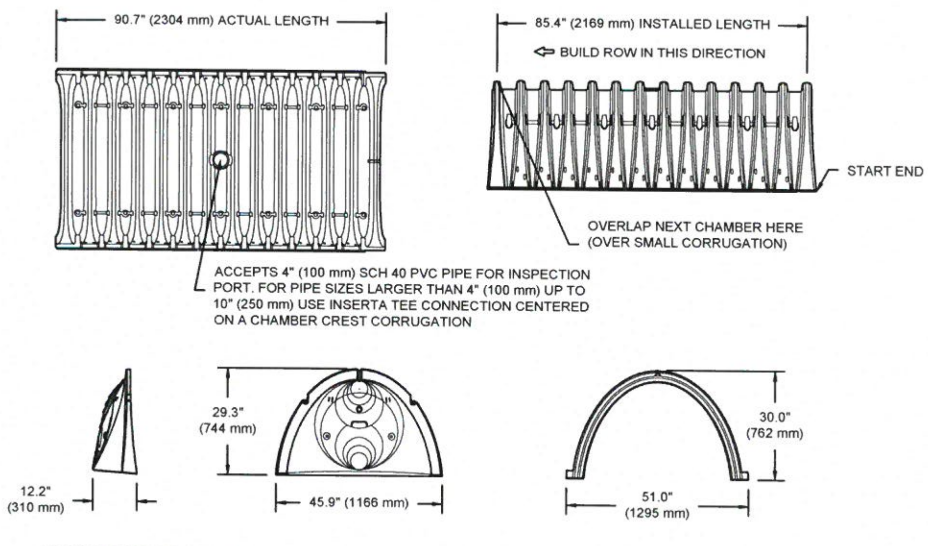


CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)

INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

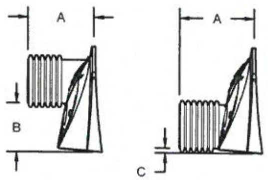
SC-740 TECHNICAL SPECIFICATION
NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Brian Connolly
Site name:	TANK 2:- CAPDOO COMMONS
Site location:	CLANE

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

Site Details

Latitude:	53.29396° N
Longitude:	6.67305° W
Reference:	888794989
Date:	Oct 28 2019 14:35

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 8.9

Methodology

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

SPR estimation method: Calculate from SOIL type

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	821	821
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	19.55	19.55
1 in 1 year (l/s):	16.61	16.61
1 in 30 years (l/s):	41.63	41.63
1 in 100 year (l/s):	51.02	51.02
1 in 200 years (l/s):	55.9	55.9

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 103 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	0.900	0.900	0.0	40.8	40.8	289.6	O K
30 min Winter	1.227	1.227	0.0	44.0	44.0	394.6	O K
60 min Winter	1.500	1.500	0.0	47.9	47.9	482.2	O K
120 min Winter	1.645	1.645	0.0	50.0	50.0	529.1	O K
180 min Winter	1.672	1.672	0.0	50.4	50.4	537.7	O K
240 min Winter	1.653	1.653	0.0	50.1	50.1	531.6	O K
360 min Winter	1.559	1.559	0.0	48.7	48.7	501.3	O K
480 min Winter	1.440	1.440	0.0	47.0	47.0	463.2	O K
600 min Winter	1.318	1.318	0.0	45.3	45.3	423.8	O K
720 min Winter	1.196	1.196	0.0	43.6	43.6	384.8	O K
960 min Winter	0.961	0.961	0.0	41.1	41.1	309.0	O K
1440 min Winter	0.547	0.547	0.0	40.8	40.8	175.8	O K
2160 min Winter	0.322	0.322	0.0	35.5	35.5	103.6	O K
2880 min Winter	0.254	0.254	0.0	29.7	29.7	81.8	O K
4320 min Winter	0.196	0.196	0.0	22.5	22.5	63.0	O K
5760 min Winter	0.166	0.166	0.0	18.4	18.4	53.4	O K
7200 min Winter	0.147	0.147	0.0	15.7	15.7	47.3	O K
8640 min Winter	0.134	0.134	0.0	13.8	13.8	42.9	O K
10080 min Winter	0.123	0.123	0.0	12.3	12.3	39.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	80.247	0.0	328.2	24
30 min Winter	56.084	0.0	458.9	36
60 min Winter	36.915	0.0	604.5	62
120 min Winter	23.512	0.0	770.1	104
180 min Winter	17.903	0.0	879.6	142
240 min Winter	14.722	0.0	964.4	180
360 min Winter	11.142	0.0	1094.8	256
480 min Winter	9.130	0.0	1196.3	330
600 min Winter	7.819	0.0	1280.5	400
720 min Winter	6.886	0.0	1353.3	470
960 min Winter	5.633	0.0	1476.0	604
1440 min Winter	4.243	0.0	1667.6	826
2160 min Winter	3.194	0.0	1883.4	1144
2880 min Winter	2.609	0.0	2050.9	1480
4320 min Winter	1.958	0.0	2309.3	2208
5760 min Winter	1.596	0.0	2510.2	2928
7200 min Winter	1.362	0.0	2677.1	3656
8640 min Winter	1.196	0.0	2821.2	4368
10080 min Winter	1.072	0.0	2948.9	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.264	Longest Storm (mins)	10080
Summer Storms	No	Climate Change %	+20

Time Area Diagram

Total Area (ha) 1.950

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.650	4	8	0.650	8	12	0.650

Model Details

Storage is Online Cover Level (m) 2.500

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.60
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	536.0	536.0	1.800	0.0	695.1
1.700	536.0	695.1			

Hydro-Brake® Outflow Control

Design Head (m) 1.700 Hydro-Brake® Type Md5 SW Only Invert Level (m) 0.000
Design Flow (l/s) 51.0 Diameter (mm) 254

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.1	1.200	43.7	3.000	67.3	7.000	102.7
0.200	23.0	1.400	46.5	3.500	72.6	7.500	106.3
0.300	34.0	1.600	49.3	4.000	77.7	8.000	109.8
0.400	39.0	1.800	52.2	4.500	82.4	8.500	113.2
0.500	40.7	2.000	55.0	5.000	86.8	9.000	116.5
0.600	40.7	2.200	57.6	5.500	91.1	9.500	119.7
0.800	40.3	2.400	60.2	6.000	95.1		
1.000	41.4	2.600	62.6	6.500	99.0		

ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST StormTech

FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

TANK 2 Capdoo & Abbeylands, Clane

STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500 OR APPROVED EQUAL.
2. CHAMBERS SHALL BE MADE FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORT PANELS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
4. 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.
5. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
6. CHAMBERS SHALL BE DESIGNED AND ALLOWABLE LOADS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
7. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. THE CHAMBER MANUFACTURER SHALL SUBMIT THE FOLLOWING UPON REQUEST TO THE SITE DESIGN ENGINEER FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE:
   a. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES 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 AASHTO FOR THERMOPLASTIC PIPE.
   b. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET. THE 50 YEAR CREEP MODULUS DATA SPECIFIED IN ASTM F2418 MUST BE USED AS PART OF THE AASHTO STRUCTURAL EVALUATION TO VERIFY LONG-TERM PERFORMANCE.
   c. STRUCTURAL CROSS SECTION DETAIL ON WHICH THE STRUCTURAL EVALUATION IS BASED.
8. 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 SUBGRADE.
   - 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 - 9" (230 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 3/4-2" (20-50 mm) MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING..
10. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE 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 CONSRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

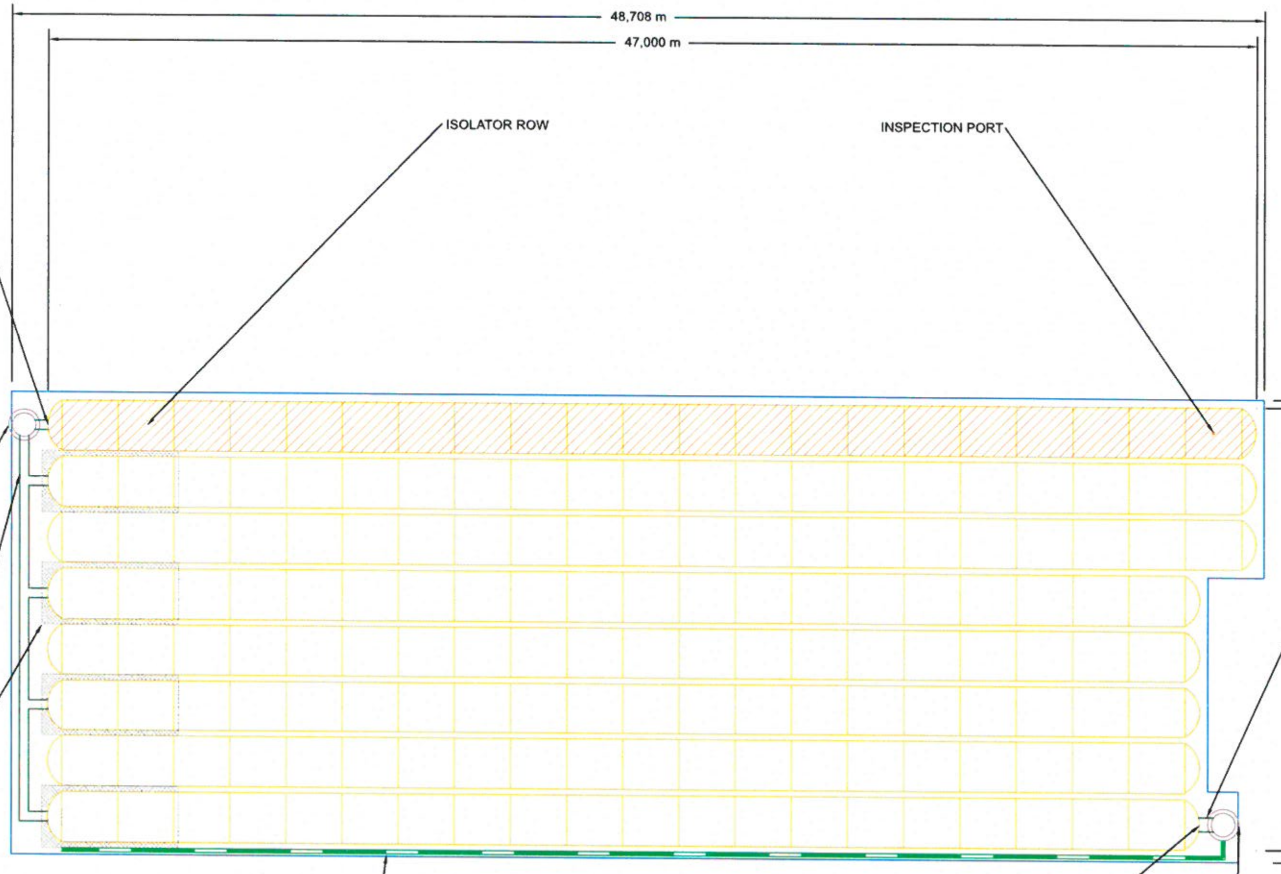
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

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

CONCEPTUAL LAYOUT

(163) STORMTECH MC-3500 CHAMBERS
(16) STORMTECH MC-3500 END CAPS
INSTALLED WITH 305 mm COVER STONE, 229 mm BASE STONE, 40% STONE VOID
INSTALLED SYSTEM VOLUME: 884 m³
AREA OF SYSTEM: 858 m²
PERIMETER OF SYSTEM: 136 m

COMPUTER GENERATED CONCEPTUAL LAYOUT - NOT FOR CONSTRUCTION



TANK 2 Capdoo & Abbeylands, Clane

REV	DRW	CHK	DESCRIPTION

DATE: 09/19/2019 | DRAWN: BA
PROJECT #: Tool | CHECKED: ---

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NOT TO SCALE

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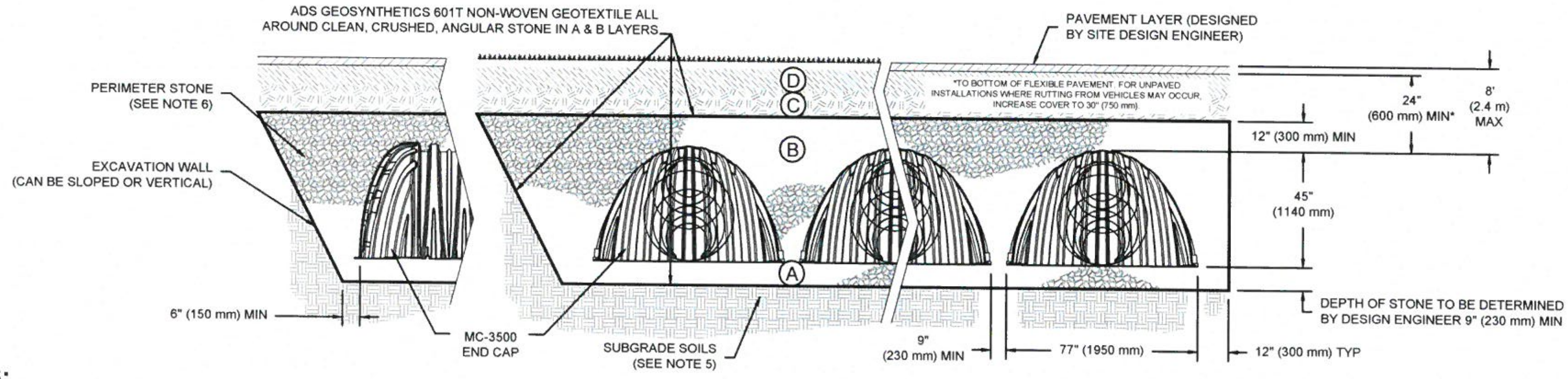
SHEET
2 OF 6

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 SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE 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 SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE 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, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	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.



NOTES:

1. MC-3500 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
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. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE "SITE DESIGN ENGINEER" REFERS TO THE ENGINEER RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE STORMTECH CHAMBERS FOR THIS PROJECT.
5. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
7. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

TANK 2 Capdoo & Abbeylands, Clane

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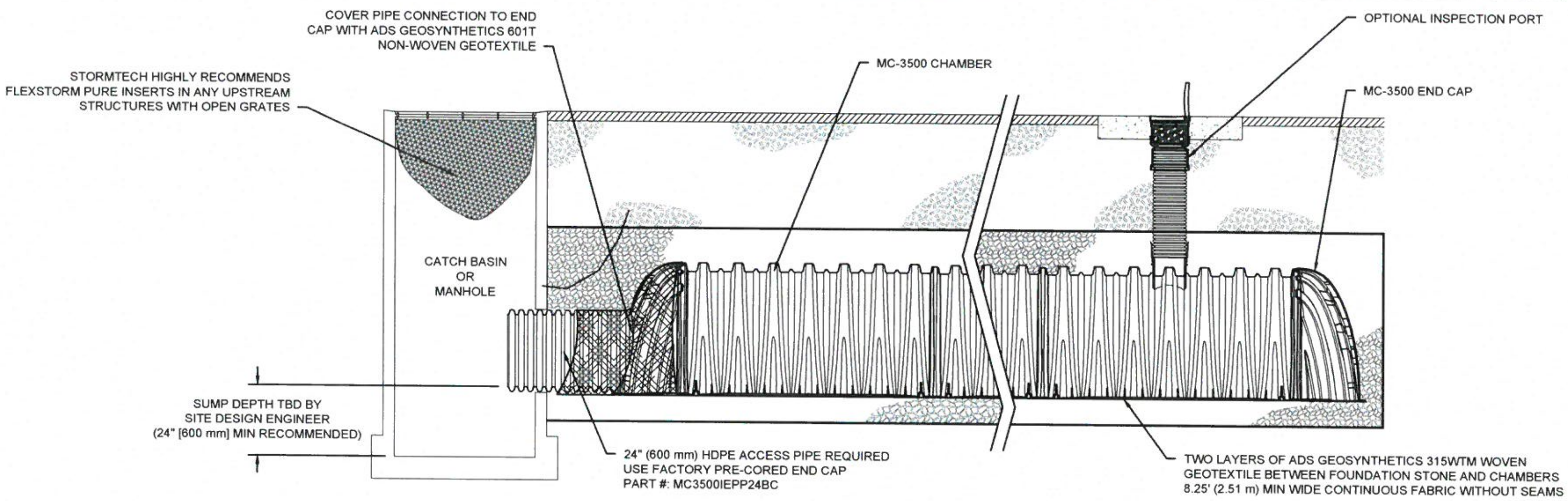


MC-3500 ISOLATOR ROW DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW 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 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 ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW 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.

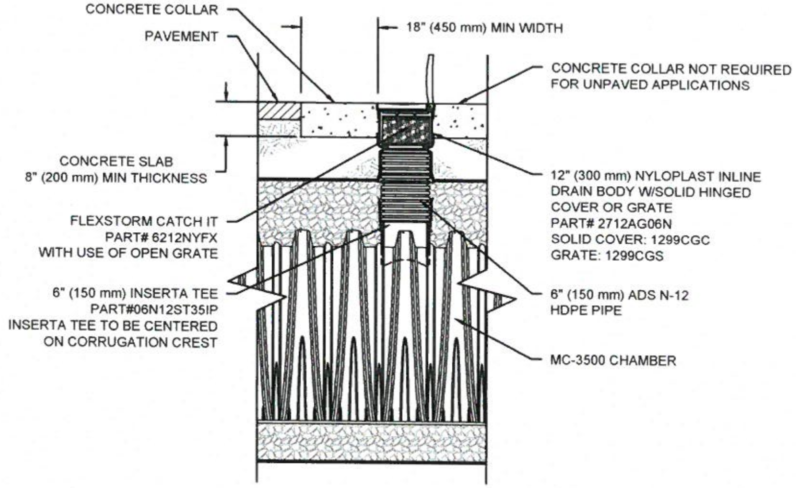
STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

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.



MC-3500 6" INSPECTION PORT DETAIL
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SHEET
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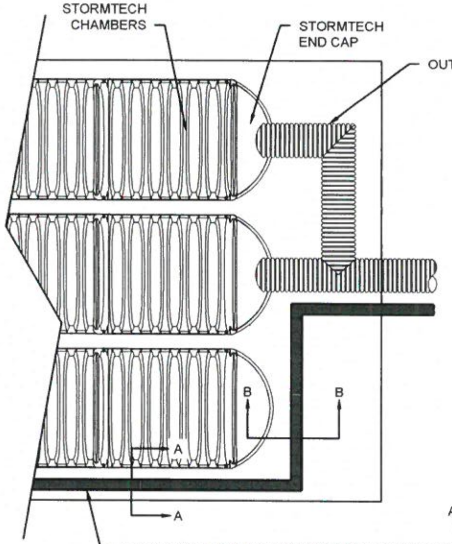
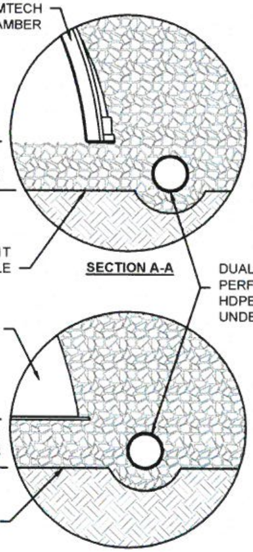
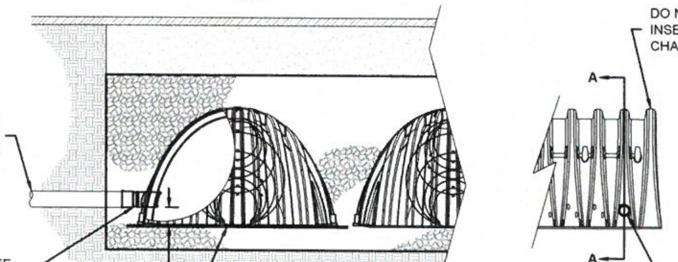
UNDERDRAIN DETAIL
NTS





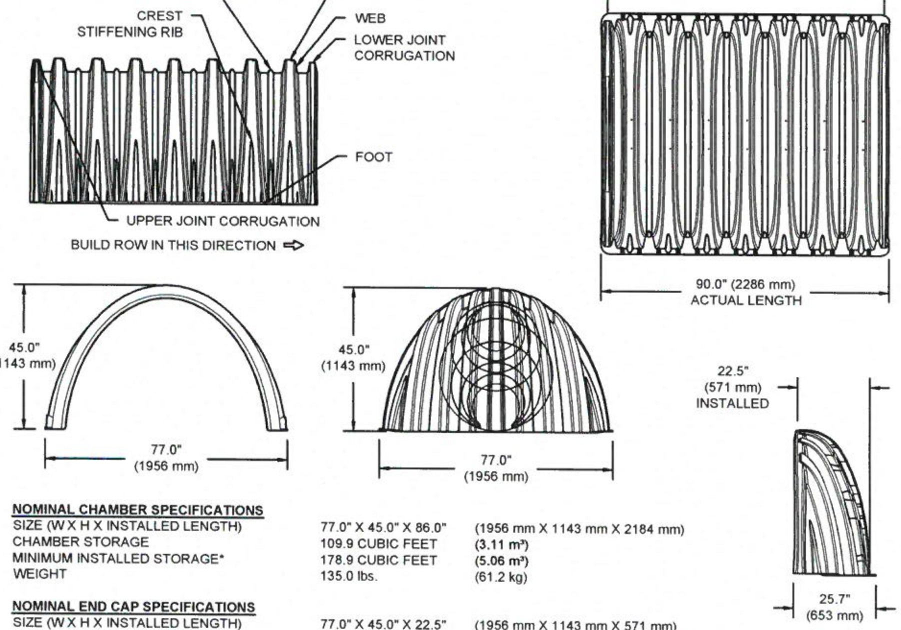
INSERTA TEE DETAIL
NTS



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS.
CONTACT STORMTECH FOR MORE INFORMATION.

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	($3.11\ m^3$)
MINIMUM INSTALLED STORAGE*	178.9 CUBIC FEET	($5.06\ m^3$)
WEIGHT	135.0 lbs.	(61.2 kg)

NOMINAL END CAP SPECIFICATIONS

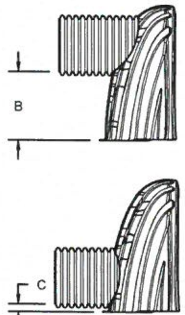
SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 22.5"	(1956 mm X 1143 mm X 571 mm)
END CAP STORAGE	14.9 CUBIC FEET	($0.42\ m^3$)
MINIMUM INSTALLED STORAGE*	46.0 CUBIC FEET	($1.30\ m^3$)
WEIGHT	50.0 lbs.	(22.7 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 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"

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)	---
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP30BC	30" (750 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 HIGHTEST POSSIBLE FOR THE PIPE SIZE.

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MC-SERIES END CAP INSERTION DETAIL

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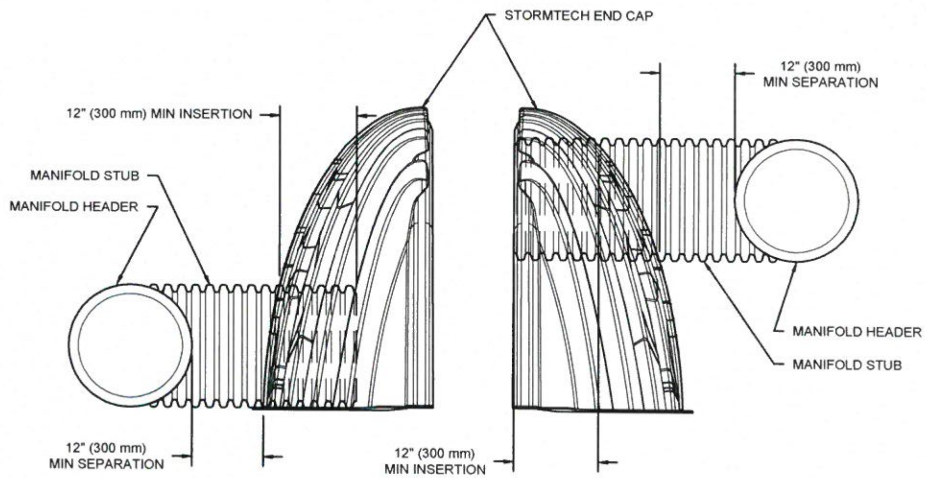

NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

REV	DRW	CHK	DESCRIPTION

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Appendix C

SURFACE WATER CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.100	Add Flow / Climate Change (%)	10
Ratio R	0.317	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm at outfall S (pipe S1.010)

Time (mins)	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**
0-4	0.109	4-8	1.613	8-12	0.947	12-16	0.007

Total Area Contributing (ha) = 2.677

Total Pipe Volume (m³) = 112.302

Time Area Diagram at outfall S (pipe S8.007)

Time (mins)	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**
0-4	0.290	4-8	2.241	8-12	0.335

Total Area Contributing (ha) = 2.866

Total Pipe Volume (m³) = 166.291

Network Design Table for Storm

PN	**Length (m)**	**Fall (m)**	**Slope (1:X)**	**I.Area (ha)**	**T.E. (mins)**	**Base Flow (l/s)**	**k (mm)**	**HYD SECT**	**DIA (mm)**	**Section Type**	**Auto Design**

Network Results Table

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
S1.000	28.500	0.190	150.0	0.212	5.00	0.0	0.600	o	375	Pipe/Conduit
S1.001	36.433	0.112	325.3	0.114	0.00	0.0	0.600	o	375	Pipe/Conduit
S1.002	65.890	0.202	326.2	0.117	0.00	0.0	0.600	o	375	Pipe/Conduit
S2.000	40.856	0.272	150.2	0.143	5.00	0.0	0.600	o	300	Pipe/Conduit
S2.001	64.726	0.259	249.9	0.071	0.00	0.0	0.600	o	300	Pipe/Conduit
S2.002	43.029	0.172	250.2	0.140	0.00	0.0	0.600	o	300	Pipe/Conduit
S1.003	17.762	0.055	322.9	0.047	0.00	0.0	0.600	o	375	Pipe/Conduit
S3.000	28.304	0.189	149.8	0.124	5.00	0.0	0.600	o	225	Pipe/Conduit
S1.004	45.585	0.140	325.6	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit
S1.005	20.047	0.061	328.6	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit
S4.000	53.278	0.171	311.6	0.191	5.00	0.0	0.600	o	375	Pipe/Conduit
S5.000	31.938	0.213	149.9	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
S4.001	73.259	0.234	313.1	0.326	0.00	0.0	0.600	o	375	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	64.990	0.212	0.0	1.48	163.1
S1.001	64.800	0.326	0.0	1.00	110.3
S1.002	64.688	0.443	0.0	1.00	110.2
S2.000	65.189	0.143	0.0	1.28	90.5
S2.001	64.917	0.214	0.0	0.99	70.0
S2.002	64.658	0.354	0.0	0.99	69.9
S1.003	64.486	0.844	0.0	1.00	110.7
S3.000	64.620	0.124	0.0	1.07	42.4
S1.004	64.431	0.968	0.0	1.24	267.5
S1.005	64.291	0.968	0.0	1.23	266.3
S4.000	65.170	0.191	0.0	1.02	112.8
S5.000	65.212	0.000	0.0	1.07	42.4
S4.001	64.999	0.516	0.0	1.02	112.5

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
S6.000	23.734	0.159	149.3	0.110	5.00	0.0	0.600	o	225	Pipe/Conduit
S4.002	66.013	0.211	312.9	0.266	0.00	0.0	0.600	o	450	Pipe/Conduit
S4.003	29.602	0.094	314.9	0.085	0.00	0.0	0.600	o	450	Pipe/Conduit
S7.000	27.506	0.088	312.6	0.205	5.00	0.0	0.600	o	300	Pipe/Conduit
S7.001	38.594	0.123	313.8	0.094	0.00	0.0	0.600	o	300	Pipe/Conduit
S4.004	55.200	0.176	313.6	0.156	0.00	0.0	0.600	o	525	Pipe/Conduit
S4.005	17.086	0.054	316.4	0.081	0.00	0.0	0.600	o	525	Pipe/Conduit
S1.006	9.090	0.032	284.1	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit
S1.007	22.093	0.079	279.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit
S1.008	61.218	0.217	282.1	0.196	0.00	0.0	0.600	o	300	Pipe/Conduit
S1.009	34.483	0.122	282.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
S1.010	38.979	0.138	282.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
S8.000	50.194	0.223	225.0	0.138	5.00	0.0	0.600	o	225	Pipe/Conduit
S8.001	49.106	0.246	200.0	0.202	0.00	0.0	0.600	o	300	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S6.000	64.924	0.110	0.0	1.07	42.5
S4.002	64.765	0.892	0.0	1.14	181.9
S4.003	64.554	0.977	0.0	1.14	181.3
S7.000	64.671	0.205	0.0	0.88	62.5
S7.001	64.583	0.299	0.0	0.88	62.4
S4.004	64.460	1.432	0.0	1.26	272.6
S4.005	64.284	1.512	0.0	1.25	271.4
S1.006	64.230	2.481	0.0	1.44	407.1
S1.007	64.198	2.481	0.0	1.45	410.3
S1.008	64.119	2.677	0.0	0.93	65.8
S1.009	63.902	2.677	0.0	0.93	65.8
S1.010	63.780	2.677	0.0	0.93	65.8
S8.000	65.030	0.138	0.0	0.87	34.5
S8.001	64.732	0.340	0.0	1.11	78.3

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
S8.002	37.876	0.189	200.0	0.138	0.00	0.0	0.600	o	300	Pipe/Conduit
S8.003	48.132	0.241	200.0	0.129	0.00	0.0	0.600	o	375	Pipe/Conduit
S9.000	38.645	0.172	224.7	0.263	5.00	0.0	0.600	o	375	Pipe/Conduit
S9.001	21.854	0.097	225.3	0.076	0.00	0.0	0.600	o	375	Pipe/Conduit
S9.002	39.364	0.175	224.9	0.134	0.00	0.0	0.600	o	375	Pipe/Conduit
S9.003	37.771	0.168	225.0	0.108	0.00	0.0	0.600	o	375	Pipe/Conduit
S9.004	36.289	0.161	225.0	0.100	0.00	0.0	0.600	o	375	Pipe/Conduit
S9.005	46.323	0.485	95.4	0.063	0.00	0.0	0.600	o	375	Pipe/Conduit
S8.004	42.959	0.035	1227.4	0.111	0.00	0.0	0.600	o	675	Pipe/Conduit
S10.000	19.420	0.173	112.3	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
S10.001	32.376	0.288	112.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
S10.002	26.896	0.864	31.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
S11.000	22.936	0.150	152.9	0.367	5.00	0.0	0.600	o	750	Pipe/Conduit
S11.001	16.496	0.040	412.4	0.071	0.00	0.0	0.600	o	750	Pipe/Conduit
S12.000	10.829	0.118	91.8	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S8.002	64.486	0.478	0.0	1.11	78.3
S8.003	64.222	0.607	0.0	1.28	141.1
S9.000	65.240	0.263	0.0	1.20	133.0
S9.001	65.068	0.339	0.0	1.20	132.9
S9.002	64.971	0.473	0.0	1.20	133.0
S9.003	64.796	0.581	0.0	1.20	133.0
S9.004	64.628	0.681	0.0	1.20	133.0
S9.005	64.467	0.744	0.0	1.86	204.9
S8.004	63.681	1.462	0.0	0.74	264.6
S10.000	64.725	0.000	0.0	1.23	49.0
S10.001	64.552	0.000	0.0	1.23	49.0
S10.002	64.264	0.000	0.0	2.35	93.6
S11.000	63.700	0.367	0.0	2.26	998.8
S11.001	63.650	0.438	0.0	1.37	606.0
S12.000	65.790	0.000	0.0	1.37	54.3

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
S12.001	31.140	0.338	92.1	0.135	0.00	0.0	0.600	o	225	Pipe/Conduit
S12.002	23.687	0.255	92.9	0.064	0.00	0.0	0.600	o	225	Pipe/Conduit
S12.003	47.792	0.514	93.0	0.114	0.00	0.0	0.600	o	300	Pipe/Conduit
S12.004	37.931	0.955	39.7	0.046	0.00	0.0	0.600	o	300	Pipe/Conduit
S11.002	76.745	0.160	479.7	0.350	0.00	0.0	0.600	o	750	Pipe/Conduit
S11.003	47.229	0.050	944.6	0.142	0.00	0.0	0.600	o	750	Pipe/Conduit
S10.003	45.348	0.045	1007.7	0.116	0.00	0.0	0.600	o	750	Pipe/Conduit
S8.005	10.015	0.047	213.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit
S8.006	50.597	0.235	215.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
S8.007	15.680	0.073	214.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S12.001	65.672	0.135	0.0	1.36	54.2
S12.002	65.334	0.199	0.0	1.36	54.0
S12.003	65.079	0.313	0.0	1.63	115.3
S12.004	64.565	0.359	0.0	2.50	176.9
S11.002	63.610	1.147	0.0	1.27	561.5
S11.003	63.450	1.288	0.0	0.90	398.6
S10.003	63.400	1.404	0.0	0.87	385.7
S8.005	63.355	2.866	0.0	1.91	845.2
S8.006	63.308	2.866	0.0	1.07	75.5
S8.007	63.073	2.866	0.0	1.07	75.6

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	375	S1	66.475	64.990	1.110	Open Manhole	1350
S1.001	o	375	S2	66.375	64.800	1.200	Open Manhole	1350
S1.002	o	375	S3	66.263	64.688	1.200	Open Manhole	1350
S2.000	o	300	S4	66.689	65.189	1.200	Open Manhole	1200
S2.001	o	300	S5	66.417	64.917	1.200	Open Manhole	1200
S2.002	o	300	S6	66.158	64.658	1.200	Open Manhole	1200
S1.003	o	375	S4	66.061	64.486	1.200	Open Manhole	1350
S3.000	o	225	S5	66.045	64.620	1.200	Open Manhole	1200
S1.004	o	525	S5	66.156	64.431	1.200	Open Manhole	1500
S1.005	o	525	S6	66.450	64.291	1.634	Open Manhole	1500
S4.000	o	375	S11	66.745	65.170	1.200	Open Manhole	1350
S5.000	o	225	S12	66.637	65.212	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	28.500	150.0	S2	66.375	64.800	1.200	Open Manhole	1350
S1.001	36.433	325.3	S3	66.263	64.688	1.200	Open Manhole	1350
S1.002	65.890	326.2	S4	66.061	64.486	1.200	Open Manhole	1350
S2.000	40.856	150.2	S5	66.417	64.917	1.200	Open Manhole	1200
S2.001	64.726	249.9	S6	66.158	64.658	1.200	Open Manhole	1200
S2.002	43.029	250.2	S4	66.061	64.486	1.275	Open Manhole	1350
S1.003	17.762	322.9	S5	66.156	64.431	1.350	Open Manhole	1500
S3.000	28.304	149.8	S5	66.156	64.431	1.500	Open Manhole	1500
S1.004	45.585	325.6	S6	66.450	64.291	1.634	Open Manhole	1500
S1.005	20.047	328.6	S7	66.250	64.230	1.495	Open Manhole	1500
S4.000	53.278	311.6	S12	66.800	64.999	1.426	Open Manhole	1350
S5.000	31.938	149.9	S12	66.800	64.999	1.576	Open Manhole	1350

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S4.001	o	375	S12	66.800	64.999	1.426	Open Manhole	1350
S6.000	o	225	S13	66.950	64.924	1.801	Open Manhole	1200
S4.002	o	450	S13	66.415	64.765	1.200	Open Manhole	1350
S4.003	o	450	S14	66.350	64.554	1.346	Open Manhole	1350
S7.000	o	300	S17	66.096	64.671	1.125	Open Manhole	1200
S7.001	o	300	S18	66.083	64.583	1.200	Open Manhole	1200
S4.004	o	525	S15	66.185	64.460	1.200	Open Manhole	1500
S4.005	o	525	S16	66.250	64.284	1.441	Open Manhole	1500
S1.006	o	600	S7	66.250	64.230	1.420	Open Manhole	1500
S1.007	o	600	S8	66.250	64.198	1.452	Open Manhole	1500
S1.008	o	300	S9	65.544	64.119	1.125	Open Manhole	1500
S1.009	o	300	S10	65.450	63.902	1.248	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S4.001	73.259	313.1	S13	66.415	64.765	1.275	Open Manhole	1350
S6.000	23.734	149.3	S13	66.415	64.765	1.425	Open Manhole	1350
S4.002	66.013	312.9	S14	66.350	64.554	1.346	Open Manhole	1350
S4.003	29.602	314.9	S15	66.185	64.460	1.275	Open Manhole	1500
S7.000	27.506	312.6	S18	66.083	64.583	1.200	Open Manhole	1200
S7.001	38.594	313.8	S15	66.185	64.460	1.425	Open Manhole	1500
S4.004	55.200	313.6	S16	66.250	64.284	1.441	Open Manhole	1500
S4.005	17.086	316.4	S7	66.250	64.230	1.495	Open Manhole	1500
S1.006	9.090	284.1	S8	66.250	64.198	1.452	Open Manhole	1500
S1.007	22.093	279.7	S9	65.544	64.119	0.825	Open Manhole	1500
S1.008	61.218	282.1	S10	65.450	63.902	1.248	Open Manhole	1200
S1.009	34.483	282.6	S11	65.400	63.780	1.320	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.010	o	300	S11	65.400	63.780	1.320	Open Manhole	1200
S8.000	o	225	S23	66.700	65.030	1.445	Open Manhole	1200
S8.001	o	300	S24	66.700	64.732	1.668	Open Manhole	1200
S8.002	o	300	S25	66.800	64.486	2.014	Open Manhole	1200
S8.003	o	375	S26	67.000	64.222	2.403	Open Manhole	1350
S9.000	o	375	S27	66.100	65.240	0.485	Open Manhole	1350
S9.001	o	375	S28	66.450	65.068	1.007	Open Manhole	1350
S9.002	o	375	S29	66.250	64.971	0.904	Open Manhole	1350
S9.003	o	375	S30	66.800	64.796	1.629	Open Manhole	1350
S9.004	o	375	S31	66.800	64.628	1.797	Open Manhole	1350
S9.005	o	375	S32	67.000	64.467	2.158	Open Manhole	1350
S8.004	o	675	S27	67.250	63.681	2.894	Open Manhole	1500
S10.000	o	225	S28	66.150	64.725	1.200	Open Manhole	1200
S10.001	o	225	S29	66.150	64.552	1.373	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.010	38.979	282.5	S	65.400	63.642	1.458	Open Manhole	0
S8.000	50.194	225.0	S24	66.700	64.807	1.668	Open Manhole	1200
S8.001	49.106	200.0	S25	66.800	64.486	2.014	Open Manhole	1200
S8.002	37.876	200.0	S26	67.000	64.297	2.403	Open Manhole	1350
S8.003	48.132	200.0	S27	67.250	63.981	2.894	Open Manhole	1500
S9.000	38.645	224.7	S28	66.450	65.068	1.007	Open Manhole	1350
S9.001	21.854	225.3	S29	66.250	64.971	0.904	Open Manhole	1350
S9.002	39.364	224.9	S30	66.800	64.796	1.629	Open Manhole	1350
S9.003	37.771	225.0	S31	66.800	64.628	1.797	Open Manhole	1350
S9.004	36.289	225.0	S32	67.000	64.467	2.158	Open Manhole	1350
S9.005	46.323	95.4	S27	67.250	63.981	2.894	Open Manhole	1500
S8.004	42.959	1227.4	S28	66.450	63.646	2.129	Open Manhole	1500
S10.000	19.420	112.3	S29	66.150	64.552	1.373	Open Manhole	1200
S10.001	32.376	112.4	S30	66.150	64.264	1.661	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S10.002	o	225	S30	66.150	64.264	1.661	Open Manhole	1200
S11.000	o	750	S35	66.000	63.700	1.550	Open Manhole	1350
S11.001	o	750	S36	66.150	63.650	1.750	Open Manhole	1350
S12.000	o	225	S39	67.200	65.790	1.185	Open Manhole	1200
S12.001	o	225	S40	67.050	65.672	1.153	Open Manhole	1200
S12.002	o	225	S41	66.750	65.334	1.191	Open Manhole	1200
S12.003	o	300	S42	66.500	65.079	1.121	Open Manhole	1200
S12.004	o	300	S43	66.400	64.565	1.535	Open Manhole	1200
S11.002	o	750	S37	66.350	63.610	1.990	Open Manhole	1500
S11.003	o	750	S34	66.000	63.450	1.800	Open Manhole	1500
S10.003	o	750	S31	66.150	63.400	2.000	Open Manhole	1500
S8.005	o	750	S28	66.450	63.355	2.345	Open Manhole	1500
S8.006	o	300	S29	66.450	63.308	2.842	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S10.002	26.896	31.1	S31	66.150	63.400	2.525	Open Manhole	1500
S11.000	22.936	152.9	S36	66.150	63.550	1.850	Open Manhole	1350
S11.001	16.496	412.4	S37	66.350	63.610	1.990	Open Manhole	1500
S12.000	10.829	91.8	S40	67.050	65.672	1.153	Open Manhole	1200
S12.001	31.140	92.1	S41	66.750	65.334	1.191	Open Manhole	1200
S12.002	23.687	92.9	S42	66.500	65.079	1.196	Open Manhole	1200
S12.003	47.792	93.0	S43	66.400	64.565	1.535	Open Manhole	1200
S12.004	37.931	39.7	S37	66.350	63.610	2.440	Open Manhole	1500
S11.002	76.745	479.7	S34	66.000	63.450	1.800	Open Manhole	1500
S11.003	47.229	944.6	S31	66.150	63.400	2.000	Open Manhole	1500
S10.003	45.348	1007.7	S28	66.450	63.355	2.345	Open Manhole	1500
S8.005	10.015	213.1	S29	66.450	63.308	2.392	Open Manhole	1500
S8.006	50.597	215.3	S30	66.150	63.073	2.777	Open Manhole	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S8.007	o	300	S30	66.150	63.073	2.777	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S8.007	15.680	214.8	S	66.150	63.000	2.850	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.010	S	65.400	63.642	0.000	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S8.007	S	66.150	63.000	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Return Period (years) 100

Synthetic Rainfall Details

Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.100	Cv (Winter)	0.840
Ratio R	0.317	Storm Duration (mins)	30
Profile Type	Summer		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S8, DS/PN: S1.007, Volume (m³): 5.8

Unit Reference	MD-SHE-0214-2430-1200-2430
Design Head (m)	1.200
Design Flow (l/s)	24.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	214
Invert Level (m)	64.198
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	24.3	Kick-Flo®	0.842	20.5
Flush-Flo™	0.390	24.2	Mean Flow over Head Range	-	20.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.2	1.200	24.3	3.000	37.7	7.000	56.8
0.200	20.8	1.400	26.1	3.500	40.6	7.500	58.7
0.300	23.9	1.600	27.9	4.000	43.3	8.000	60.6
0.400	24.2	1.800	29.5	4.500	45.8	8.500	62.4
0.500	24.0	2.000	31.0	5.000	48.2	9.000	64.1
0.600	23.6	2.200	32.5	5.500	50.5	9.500	65.8
0.800	21.5	2.400	33.8	6.000	52.7		
1.000	22.3	2.600	35.2	6.500	54.8		

Hydro-Brake® Optimum Manhole: S28, DS/PN: S8.005, Volume (m³): 39.7

Unit Reference	MD-SHE-0294-5100-1200-5100
Design Head (m)	1.200
Design Flow (l/s)	51.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	294
Invert Level (m)	63.355
Minimum Outlet Pipe Diameter (mm)	375

Hydro-Brake® Optimum Manhole: S28, DS/PN: S8.005, Volume (m^3): 39.7

Suggested Manhole Diameter (mm) 1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	51.0	Kick-Flo®	0.900	44.4
Flush-Flo™	0.469	50.8	Mean Flow over Head Range	-	41.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.1	1.200	51.0	3.000	79.4	7.000	119.9
0.200	30.3	1.400	54.9	3.500	85.6	7.500	124.1
0.300	49.0	1.600	58.5	4.000	91.3	8.000	128.0
0.400	50.6	1.800	62.0	4.500	96.7	8.500	131.9
0.500	50.8	2.000	65.2	5.000	101.8	9.000	135.6
0.600	50.3	2.200	68.3	5.500	106.6	9.500	139.3
0.800	47.6	2.400	71.2	6.000	111.2		
1.000	46.7	2.600	74.1	6.500	115.7		

Storage Structures for Storm

Cellular Storage Manhole: S8, DS/PN: S1.007

Invert Level (m) 64.198 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	900.0	0.0	1.300	0.0	0.0
0.100	900.0	0.0	1.400	0.0	0.0
0.200	900.0	0.0	1.500	0.0	0.0
0.300	900.0	0.0	1.600	0.0	0.0
0.400	900.0	0.0	1.700	0.0	0.0
0.500	900.0	0.0	1.800	0.0	0.0
0.600	900.0	0.0	1.900	0.0	0.0
0.700	900.0	0.0	2.000	0.0	0.0
0.800	900.0	0.0	2.100	0.0	0.0
0.900	900.0	0.0	2.200	0.0	0.0
1.000	900.0	0.0	2.300	0.0	0.0
1.100	900.0	0.0	2.400	0.0	0.0
1.200	900.0	0.0	2.500	0.0	0.0

Cellular Storage Manhole: S28, DS/PN: S8.005

Invert Level (m) 63.355 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	900.0	0.0	1.300	0.0	0.0
0.100	900.0	0.0	1.400	0.0	0.0
0.200	900.0	0.0	1.500	0.0	0.0
0.300	900.0	0.0	1.600	0.0	0.0
0.400	900.0	0.0	1.700	0.0	0.0
0.500	900.0	0.0	1.800	0.0	0.0
0.600	900.0	0.0	1.900	0.0	0.0
0.700	900.0	0.0	2.000	0.0	0.0
0.800	900.0	0.0	2.100	0.0	0.0
0.900	900.0	0.0	2.200	0.0	0.0
1.000	900.0	0.0	2.300	0.0	0.0
1.100	900.0	0.0	2.400	0.0	0.0
1.200	900.0	0.0	2.500	0.0	0.0

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 10.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.317
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 17.100 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	2	+0%					65.124
S1.001	S2	15 Winter	2	+0%					65.011
S1.002	S3	15 Winter	2	+0%					64.922
S2.000	S4	15 Winter	2	+0%					65.294
S2.001	S5	15 Winter	2	+0%					65.062
S2.002	S6	15 Winter	2	+0%					64.927
S1.003	S4	15 Winter	2	+0%					64.850
S3.000	S5	30 Winter	2	+0%					64.766
S1.004	S5	15 Winter	2	+0%					64.759
S1.005	S6	15 Winter	2	+0%					64.727
S4.000	S11	15 Winter	2	+0%					65.322
S5.000	S12	15 Winter	2	+0%					65.243
S4.001	S12	15 Winter	2	+0%					65.221
S6.000	S13	15 Winter	2	+0%					65.088
S4.002	S13	15 Winter	2	+0%					65.041
S4.003	S14	15 Winter	2	+0%					64.905

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.241	0.000	0.23		32.6	OK	
S1.001	S2	-0.164	0.000	0.46		45.4	OK	
S1.002	S3	-0.141	0.000	0.52		54.0	OK	
S2.000	S4	-0.195	0.000	0.26		22.1	OK	
S2.001	S5	-0.155	0.000	0.46		30.4	OK	
S2.002	S6	-0.031	0.000	0.63		41.5	OK	
S1.003	S4	-0.011	0.000	1.02		92.8	OK	
S3.000	S5	-0.079	0.000	0.39		15.2	OK	
S1.004	S5	-0.197	0.000	0.41		96.8	OK	
S1.005	S6	-0.089	0.000	0.42		86.5	OK	
S4.000	S11	-0.223	0.000	0.28		28.9	OK	
S5.000	S12	-0.194	0.000	0.00		0.2	OK	
S4.001	S12	-0.153	0.000	0.63		67.0	OK	
S6.000	S13	-0.061	0.000	0.42		16.4	OK	
S4.002	S13	-0.174	0.000	0.63		105.7	OK	
S4.003	S14	-0.099	0.000	0.68		105.3	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S7.000	S17	15 Winter	2	+0%					64.905
S7.001	S18	15 Winter	2	+0%					64.850
S4.004	S15	15 Winter	2	+0%					64.811
S4.005	S16	15 Winter	2	+0%					64.752
S1.006	S7	15 Winter	2	+0%					64.709
S1.007	S8	360 Winter	2	+0%					64.595
S1.008	S9	180 Winter	2	+0%					64.257
S1.009	S10	180 Winter	2	+0%					64.042
S1.010	S11	180 Winter	2	+0%					63.920
S8.000	S23	15 Winter	2	+0%					65.165
S8.001	S24	15 Winter	2	+0%					64.909
S8.002	S25	15 Winter	2	+0%					64.709
S8.003	S26	15 Winter	2	+0%					64.431
S9.000	S27	15 Winter	2	+0%					65.399
S9.001	S28	15 Winter	2	+0%					65.274
S9.002	S29	15 Winter	2	+0%					65.174
S9.003	S30	15 Winter	2	+0%					65.021
S9.004	S31	15 Winter	2	+0%					64.868
S9.005	S32	15 Winter	2	+0%					64.651
S8.004	S27	15 Winter	2	+0%					64.127
S10.000	S28	360 Winter	2	+0%					64.725
S10.001	S29	360 Winter	2	+0%					64.552
S10.002	S30	360 Winter	2	+0%					64.264
S11.000	S35	15 Winter	2	+0%					63.944
S11.001	S36	15 Winter	2	+0%					63.944
S12.000	S39	15 Winter	2	+0%					65.797
S12.001	S40	15 Winter	2	+0%					65.763
S12.002	S41	15 Winter	2	+0%					65.451
S12.003	S42	15 Winter	2	+0%					65.205
S12.004	S43	15 Winter	2	+0%					64.673
S11.002	S37	15 Winter	2	+0%					63.933
S11.003	S34	15 Winter	2	+0%					63.865
S10.003	S31	240 Winter	2	+0%					63.758
S8.005	S28	240 Winter	2	+0%					63.738
S8.006	S29	240 Winter	2	+0%					63.471
S8.007	S30	240 Winter	2	+0%					63.248

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.000	S17	-0.066	0.000	0.54		30.6	OK	
S7.001	S18	-0.033	0.000	0.69		39.7	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.004	S15	-0.174	0.000	0.59		143.9	OK	
S4.005	S16	-0.057	0.000	0.69		140.7	OK	
S1.006	S7	-0.121	0.000	0.91		226.3	OK	
S1.007	S8	-0.203	0.000	0.07		23.6	OK	
S1.008	S9	-0.162	0.000	0.44		27.3	OK	
S1.009	S10	-0.160	0.000	0.45		27.2	OK	
S1.010	S11	-0.160	0.000	0.45		27.3	OK	
S8.000	S23	-0.090	0.000	0.64		21.2	OK	
S8.001	S24	-0.123	0.000	0.63		46.7	OK	
S8.002	S25	-0.077	0.000	0.86		62.5	OK	
S8.003	S26	-0.166	0.000	0.59		76.8	OK	
S9.000	S27	-0.216	0.000	0.33		40.1	OK	
S9.001	S28	-0.169	0.000	0.43		48.6	OK	
S9.002	S29	-0.172	0.000	0.54		64.6	OK	
S9.003	S30	-0.150	0.000	0.64		76.5	OK	
S9.004	S31	-0.135	0.000	0.72		86.0	OK	
S9.005	S32	-0.191	0.000	0.48		91.4	OK	
S8.004	S27	-0.229	0.000	0.77		176.3	OK	
S10.000	S28	-0.225	0.000	0.00		0.0	OK	
S10.001	S29	-0.225	0.000	0.00		0.0	OK	
S10.002	S30	-0.225	0.000	0.00		0.0	OK	
S11.000	S35	-0.506	0.000	0.09		55.4	OK	
S11.001	S36	-0.456	0.000	0.17		62.1	OK	
S12.000	S39	-0.218	0.000	0.00		0.0	OK	
S12.001	S40	-0.134	0.000	0.35		17.7	OK	
S12.002	S41	-0.108	0.000	0.53		26.4	OK	
S12.003	S42	-0.174	0.000	0.38		40.7	OK	
S12.004	S43	-0.192	0.000	0.28		46.3	OK	
S11.002	S37	-0.427	0.000	0.28		141.8	OK	
S11.003	S34	-0.335	0.000	0.40		132.6	OK	
S10.003	S31	-0.392	0.000	0.16		47.8	OK	
S8.005	S28	-0.367	0.000	0.08		40.6	OK	
S8.006	S29	-0.137	0.000	0.57		40.6	OK	
S8.007	S30	-0.125	0.000	0.64		40.6	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.317
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.100	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	30/15 Summer				65.557
S1.001	S2	15 Winter	30	+0%	30/15 Summer				65.512
S1.002	S3	15 Winter	30	+0%	30/15 Summer				65.466
S2.000	S4	15 Winter	30	+0%	30/15 Winter				65.624
S2.001	S5	15 Winter	30	+0%	30/15 Summer				65.562
S2.002	S6	15 Winter	30	+0%	30/15 Summer				65.463
S1.003	S4	15 Winter	30	+0%	30/15 Summer				65.311
S3.000	S5	15 Winter	30	+0%	30/15 Summer				65.236
S1.004	S5	15 Winter	30	+0%	30/15 Summer				65.127
S1.005	S6	15 Winter	30	+0%	30/15 Summer				65.037
S4.000	S11	15 Winter	30	+0%	30/15 Summer				65.891
S5.000	S12	15 Winter	30	+0%	30/15 Summer				65.826
S4.001	S12	15 Winter	30	+0%	30/15 Summer				65.842
S6.000	S13	15 Winter	30	+0%	30/15 Summer				65.738
S4.002	S13	15 Winter	30	+0%	30/15 Summer				65.674
S4.003	S14	15 Winter	30	+0%	30/15 Summer				65.483

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.192	0.000	0.39		56.0	SURCHARGED	
S1.001	S2	0.337	0.000	0.73		72.3	SURCHARGED	
S1.002	S3	0.403	0.000	0.85		88.5	SURCHARGED	
S2.000	S4	0.135	0.000	0.49		41.2	SURCHARGED	
S2.001	S5	0.345	0.000	0.69		45.9	SURCHARGED	
S2.002	S6	0.505	0.000	0.99		64.9	SURCHARGED	
S1.003	S4	0.450	0.000	1.71		155.6	SURCHARGED	
S3.000	S5	0.391	0.000	0.81		32.0	SURCHARGED	
S1.004	S5	0.171	0.000	0.74		174.4	SURCHARGED	
S1.005	S6	0.221	0.000	0.85		175.7	SURCHARGED	
S4.000	S11	0.346	0.000	0.42		44.2	SURCHARGED	
S5.000	S12	0.389	0.000	0.06		2.5	SURCHARGED	
S4.001	S12	0.468	0.000	1.02		108.2	SURCHARGED	
S6.000	S13	0.589	0.000	0.71		27.7	SURCHARGED	
S4.002	S13	0.459	0.000	1.02		172.9	SURCHARGED	
S4.003	S14	0.479	0.000	1.15		179.2	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S7.000	S17	15 Winter	30	+0%	30/15 Summer				65.515
S7.001	S18	15 Winter	30	+0%	30/15 Summer				65.452
S4.004	S15	15 Winter	30	+0%	30/15 Summer				65.327
S4.005	S16	15 Winter	30	+0%	30/15 Summer				65.113
S1.006	S7	15 Winter	30	+0%	30/15 Summer				64.981
S1.007	S8	360 Winter	30	+0%	30/120 Summer				64.967
S1.008	S9	15 Winter	30	+0%					64.331
S1.009	S10	15 Winter	30	+0%					64.122
S1.010	S11	15 Winter	30	+0%					63.974
S8.000	S23	15 Winter	30	+0%	30/15 Summer				65.673
S8.001	S24	15 Winter	30	+0%	30/15 Summer				65.413
S8.002	S25	15 Winter	30	+0%	30/15 Summer				65.110
S8.003	S26	15 Winter	30	+0%	30/15 Summer				64.648
S9.000	S27	15 Winter	30	+0%					65.564
S9.001	S28	15 Winter	30	+0%	30/15 Summer				65.498
S9.002	S29	15 Winter	30	+0%	30/15 Summer				65.444
S9.003	S30	15 Winter	30	+0%	30/15 Summer				65.272
S9.004	S31	15 Winter	30	+0%	30/15 Summer				65.081
S9.005	S32	15 Winter	30	+0%					64.739
S8.004	S27	15 Winter	30	+0%					64.340
S10.000	S28	360 Winter	30	+0%					64.725
S10.001	S29	360 Winter	30	+0%					64.552
S10.002	S30	360 Winter	30	+0%					64.264
S11.000	S35	15 Winter	30	+0%					64.137
S11.001	S36	15 Winter	30	+0%					64.194
S12.000	S39	15 Winter	30	+0%					65.826
S12.001	S40	15 Winter	30	+0%					65.878
S12.002	S41	15 Winter	30	+0%	30/15 Summer				65.673
S12.003	S42	15 Winter	30	+0%					65.291
S12.004	S43	15 Winter	30	+0%					64.740
S11.002	S37	15 Winter	30	+0%					64.171
S11.003	S34	15 Winter	30	+0%					64.102
S10.003	S31	240 Winter	30	+0%					64.080
S8.005	S28	240 Winter	30	+0%					64.079
S8.006	S29	120 Winter	30	+0%					63.497
S8.007	S30	600 Winter	30	+0%					63.276

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.000	S17	0.544	0.000	0.89		50.2	SURCHARGED	
S7.001	S18	0.569	0.000	1.25		72.4	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.004	S15	0.342	0.000	1.05		258.1	SURCHARGED	
S4.005	S16	0.304	0.000	1.31		269.4	SURCHARGED	
S1.006	S7	0.151	0.000	1.75		434.8	SURCHARGED	
S1.007	S8	0.169	0.000	0.08		24.0	SURCHARGED	
S1.008	S9	-0.088	0.000	0.78		49.0	OK	
S1.009	S10	-0.080	0.000	0.75		45.3	OK	
S1.010	S11	-0.106	0.000	0.74		45.0	OK	
S8.000	S23	0.418	0.000	1.07		35.5	SURCHARGED	
S8.001	S24	0.381	0.000	1.10		81.1	SURCHARGED	
S8.002	S25	0.323	0.000	1.56		113.0	SURCHARGED	
S8.003	S26	0.051	0.000	1.04		135.5	SURCHARGED	
S9.000	S27	-0.051	0.000	0.58		70.1	OK	
S9.001	S28	0.055	0.000	0.71		80.2	SURCHARGED	
S9.002	S29	0.098	0.000	0.88		106.6	SURCHARGED	
S9.003	S30	0.101	0.000	1.06		127.3	SURCHARGED	
S9.004	S31	0.078	0.000	1.22		146.6	SURCHARGED	
S9.005	S32	-0.103	0.000	0.83		155.9	OK	
S8.004	S27	-0.016	0.000	1.34		308.3	OK	
S10.000	S28	-0.225	0.000	0.00		0.0	OK	
S10.001	S29	-0.225	0.000	0.00		0.0	OK	
S10.002	S30	-0.225	0.000	0.00		0.0	OK	
S11.000	S35	-0.313	0.000	0.17		104.0	OK	
S11.001	S36	-0.206	0.000	0.31		113.8	OK	
S12.000	S39	-0.189	0.000	0.00		0.2	OK	
S12.001	S40	-0.019	0.000	0.77		39.3	OK	
S12.002	S41	0.114	0.000	1.15		56.8	SURCHARGED	
S12.003	S42	-0.088	0.000	0.82		88.9	OK	
S12.004	S43	-0.125	0.000	0.62		101.4	OK	
S11.002	S37	-0.189	0.000	0.58		291.2	OK	
S11.003	S34	-0.098	0.000	0.81		271.0	OK	
S10.003	S31	-0.070	0.000	0.28		85.7	OK	
S8.005	S28	-0.026	0.000	0.10		50.1	OK	
S8.006	S29	-0.111	0.000	0.70		50.1	OK	
S8.007	S30	-0.097	0.000	0.79		50.6	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.317
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.100	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+0%	100/15 Summer				65.988
S1.001	S2	15 Winter	100	+0%	100/15 Summer				65.923
S1.002	S3	15 Winter	100	+0%	100/15 Summer				65.813
S2.000	S4	15 Winter	100	+0%	100/15 Summer				66.122
S2.001	S5	15 Winter	100	+0%	100/15 Summer				66.035
S2.002	S6	15 Winter	100	+0%	100/15 Summer				65.856
S1.003	S4	15 Winter	100	+0%	100/15 Summer				65.600
S3.000	S5	15 Winter	100	+0%	100/15 Summer				65.480
S1.004	S5	15 Winter	100	+0%	100/15 Summer				65.348
S1.005	S6	360 Winter	100	+0%	100/15 Summer				65.246
S4.000	S11	15 Winter	100	+0%	100/15 Summer				66.575
S5.000	S12	15 Winter	100	+0%	100/15 Summer				66.485
S4.001	S12	15 Winter	100	+0%	100/15 Summer				66.497
S6.000	S13	15 Winter	100	+0%	100/15 Summer				66.323
S4.002	S13	15 Winter	100	+0%	100/15 Summer				66.183
S4.003	S14	15 Winter	100	+0%	100/15 Summer				65.851

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.623	0.000	0.43		62.3	SURCHARGED	
S1.001	S2	0.748	0.000	0.83		82.3	SURCHARGED	
S1.002	S3	0.750	0.000	1.03		106.7	SURCHARGED	
S2.000	S4	0.633	0.000	0.55		46.1	SURCHARGED	
S2.001	S5	0.818	0.000	0.76		50.7	SURCHARGED	
S2.002	S6	0.898	0.000	1.24		80.8	SURCHARGED	
S1.003	S4	0.739	0.000	2.13		194.6	SURCHARGED	
S3.000	S5	0.635	0.000	1.00		39.3	SURCHARGED	
S1.004	S5	0.392	0.000	0.96		226.7	SURCHARGED	
S1.005	S6	0.430	0.000	0.26		54.5	SURCHARGED	
S4.000	S11	1.030	0.000	0.49		51.3	FLOOD RISK	
S5.000	S12	1.048	0.000	0.11		4.4	FLOOD RISK	
S4.001	S12	1.123	0.000	1.17		124.4	SURCHARGED	
S6.000	S13	1.174	0.000	0.78		30.6	SURCHARGED	
S4.002	S13	0.968	0.000	1.24		209.8	FLOOD RISK	
S4.003	S14	0.847	0.000	1.46		227.3	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S7.000	S17	15 Winter	100	+0%	100/15 Summer				65.977
S7.001	S18	15 Winter	100	+0%	100/15 Summer				65.864
S4.004	S15	15 Winter	100	+0%	100/15 Summer				65.642
S4.005	S16	15 Winter	100	+0%	100/15 Summer				65.309
S1.006	S7	360 Winter	100	+0%	100/15 Summer				65.262
S1.007	S8	360 Winter	100	+0%	100/30 Winter				65.266
S1.008	S9	15 Winter	100	+0%					64.395
S1.009	S10	15 Winter	100	+0%					64.168
S1.010	S11	15 Winter	100	+0%					64.008
S8.000	S23	15 Winter	100	+0%	100/15 Summer				66.342
S8.001	S24	15 Winter	100	+0%	100/15 Summer				66.000
S8.002	S25	15 Winter	100	+0%	100/15 Summer				65.559
S8.003	S26	15 Winter	100	+0%	100/15 Summer				64.854
S9.000	S27	15 Winter	100	+0%	100/15 Summer				65.991
S9.001	S28	15 Winter	100	+0%	100/15 Summer				65.878
S9.002	S29	15 Winter	100	+0%	100/15 Summer				65.787
S9.003	S30	15 Winter	100	+0%	100/15 Summer				65.578
S9.004	S31	15 Winter	100	+0%	100/15 Summer				65.288
S9.005	S32	15 Winter	100	+0%	100/15 Summer				64.932
S8.004	S27	15 Winter	100	+0%	100/15 Summer				64.389
S10.000	S28	360 Winter	100	+0%					64.725
S10.001	S29	360 Winter	100	+0%					64.552
S10.002	S30	240 Winter	100	+0%					64.300
S11.000	S35	15 Winter	100	+0%					64.288
S11.001	S36	15 Winter	100	+0%					64.316
S12.000	S39	15 Winter	100	+0%	100/15 Summer				66.117
S12.001	S40	15 Winter	100	+0%	100/15 Summer				66.136
S12.002	S41	15 Winter	100	+0%	100/15 Summer				65.846
S12.003	S42	15 Winter	100	+0%					65.354
S12.004	S43	15 Winter	100	+0%					64.788
S11.002	S37	240 Winter	100	+0%					64.310
S11.003	S34	240 Winter	100	+0%	100/15 Winter				64.342
S10.003	S31	240 Winter	100	+0%	100/60 Winter				64.354
S8.005	S28	240 Winter	100	+0%	100/60 Winter				64.363
S8.006	S29	120 Winter	100	+0%					63.497
S8.007	S30	600 Winter	100	+0%					63.276

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.000	S17	1.006	0.000	1.05		59.0	FLOOD RISK	
S7.001	S18	0.981	0.000	1.43		82.8	FLOOD RISK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.004	S15	0.657	0.000	1.35		332.7	SURCHARGED	
S4.005	S16	0.500	0.000	1.69		347.3	SURCHARGED	
S1.006	S7	0.432	0.000	0.57		141.7	SURCHARGED	
S1.007	S8	0.468	0.000	0.08		24.0	SURCHARGED	
S1.008	S9	-0.024	0.000	0.93		58.4	OK	
S1.009	S10	-0.034	0.000	0.91		55.0	OK	
S1.010	S11	-0.072	0.000	0.87		53.3	OK	
S8.000	S23	1.087	0.000	1.34		44.2	SURCHARGED	
S8.001	S24	0.968	0.000	1.31		96.8	SURCHARGED	
S8.002	S25	0.773	0.000	1.90		137.6	SURCHARGED	
S8.003	S26	0.257	0.000	1.34		174.8	SURCHARGED	
S9.000	S27	0.376	0.000	0.66		79.4	FLOOD RISK	
S9.001	S28	0.435	0.000	0.85		96.3	SURCHARGED	
S9.002	S29	0.441	0.000	1.06		128.1	SURCHARGED	
S9.003	S30	0.407	0.000	1.29		155.6	SURCHARGED	
S9.004	S31	0.285	0.000	1.53		183.4	SURCHARGED	
S9.005	S32	0.090	0.000	1.03		193.3	SURCHARGED	
S8.004	S27	0.033	0.000	1.67		384.1	SURCHARGED	
S10.000	S28	-0.225	0.000	0.00		0.0	OK	
S10.001	S29	-0.225	0.000	0.00		0.0	OK	
S10.002	S30	-0.189	0.000	0.00		0.0	OK	
S11.000	S35	-0.162	0.000	0.22		130.5	OK	
S11.001	S36	-0.084	0.000	0.39		142.4	OK	
S12.000	S39	0.102	0.000	0.07		3.1	SURCHARGED	
S12.001	S40	0.239	0.000	0.90		45.6	SURCHARGED	
S12.002	S41	0.287	0.000	1.36		67.2	SURCHARGED	
S12.003	S42	-0.025	0.000	0.98		106.6	OK	
S12.004	S43	-0.077	0.000	0.74		120.3	OK	
S11.002	S37	-0.050	0.000	0.19		95.8	OK	
S11.003	S34	0.142	0.000	0.30		100.6	SURCHARGED	
S10.003	S31	0.204	0.000	0.34		105.9	SURCHARGED	
S8.005	S28	0.258	0.000	0.10		50.1	SURCHARGED	
S8.006	S29	-0.111	0.000	0.70		50.1	OK	
S8.007	S30	-0.097	0.000	0.80		50.7	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 10.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.317
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 17.100 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+0%	30/15 Summer				65.988
S1.001	S2	15 Winter	100	+0%	30/15 Summer				65.923
S1.002	S3	15 Winter	100	+0%	30/15 Summer				65.813
S2.000	S4	15 Winter	100	+0%	30/15 Winter				66.122
S2.001	S5	15 Winter	100	+0%	30/15 Summer				66.035
S2.002	S6	15 Winter	100	+0%	30/15 Summer				65.856
S1.003	S4	15 Winter	100	+0%	30/15 Summer				65.600
S3.000	S5	15 Winter	100	+0%	30/15 Summer				65.480
S1.004	S5	15 Winter	100	+0%	30/15 Summer				65.348
S1.005	S6	360 Winter	100	+0%	30/15 Summer				65.246
S4.000	S11	15 Winter	100	+0%	30/15 Summer				66.575
S5.000	S12	15 Winter	100	+0%	30/15 Summer				66.485
S4.001	S12	15 Winter	100	+0%	30/15 Summer				66.497
S6.000	S13	15 Winter	100	+0%	30/15 Summer				66.323
S4.002	S13	15 Winter	100	+0%	30/15 Summer				66.183
S4.003	S14	15 Winter	100	+0%	30/15 Summer				65.851

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.623	0.000	0.43		62.3	SURCHARGED	
S1.001	S2	0.748	0.000	0.83		82.3	SURCHARGED	
S1.002	S3	0.750	0.000	1.03		106.7	SURCHARGED	
S2.000	S4	0.633	0.000	0.55		46.1	SURCHARGED	
S2.001	S5	0.818	0.000	0.76		50.7	SURCHARGED	
S2.002	S6	0.898	0.000	1.24		80.8	SURCHARGED	
S1.003	S4	0.739	0.000	2.13		194.6	SURCHARGED	
S3.000	S5	0.635	0.000	1.00		39.3	SURCHARGED	
S1.004	S5	0.392	0.000	0.96		226.7	SURCHARGED	
S1.005	S6	0.430	0.000	0.26		54.5	SURCHARGED	
S4.000	S11	1.030	0.000	0.49		51.3	FLOOD RISK	
S5.000	S12	1.048	0.000	0.11		4.4	FLOOD RISK	
S4.001	S12	1.123	0.000	1.17		124.4	SURCHARGED	
S6.000	S13	1.174	0.000	0.78		30.6	SURCHARGED	
S4.002	S13	0.968	0.000	1.24		209.8	FLOOD RISK	
S4.003	S14	0.847	0.000	1.46		227.3	SURCHARGED	

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

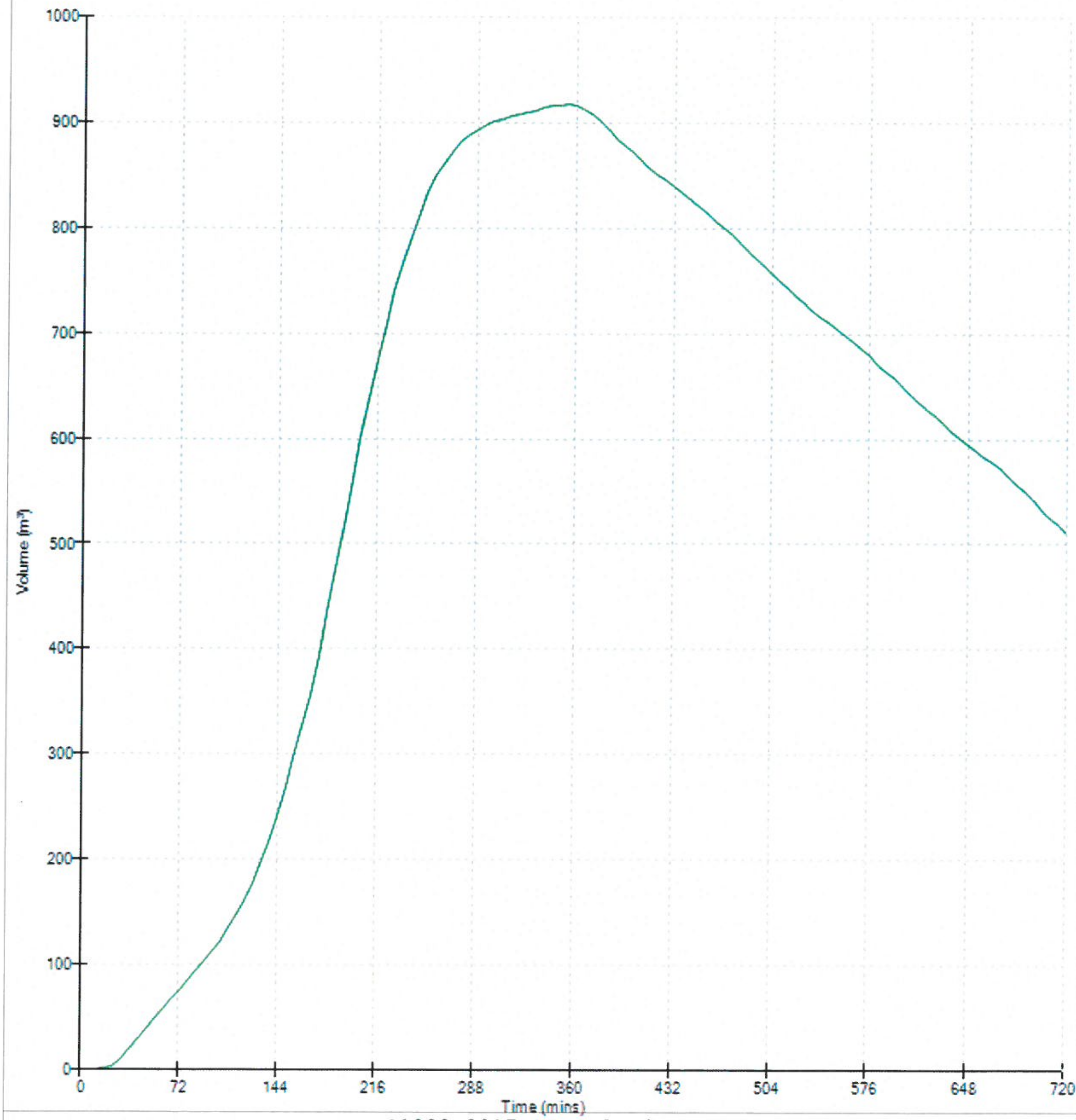
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S7.000	S17	15 Winter	100	+0%	30/15 Summer				65.977
S7.001	S18	15 Winter	100	+0%	30/15 Summer				65.864
S4.004	S15	15 Winter	100	+0%	30/15 Summer				65.642
S4.005	S16	15 Winter	100	+0%	30/15 Summer				65.309
S1.006	S7	360 Winter	100	+0%	30/15 Summer				65.262
S1.007	S8	360 Winter	100	+0%	30/120 Summer				65.266
S1.008	S9	15 Winter	100	+0%					64.395
S1.009	S10	15 Winter	100	+0%					64.168
S1.010	S11	15 Winter	100	+0%					64.008
S8.000	S23	15 Winter	100	+0%	30/15 Summer				66.342
S8.001	S24	15 Winter	100	+0%	30/15 Summer				66.000
S8.002	S25	15 Winter	100	+0%	30/15 Summer				65.559
S8.003	S26	15 Winter	100	+0%	30/15 Summer				64.854
S9.000	S27	15 Winter	100	+0%	100/15 Summer				65.991
S9.001	S28	15 Winter	100	+0%	30/15 Summer				65.878
S9.002	S29	15 Winter	100	+0%	30/15 Summer				65.787
S9.003	S30	15 Winter	100	+0%	30/15 Summer				65.578
S9.004	S31	15 Winter	100	+0%	30/15 Summer				65.288
S9.005	S32	15 Winter	100	+0%	100/15 Summer				64.932
S8.004	S27	15 Winter	100	+0%	100/15 Summer				64.389
S10.000	S28	10080 Winter	2	+0%					64.725
S10.001	S29	10080 Winter	2	+0%					64.552
S10.002	S30	240 Winter	100	+0%					64.300
S11.000	S35	15 Winter	100	+0%					64.288
S11.001	S36	15 Winter	100	+0%					64.316
S12.000	S39	15 Winter	100	+0%	100/15 Summer				66.117
S12.001	S40	15 Winter	100	+0%	100/15 Summer				66.136
S12.002	S41	15 Winter	100	+0%	30/15 Summer				65.846
S12.003	S42	15 Winter	100	+0%					65.354
S12.004	S43	15 Winter	100	+0%					64.788
S11.002	S37	240 Winter	100	+0%					64.310
S11.003	S34	240 Winter	100	+0%	100/15 Winter				64.342
S10.003	S31	240 Winter	100	+0%	100/60 Winter				64.354
S8.005	S28	240 Winter	100	+0%	100/60 Winter				64.363
S8.006	S29	120 Winter	100	+0%					63.497
S8.007	S30	600 Winter	100	+0%					63.276

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.000	S17	1.006	0.000	1.05		59.0	FLOOD RISK	
S7.001	S18	0.981	0.000	1.43		82.8	FLOOD RISK	

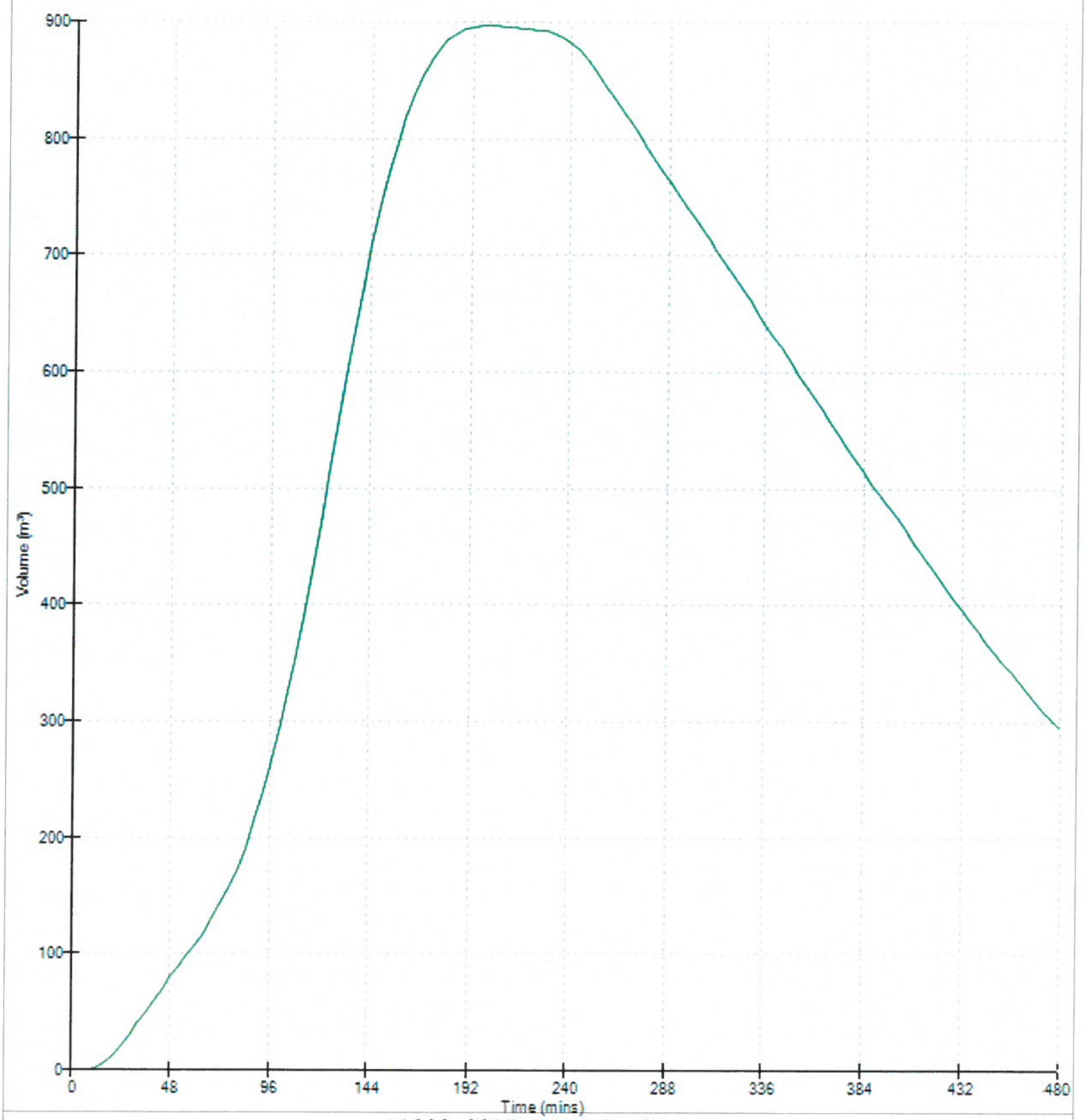
Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.004	S15	0.657	0.000	1.35		332.7	SURCHARGED	
S4.005	S16	0.500	0.000	1.69		347.3	SURCHARGED	
S1.006	S7	0.432	0.000	0.57		141.7	SURCHARGED	
S1.007	S8	0.468	0.000	0.08		24.0	SURCHARGED	
S1.008	S9	-0.024	0.000	0.93		58.4	OK	
S1.009	S10	-0.034	0.000	0.91		55.0	OK	
S1.010	S11	-0.072	0.000	0.87		53.3	OK	
S8.000	S23	1.087	0.000	1.34		44.2	SURCHARGED	
S8.001	S24	0.968	0.000	1.31		96.8	SURCHARGED	
S8.002	S25	0.773	0.000	1.90		137.6	SURCHARGED	
S8.003	S26	0.257	0.000	1.34		174.8	SURCHARGED	
S9.000	S27	0.376	0.000	0.66		79.4	FLOOD RISK	
S9.001	S28	0.435	0.000	0.85		96.3	SURCHARGED	
S9.002	S29	0.441	0.000	1.06		128.1	SURCHARGED	
S9.003	S30	0.407	0.000	1.29		155.6	SURCHARGED	
S9.004	S31	0.285	0.000	1.53		183.4	SURCHARGED	
S9.005	S32	0.090	0.000	1.03		193.3	SURCHARGED	
S8.004	S27	0.033	0.000	1.67		384.1	SURCHARGED	
S10.000	S28	-0.225	0.000	0.00		0.0	OK	
S10.001	S29	-0.225	0.000	0.00		0.0	OK	
S10.002	S30	-0.189	0.000	0.00		0.0	OK	
S11.000	S35	-0.162	0.000	0.22		130.5	OK	
S11.001	S36	-0.084	0.000	0.39		142.4	OK	
S12.000	S39	0.102	0.000	0.07		3.1	SURCHARGED	
S12.001	S40	0.239	0.000	0.90		45.6	SURCHARGED	
S12.002	S41	0.287	0.000	1.36		67.2	SURCHARGED	
S12.003	S42	-0.025	0.000	0.98		106.6	OK	
S12.004	S43	-0.077	0.000	0.74		120.3	OK	
S11.002	S37	-0.050	0.000	0.19		95.8	OK	
S11.003	S34	0.142	0.000	0.30		100.6	SURCHARGED	
S10.003	S31	0.204	0.000	0.34		105.9	SURCHARGED	
S8.005	S28	0.258	0.000	0.10		50.1	SURCHARGED	
S8.006	S29	-0.111	0.000	0.70		50.1	OK	
S8.007	S30	-0.097	0.000	0.80		50.7	OK	

Graphs for Pipe S1.007 US/MH S8 (Storm)
360 minute 100 year Winter I+0%
Status: SURCHARGED



Graphs for Pipe S8.005 US/MH S28 (Storm)
240 minute 100 year Winter I+0%
Status: SURCHARGED



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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 10.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.317
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 17.100 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15
Return Period(s) (years) 100
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+0%	100/15 Winter				65.137
S1.001	S2	15 Winter	100	+0%	100/15 Summer				65.066
S1.002	S3	15 Winter	100	+0%	100/15 Summer				64.964
S2.000	S4	15 Winter	100	+0%	100/15 Summer				65.268
S2.001	S5	15 Winter	100	+0%	100/15 Summer				65.189
S2.002	S6	15 Winter	100	+0%	100/15 Summer				65.040
S1.003	S4	15 Winter	100	+0%	100/15 Summer				64.773
S3.000	S5	15 Winter	100	+0%	100/15 Summer				64.588
S1.004	S5	15 Winter	100	+0%	100/15 Summer				64.501
S1.005	S6	15 Winter	100	+0%	100/15 Summer				64.357
S4.000	S11	15 Winter	100	+0%	100/15 Summer				66.251
S5.000	S12	15 Winter	100	+0%	100/15 Summer				66.160
S4.001	S12	15 Winter	100	+0%	100/15 Summer				66.170
S6.000	S13	15 Winter	100	+0%	100/15 Summer				65.956
S4.002	S13	15 Winter	100	+0%	100/15 Summer				65.823
S4.003	S14	15 Winter	100	+0%	100/15 Summer				65.434
S7.000	S17	15 Winter	100	+0%	100/15 Summer				65.746
S7.001	S18	15 Winter	100	+0%	100/15 Summer				65.415

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.162	0.000	0.50		72.0	SURCHARGED	
S1.001	S2	0.281	0.000	0.83		99.0	SURCHARGED	
S1.002	S3	0.340	0.000	1.01		126.4	SURCHARGED	
S2.000	S4	0.278	0.000	0.83		47.7	SURCHARGED	
S2.001	S5	0.327	0.000	1.06		62.1	SURCHARGED	
S2.002	S6	0.378	0.000	0.94		85.4	SURCHARGED	
S1.003	S4	0.443	0.000	1.12		210.0	SURCHARGED	
S3.000	S5	0.203	0.000	0.91		44.0	SURCHARGED	
S1.004	S5	0.400	0.000	1.22		231.0	SURCHARGED	
S1.005	S6	0.346	0.000	1.07		232.1	SURCHARGED	
S4.000	S11	0.365	0.000	0.37		56.7	FLOOD RISK	
S5.000	S12	0.519	0.000	0.10		3.4	FLOOD RISK	
S4.001	S12	0.671	0.000	1.25		135.8	SURCHARGED	
S6.000	S13	0.181	0.000	0.67		40.3	SURCHARGED	
S4.002	S13	0.568	0.000	1.45		231.3	SURCHARGED	
S4.003	S14	0.368	0.000	0.90		250.8	SURCHARGED	
S7.000	S17	0.687	0.000	1.82		58.2	FLOOD RISK	
S7.001	S18	0.478	0.000	1.23		84.1	FLOOD RISK	

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

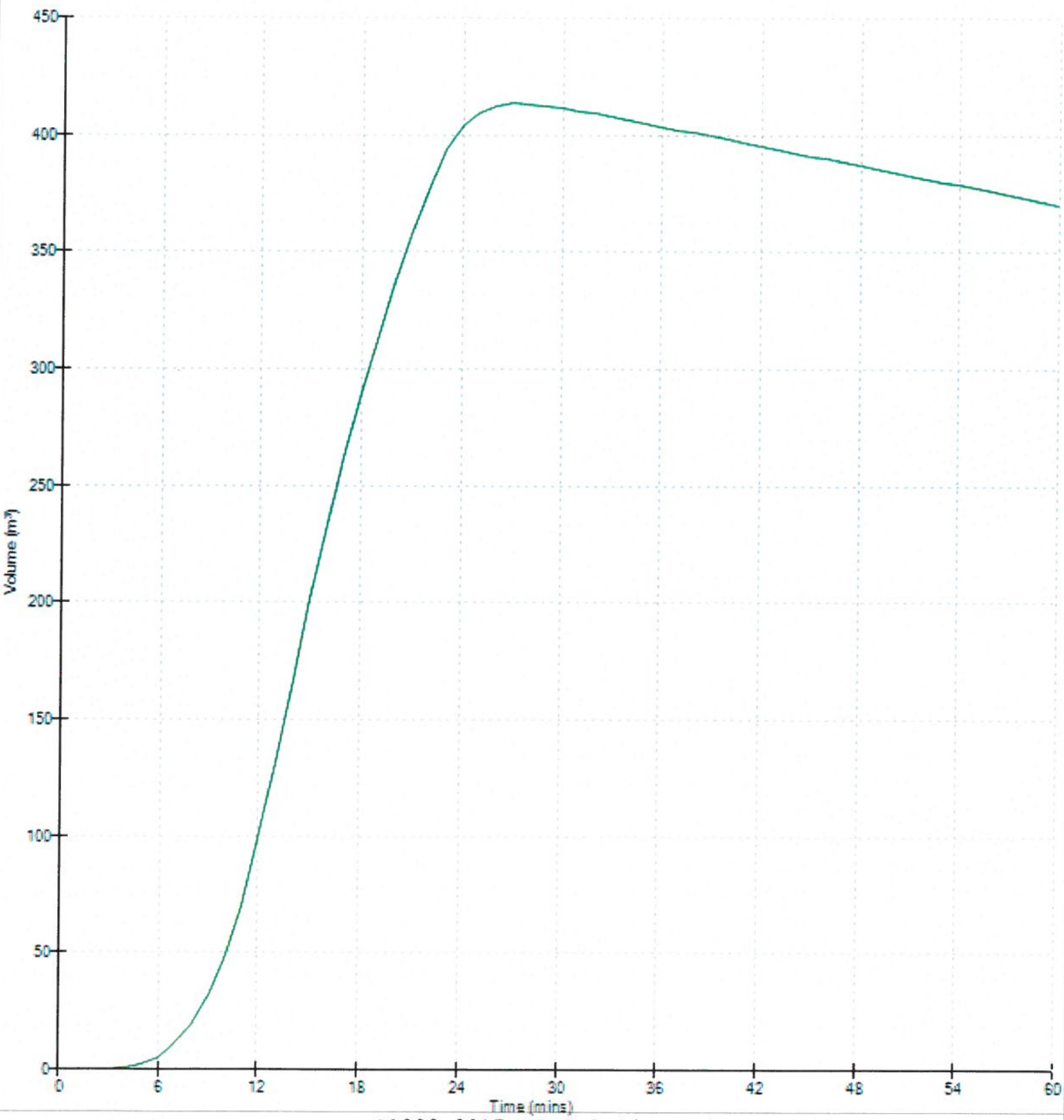
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.004	S15	15 Winter	100	+0%	100/15 Summer				65.192
S4.005	S16	15 Winter	100	+0%	100/15 Summer				64.796
S1.006	S7	15 Winter	100	+0%	100/15 Summer				64.246
S1.007	S8	15 Winter	100	+0%					63.785
S1.008	S9	15 Winter	100	+0%					63.379
S1.009	S10	15 Winter	100	+0%					63.118
S1.010	S11	15 Winter	100	+0%					62.957
S8.000	S23	15 Winter	100	+0%	100/15 Summer				66.342
S8.001	S24	15 Winter	100	+0%	100/15 Summer				66.000
S8.002	S25	15 Winter	100	+0%	100/15 Summer				65.559
S8.003	S26	15 Winter	100	+0%	100/15 Summer				64.854
S9.000	S27	15 Winter	100	+0%	100/15 Summer				65.991
S9.001	S28	15 Winter	100	+0%	100/15 Summer				65.878
S9.002	S29	15 Winter	100	+0%	100/15 Summer				65.787
S9.003	S30	15 Winter	100	+0%	100/15 Summer				65.578
S9.004	S31	15 Winter	100	+0%	100/15 Summer				65.288
S9.005	S32	15 Winter	100	+0%	100/15 Summer				64.932
S8.004	S27	15 Winter	100	+0%	100/15 Summer				64.389
S10.000	S28	15 Winter	100	+0%					64.725
S10.001	S29	15 Winter	100	+0%					64.552
S10.002	S30	15 Winter	100	+0%					64.264
S11.000	S35	15 Winter	100	+0%	100/15 Summer				64.406
S11.001	S36	15 Winter	100	+0%	100/15 Summer				64.340
S12.000	S39	15 Winter	100	+0%	100/15 Summer				66.859
S12.001	S40	15 Winter	100	+0%	100/15 Summer				66.879
S12.002	S41	15 Winter	100	+0%	100/15 Summer				66.718
S12.003	S42	15 Winter	100	+0%	100/15 Summer				66.484
S12.004	S43	15 Winter	100	+0%	100/15 Summer				65.442
S11.002	S37	15 Winter	100	+0%	100/15 Summer				64.235
S11.003	S34	15 Winter	100	+0%	100/15 Summer				63.961
S10.003	S31	15 Winter	100	+0%					63.588
S8.005	S28	15 Winter	100	+0%					63.280
S8.006	S29	15 Summer	100	+0%					62.813
S8.007	S30	15 Summer	100	+0%					62.610

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.004	S15	0.427	0.000	1.64		356.5	SURCHARGED	
S4.005	S16	0.169	0.000	2.18		366.8	SURCHARGED	
S1.006	S7	0.301	0.000	2.16		599.9	SURCHARGED	
S1.007	S8	-0.120	0.000	0.07		23.6	OK	

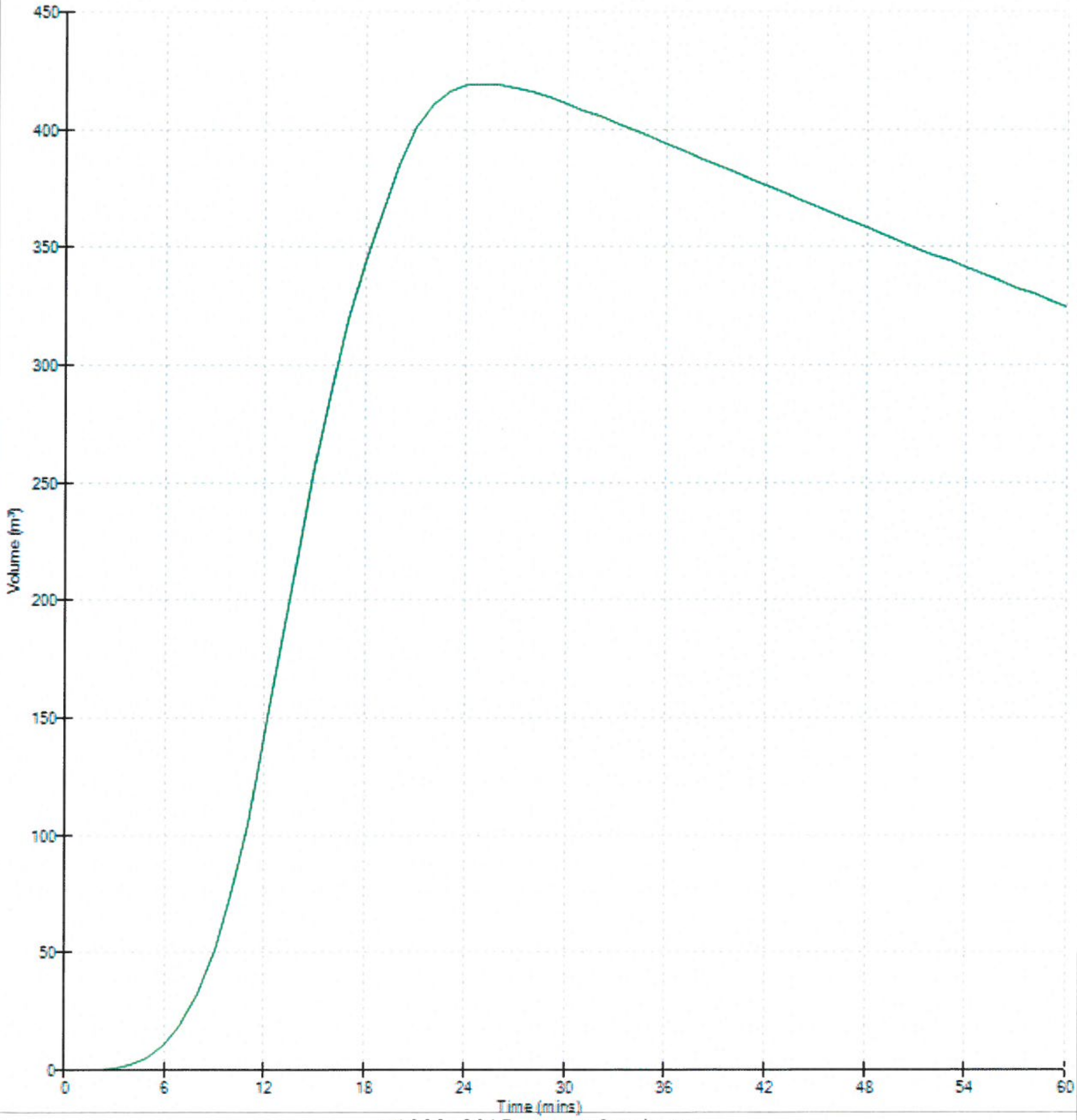
Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.008	S9	-0.427	0.000	0.18		74.2	OK	
S1.009	S10	-0.416	0.000	0.19		73.5	OK	
S1.010	S11	-0.423	0.000	0.19		73.2	OK	
S8.000	S23	1.087	0.000	1.34		44.2	SURCHARGED	
S8.001	S24	0.968	0.000	1.31		96.8	SURCHARGED	
S8.002	S25	0.773	0.000	1.90		137.6	SURCHARGED	
S8.003	S26	0.257	0.000	1.34		174.8	SURCHARGED	
S9.000	S27	0.376	0.000	0.66		79.4	FLOOD RISK	
S9.001	S28	0.435	0.000	0.85		96.3	SURCHARGED	
S9.002	S29	0.441	0.000	1.06		128.1	SURCHARGED	
S9.003	S30	0.407	0.000	1.29		155.6	SURCHARGED	
S9.004	S31	0.285	0.000	1.53		183.4	SURCHARGED	
S9.005	S32	0.090	0.000	1.03		193.3	SURCHARGED	
S8.004	S27	0.033	0.000	1.67		384.1	SURCHARGED	
S10.000	S28	-0.225	0.000	0.00		0.0	OK	
S10.001	S29	-0.225	0.000	0.00		0.0	OK	
S10.002	S30	-0.225	0.000	0.00		0.0	OK	
S11.000	S35	0.406	0.000	0.90		41.5	SURCHARGED	
S11.001	S36	0.391	0.000	1.70		64.4	SURCHARGED	
S12.000	S39	0.844	0.000	0.10		4.8	SURCHARGED	
S12.001	S40	0.982	0.000	0.71		36.0	FLOOD RISK	
S12.002	S41	1.159	0.000	0.95		47.2	FLOOD RISK	
S12.003	S42	1.180	0.000	1.42		73.1	FLOOD RISK	
S12.004	S43	0.652	0.000	1.55		84.3	SURCHARGED	
S11.002	S37	0.323	0.000	1.56		253.5	SURCHARGED	
S11.003	S34	0.151	0.000	1.81		282.0	SURCHARGED	
S10.003	S31	-0.159	0.000	0.82		303.6	OK	
S8.005	S28	-0.129	0.000	0.13		49.8	OK	
S8.006	S29	-0.552	0.000	0.09		49.8	OK	
S8.007	S30	-0.531	0.000	0.12		49.8	OK	

Graphs for Pipe S1.007 US/MH S8 (Storm)
15 minute 100 year Winter I+0%
Status: OK



Graphs for Pipe S8.005 US/MH S28 (Storm)
15 minute 100 year Winter I+0%
Status: OK



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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.317
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.100	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15
Return Period(s) (years)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%					64.779
S1.001	S2	15 Winter	30	+0%					64.714
S1.002	S3	15 Winter	30	+0%	30/15 Winter				64.632
S2.000	S4	15 Winter	30	+0%					64.930
S2.001	S5	15 Winter	30	+0%					64.845
S2.002	S6	15 Winter	30	+0%					64.658
S1.003	S4	15 Winter	30	+0%	30/15 Summer				64.479
S3.000	S5	15 Winter	30	+0%					64.366
S1.004	S5	15 Winter	30	+0%	30/15 Summer				64.283
S1.005	S6	15 Winter	30	+0%	30/15 Summer				64.186
S4.000	S11	15 Winter	30	+0%					65.756
S5.000	S12	15 Winter	30	+0%	30/15 Winter				65.682
S4.001	S12	15 Winter	30	+0%	30/15 Summer				65.694
S6.000	S13	15 Winter	30	+0%					65.669
S4.002	S13	15 Winter	30	+0%	30/15 Summer				65.379
S4.003	S14	15 Winter	30	+0%	30/15 Winter				65.112
S7.000	S17	15 Winter	30	+0%	30/15 Summer				65.394
S7.001	S18	15 Winter	30	+0%	30/15 Summer				65.103

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.196	0.000	0.43		62.1	OK	
S1.001	S2	-0.071	0.000	0.75		89.7	OK	
S1.002	S3	0.009	0.000	0.89		111.4	SURCHARGED	
S2.000	S4	-0.060	0.000	0.71		41.0	OK	
S2.001	S5	-0.017	0.000	0.93		54.4	OK	
S2.002	S6	-0.004	0.000	0.88		80.1	OK	
S1.003	S4	0.149	0.000	0.89		167.3	SURCHARGED	
S3.000	S5	-0.019	0.000	0.74		35.8	OK	
S1.004	S5	0.182	0.000	0.98		185.4	SURCHARGED	
S1.005	S6	0.175	0.000	0.84		183.8	SURCHARGED	
S4.000	S11	-0.130	0.000	0.34		52.7	OK	
S5.000	S12	0.041	0.000	0.06		1.8	SURCHARGED	
S4.001	S12	0.195	0.000	1.09		118.6	SURCHARGED	
S6.000	S13	-0.106	0.000	0.54		32.2	OK	
S4.002	S13	0.124	0.000	1.25		198.9	SURCHARGED	
S4.003	S14	0.045	0.000	0.72		200.8	SURCHARGED	
S7.000	S17	0.335	0.000	1.59		50.9	SURCHARGED	
S7.001	S18	0.166	0.000	1.03		70.3	SURCHARGED	

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

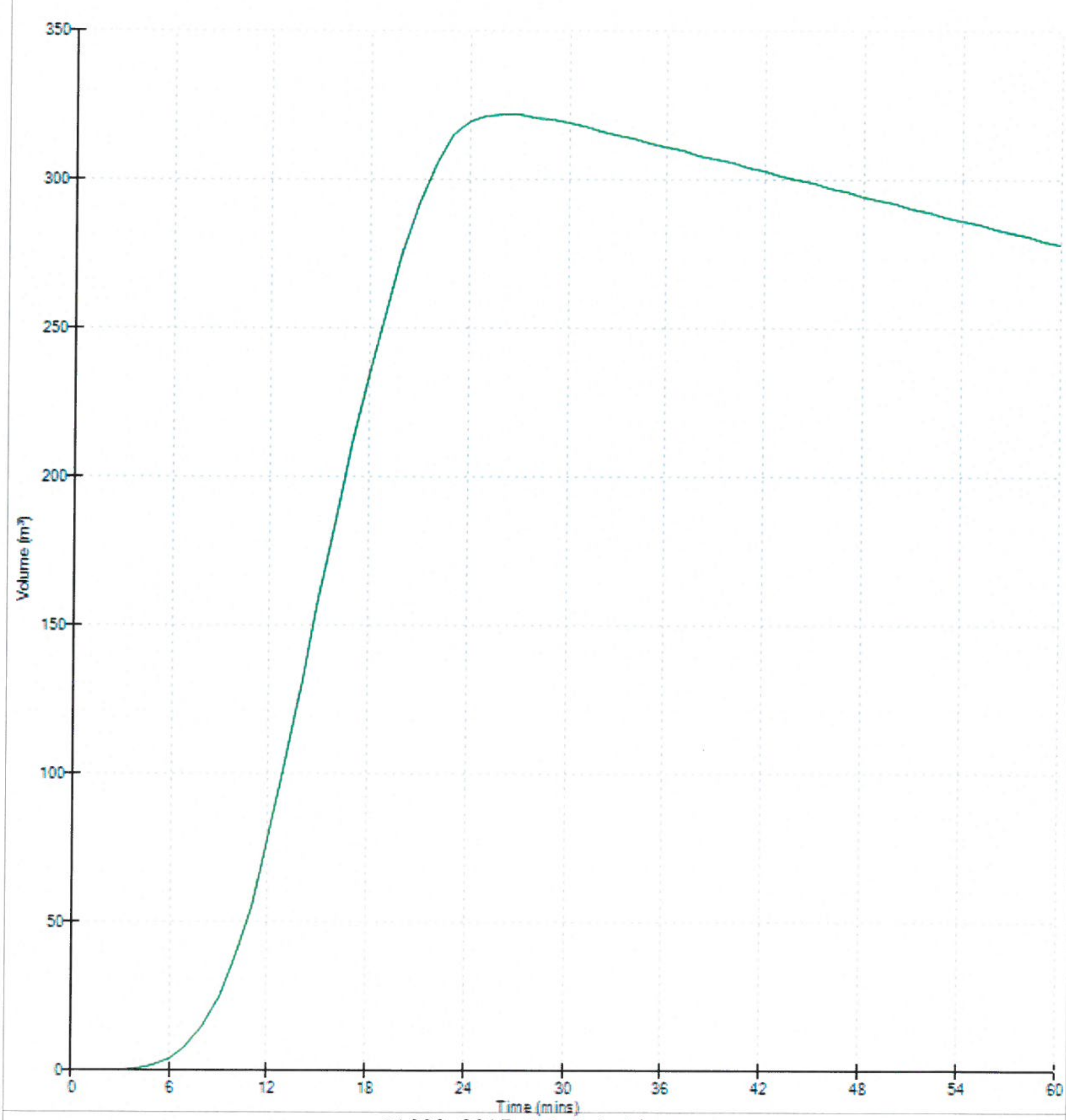
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.004	S15	15 Winter	30	+0%	30/15 Summer				64.946
S4.005	S16	15 Winter	30	+0%	30/15 Summer				64.703
S1.006	S7	15 Winter	30	+0%	30/15 Summer				64.107
S1.007	S8	15 Winter	30	+0%					63.678
S1.008	S9	15 Winter	30	+0%					63.352
S1.009	S10	15 Winter	30	+0%					63.085
S1.010	S11	15 Winter	30	+0%					62.930
S8.000	S23	15 Winter	30	+0%	30/15 Summer				65.673
S8.001	S24	15 Winter	30	+0%	30/15 Summer				65.413
S8.002	S25	15 Winter	30	+0%	30/15 Summer				65.110
S8.003	S26	15 Winter	30	+0%	30/15 Summer				64.648
S9.000	S27	15 Winter	30	+0%					65.564
S9.001	S28	15 Winter	30	+0%	30/15 Summer				65.498
S9.002	S29	15 Winter	30	+0%	30/15 Summer				65.444
S9.003	S30	15 Winter	30	+0%	30/15 Summer				65.272
S9.004	S31	15 Winter	30	+0%	30/15 Summer				65.081
S9.005	S32	15 Winter	30	+0%					64.739
S8.004	S27	15 Winter	30	+0%					64.340
S10.000	S28	15 Winter	30	+0%					64.725
S10.001	S29	15 Winter	30	+0%					64.552
S10.002	S30	15 Winter	30	+0%					64.264
S11.000	S35	15 Winter	30	+0%	30/15 Summer				64.152
S11.001	S36	15 Winter	30	+0%	30/15 Summer				64.115
S12.000	S39	15 Winter	30	+0%	30/15 Summer				66.212
S12.001	S40	15 Winter	30	+0%	30/15 Summer				66.229
S12.002	S41	15 Winter	30	+0%	30/15 Summer				66.101
S12.003	S42	15 Winter	30	+0%	30/15 Summer				65.922
S12.004	S43	15 Winter	30	+0%	30/15 Summer				65.135
S11.002	S37	15 Winter	30	+0%	30/15 Summer				64.059
S11.003	S34	15 Winter	30	+0%	30/15 Summer				63.866
S10.003	S31	15 Winter	30	+0%					63.532
S8.005	S28	15 Winter	30	+0%					63.160
S8.006	S29	15 Winter	30	+0%					62.808
S8.007	S30	15 Winter	30	+0%					62.603

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.004	S15	0.181	0.000	1.30		281.3	SURCHARGED	
S4.005	S16	0.076	0.000	1.71		287.8	SURCHARGED	
S1.006	S7	0.163	0.000	1.69		470.6	SURCHARGED	
S1.007	S8	-0.226	0.000	0.07		23.3	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.008	S9	-0.454	0.000	0.14		58.4	OK	
S1.009	S10	-0.448	0.000	0.15		58.3	OK	
S1.010	S11	-0.450	0.000	0.15		58.0	OK	
S8.000	S23	0.418	0.000	1.07		35.5	SURCHARGED	
S8.001	S24	0.381	0.000	1.10		81.1	SURCHARGED	
S8.002	S25	0.323	0.000	1.56		113.0	SURCHARGED	
S8.003	S26	0.051	0.000	1.04		135.5	SURCHARGED	
S9.000	S27	-0.051	0.000	0.58		70.1	OK	
S9.001	S28	0.055	0.000	0.71		80.2	SURCHARGED	
S9.002	S29	0.098	0.000	0.88		106.6	SURCHARGED	
S9.003	S30	0.101	0.000	1.06		127.3	SURCHARGED	
S9.004	S31	0.078	0.000	1.22		146.6	SURCHARGED	
S9.005	S32	-0.103	0.000	0.83		155.9	OK	
S8.004	S27	-0.016	0.000	1.34		308.3	OK	
S10.000	S28	-0.225	0.000	0.00		0.0	OK	
S10.001	S29	-0.225	0.000	0.00		0.0	OK	
S10.002	S30	-0.225	0.000	0.00		0.0	OK	
S11.000	S35	0.152	0.000	0.70		32.2	SURCHARGED	
S11.001	S36	0.166	0.000	1.35		51.5	SURCHARGED	
S12.000	S39	0.197	0.000	0.06		2.8	SURCHARGED	
S12.001	S40	0.332	0.000	0.67		33.8	SURCHARGED	
S12.002	S41	0.542	0.000	0.82		40.7	SURCHARGED	
S12.003	S42	0.618	0.000	1.24		64.0	SURCHARGED	
S12.004	S43	0.345	0.000	1.32		72.0	SURCHARGED	
S11.002	S37	0.147	0.000	1.26		204.1	SURCHARGED	
S11.003	S34	0.056	0.000	1.44		223.4	SURCHARGED	
S10.003	S31	-0.215	0.000	0.64		234.7	OK	
S8.005	S28	-0.250	0.000	0.12		46.0	OK	
S8.006	S29	-0.557	0.000	0.09		46.0	OK	
S8.007	S30	-0.537	0.000	0.11		46.0	OK	

Graphs for Pipe S1.007 US/MH S8 (Storm)
15 minute 30 year Winter I+0%
Status: OK

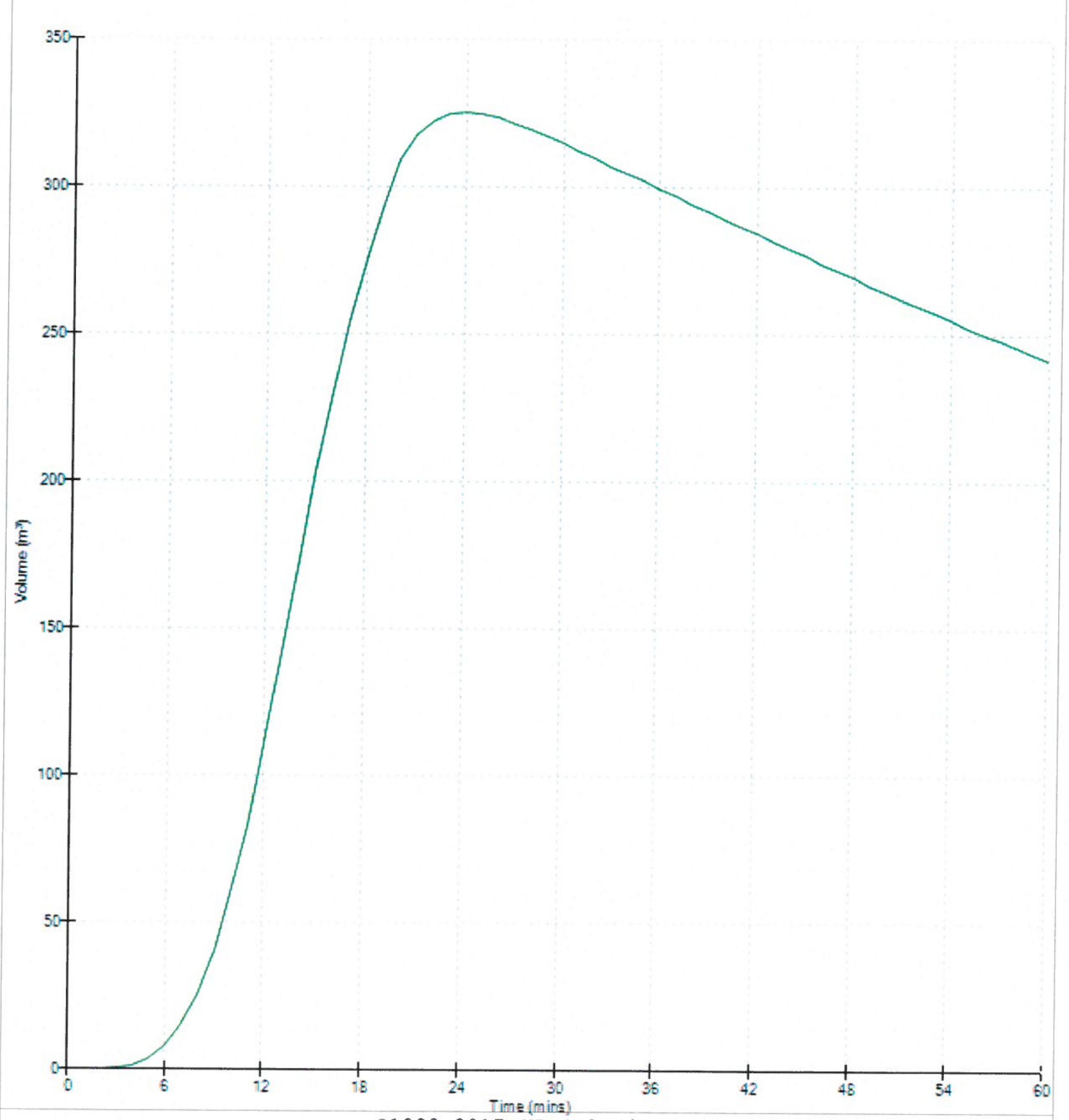


IE Consulting		Page 6
Campus Innovation Centre Green Road Carlow	Capdoo & Abbeylands, Dublin Road, Clane, Co. Kildare	
Date 11/4/2019 1:57 PM File IE1835-Storm-1-Auto Desi...	Designed by LMc Checked by PMS	
Innovyze	Network 2017.1.1	

Graphs for Pipe S8.005 US/MH S28 (Storm)

15 minute 30 year Winter I+0%

Status: OK



Appendix D

FOUL SEWER CALCULATIONS

Title: Housing scheme at Capdoo Commons	Job Ref.:	Calcs. By	Drg. No.		
Client: WESTAR INVESTMENTS LTD		Brian Connolly	P- 1802 303-1	ks: 1.5 mm Discharge: 14 units per house Sewage @ 15 °C	brian connolly associates consulting engineers the studio, wood's way clane, co. kildare tel: (045) 892211; fax (045) 892420
Subject: FOUL SEWER DESIGN	sheet 001				

Pipe Section	No. of Houses	Discharge (units)	Total Discharge (units)	Pipe Diam (mm)	U/S I.L. (m)	Length L_{pipe} (m)	Gradient 1 in ...	D/S I.L. (m)	Flow Q (l/s)	Pipe Cap. Q_{cap} (l/s)	CHECK Capacity of pipe. Qcap >Q	Proport. Flow Q/Qp	Velocity V_{pipe} (m/s)	Proport. Velocity V/Vp	Discharge. Velocity $V_{proportional}$ (m/s)	CHECK Self clean vel. V_p >0.75m/sec
F.I.C. 101 to F.I.C. 103	5	70	70	150	65.07	25	60	64.65	3.55	19.99	✓	0.18	1.13	0.76	0.86	✓
F.I.C. 102 to F.I.C. 103	4	56	56	150	65.07	25	60	64.65	3.38	19.99	✓	0.17	1.13	0.75	0.85	✓
F.I.C. 104 to F.I.C. 105	6	84	84	150	65.75	20	60	65.42	3.70	19.99	✓	0.19	1.13	0.77	0.87	✓
F.I.C. 105 to F.I.C. 106	8	112	252	150	65.42	61.5	60	64.39	4.95	19.99	✓	0.25	1.13	0.83	0.94	✓
F.I.C. 106 to F.I.C. 107	8	112	364	150	64.39	39	100	64.00	5.57	15.46	✓	0.36	0.87	0.92	0.81	✓
F.I.C. 103 to F.I.C. 107	10	140	210	150	64.65	65	100	64.00	4.69	15.46	✓	0.30	0.87	0.88	0.77	✓
F.I.C. 107 to F.I.C. 109	5	70	644	225	64.00	47	125	63.63	6.86	40.75	✓	0.17	1.02	0.75	0.77	✓
F.I.C. 109 to F.I.C. 109a	8	112	756	225	63.63	68	175	63.24	7.31	34.40	✓	0.21	0.87	0.80	0.69	✗
F.I.C. 109a to F.I.C. 110	0	0	756	225	63.24	15	175	63.15	7.31	34.40	✓	0.21	0.87	0.80	0.69	✗
F.I.C. 111 to F.I.C. 112	4	56	812	150	64.56	22.5	60	64.19	7.53	19.99	✓	0.38	1.13	0.93	1.05	✓
F.I.C. 112 to F.I.C. 116	6	84	896	150	64.19	55	60	63.27	7.86	19.99	✓	0.39	1.13	0.94	1.06	✓

Title: Housing scheme at Capdoo Commons Client: WESTAR INVESTMENTS LTD Subject: FOUL SEWER DESIGN	Job Ref.: sheet 002	Calcs. By Brian Connolly	Drg. No. P- 1802 303-1	ks: 1.5 mm Discharge: 14 units per house Sewage @ 15 °C	brian connolly associates consulting engineers the studio, wood's way clane, co. kildare tel: (045) 892211; fax (045) 892420

Pipe Section	No. of Houses	Discharge (units)	Total Discharge (units)	Pipe Diam (mm)	U/S I.L. (m)	Length L_{pipe} (m)	Gradient 1 in ...	D/S I.L. (m)	Flow Q (l/s)	Pipe Cap. Q_{cap} (l/s)	CHECK Capacity of pipe. Qcap >Q	Proport. Flow Q/Qp	Velocity V_{pipe} (m/s)	Proport. Velocity V/Vp	Discharge. Velocity $V_{proportional}$ (m/s)	CHECK Self clean vel. V_p >0.75m/sec
F.I.C. 114 to F.I.C. 115	5	70	70	150	64.53	30	60	64.03	3.55	19.99	✓	0.18	1.13	0.76	0.86	✓
F.I.C. 113 to F.I.C. 115	14	196	196	150	65.28	75	60	64.03	4.60	19.99	✓	0.23	1.13	0.82	0.92	✓
F.I.C. 115 to F.I.C. 116	10	140	406	225	64.03	75	100	63.27	5.78	45.59	✓	0.13	1.15	0.69	0.79	✓
F.I.C. 116 to F.I.C. 117	4	140	686	225	63.27	35	125	62.99	7.03	40.75	✓	0.17	1.02	0.75	0.77	✓
F.I.C. 117 to F.I.C. 118	1	14	700	225	62.99	27	125	62.77	7.09	40.75	✓	0.17	1.02	0.76	0.77	✓
F.I.C. 110 to F.I.C. 118	0	0	1400	225	63.15	42	150	62.89	9.64	37.18	✓	0.26	0.94	0.84	0.79	✓
F.I.C. 118 to F.I.C. 119	16	224	2324	225	62.89	38	150	62.64	12.55	37.18	✓	0.34	0.94	0.90	0.85	✓
F.I.C. 119 to F.I.C. F22	12	168	3192	225	62.64	27	150	62.45	15.08	37.18	✓	0.41	0.94	0.95	0.89	✓

Title: Housing scheme at Capdoo Commons Client: LeMONDE HOLDINGS LTD **Subject: FOUL SEWER DESIGN**	Job Ref.: sheet 003	Calcs. By Brian Connolly	Drg. No. P- 1802 303-2	ks: 1.5 mm Discharge: 14 units per house Sewage @ 15 °C	brian connolly associates consulting engineers the studio, wood's way clane, co. kildare tel: (045) 892211; fax (045) 892420

Pipe Section	No. of Houses	Discharge (units)	Total Discharge (units)	Pipe Diam (mm)	U/S I.L. (m)	Length L_{pipe} (m)	Gradient 1 in ...	D/S I.L. (m)	Flow Q (l/s)	Pipe Cap. Q_{cap} (l/s)	CHECK Capacity of pipe. Qcap >Q	Proport. Flow Q/Qp	Velocity V_{pipe} (m/s)	Proport. Velocity V/Vp	Discharge. Velocity $V_{proportional}$ (m/s)	CHECK Self clean vel. V_p >0.75m/sec
F.I.C. 124 to F.I.C. 125	5	70	70	150	65.82	20.5	60	65.48	3.55	19.99	✓	0.18	1.13	0.76	0.86	✓
F.I.C. 125 to F.I.C. 126	3	42	112	150	65.48	22.5	60	65.10	3.96	19.99	✓	0.20	1.13	0.78	0.89	✓
F.I.C. 126 to F.I.C. 127	4	56	168	150	65.10	24	60	64.70	4.40	19.99	✓	0.22	1.13	0.81	0.91	✓
F.I.C. 127 to F.I.C. 128	0	0	168	150	64.70	26.5	60	64.26	4.40	19.99	✓	0.22	1.13	0.81	0.91	✓
F.I.C. 128 to F.I.C. 130	0	0	168	150	64.26	42.5	60	63.55	4.40	19.99	✓	0.22	1.13	0.81	0.91	✓
F.I.C. 129 to F.I.C. 130	23	322	322	150	64.56	60.5	60	63.55	5.35	19.99	✓	0.27	1.13	0.85	0.96	✓
F.I.C. 130 to F.I.C. 131	4	56	546	225	63.55	15.5	125	63.43	6.43	40.75	✓	0.16	1.02	0.73	0.76	✓
F.I.C. 131 to F.I.C. 132	3	42	588	225	63.43	20	125	63.27	6.62	40.75	✓	0.16	1.02	0.74	0.77	✓
F.I.C. 132 to F.I.C. F30	4	56	644	225	63.27	34	125	63.00	6.86	40.75	✓	0.17	1.02	0.75	0.78	✓

Title: Housing scheme at Capdoo Commons Client: LeMONDE LTD Subject: FOUL SEWER DESIGN	Job Ref.: sheet 005	Calcs. By Brian Connolly	Drg. No. P- 1802	ks: 1.5 mm Discharge: 14 units per house Sewage @ 15 °C	brian connolly associates consulting engineers the studio, wood's way clane, co. kildare tel: (045) 892211; fax (045) 892420

Pipe Section	No. of Houses	Discharge (units)	Total Discharge (units)	Pipe Diam (mm)	U/S I.L. (m)	Length L_{pipe} (m)	Gradient 1 in ...	D/S I.L. (m)	Flow Q (l/s)	Pipe Cap. Q_{cap} (l/s)	CHECK Capacity of pipe. Qcap >Q	Proport. Flow Q/Qp	Velocity V_{pipe} (m/s)	Proport. Velocity V/Vp	Discharge. Velocity $V_{proportional}$ (m/s)	CHECK Self clean vel. V_p >0.75m/sec
F.I.C. 214 to F.I.C. 215	0	0	1722	225	62.52	39.5	200	62.32	10.69	32.17	✓	0.33	0.81	0.90	0.73	✗
F.I.C. 215 to F.I.C. EXIST A	8	112	1834	225	62.32	46.1	200	62.09	11.05	32.17	✓	0.34	0.81	0.91	0.74	✗
TO ALEXANDRA WALK PUMPING STATION																
F.I.C. 216 to F.I.C. Pump	5	70	1904	225	62.09	48	175	61.82	11.27	34.40	✓	0.33	0.87	0.90	0.78	✓
TO BROOKLANDS PUMPING STATION																
F.I.C. 22 to F.I.C. 23	80	1120	4312	300	62.43	32	270	62.31	18.21	59.43	✓	0.31	0.84	0.88	0.75	✓
F.I.C. 23 to F.I.C. 24	12	168	4480	300	62.31	38.5	270	62.17	18.67	59.43	✓	0.31	0.84	0.89	0.75	✓
F.I.C. 24 to F.I.C. 36	0	0	4480	300	62.17	29	270	62.06	18.67	59.43	✓	0.31	0.84	0.89	0.75	✓
F.I.C. 30 to F.I.C. 31	7	98	742	225	63.00	25	105	62.76	7.26	44.48	✓	0.16	1.12	0.74	0.83	✓
F.I.C. 31 to F.I.C. 33	35	490	1232	225	62.76	58.5	130	62.31	9.07	39.95	✓	0.23	1.00	0.81	0.82	✓
F.I.C. 33 to F.I.C. 36	8	112	5824	225	62.31	45	180	62.06	22.30	33.92	✓	0.66	0.85	1.07	0.91	✓
F.I.C. 36 to F.I.C. F 10	30	420	6244	225	62.06	101	270	61.69	23.42	27.65	✓	0.85	0.70	1.12	0.78	✓
F.I.C. F 10 to F.I.C. F 11	25	350	6594	225	61.69	76	285	61.42	24.36	26.91	✓	0.91	0.68	1.13	0.76	✓
F.I.C. F 11 to F.I.C. F 21	0	0	6594	225	61.42	72.5	270	61.15	24.36	27.65	✓	0.88	0.70	1.12	0.78	✓

Title: Housing scheme at Capdoo Commons Client: WESTAR INVESTMENTS LTD Subject: FOUL SEWER DESIGN	Job Ref.: sheet 006	Calcs. By Brian Connolly	Drg. No. P- 1802-303	brian connolly associates consulting engineers the studio, wood's way clane, co. kildare tel: (045) 892211; fax (045) 892420

ABBEYPARK PUMPING STATION CAPACITY

Existing Houses	Total Units
Abbeypark	121
Brooklands	164
The Oaks	20
Private Houses	4
The Cloisters	32
Abbeywood	44
Total No of units	385

Allow 600 litres per dwelling per day = 600l. x 385 dwellings = 231,000 litres/day

Capacity of tank :

Diameter 13.5 m

depth 2.8m (64.23-61.43) lowest I.L. at end of line

Volume 400.95 m3 = 400,950 litres/day

at 600 litres per dwelling

Tank Capacity 400,950 / 600 = 668 dwellings

Spare Capacity of Abbeylands Tank = 668 - 385 = 283 dwellings.

Check: Tank to service 166 dwellings + Creche from proposed development.

Title:	Job Ref.:	Calcs. By	Drg. No.	
Housing scheme at Capdoo Commons Client: WESTAR INVESTMENTS LTD Subject: FOUL SEWER DESIGN	sheet 007	Brian Connolly	P- 1802-303	brian connolly associates consulting engineers the studio, wood's way clane, co. kildare tel: (045) 892211; fax (045) 892420

Alexandra Walk Pumping Station

Planning file 06/2674 was granted for a 90 bedroom nursing home and 49 No. retirement dwellings and storage reserved in the Alexandra Walk Pumping Station Planning File 04/141)to facilitate the development.

Planning file 04/141 constructed a pumping station with a 24 hour underground storage tank capacity of 240 m3 with 140 m3 to facilitate the development of planning file 04/141 and an additional capacity of 100m3 for future development.

Design Requirements as submitted under planning file 06/2674

90 bed nursing home @ 350 l/person/day	31,500	l/day
49 retirement dwellings @ 180 l/person/day (3 person)	26,460	l/day
	57,960	l/day

Design in accordance with Irish Water: Code of Practice for Wastewater Infrastructure, Appendix C Gravity Sewer Design Requirements
150 l/person/day with a population estimate of 2.7 person per unit

Equivalent number of dwellings	57,960/ (2.7 x 150) =	143 dwellings
Alternatively, 100m3 spare capacity =	100,000 /(2.7 x 150) =	247 dwellings

Check: Proposed development is for 134 dwellings to connect to Alexandra Walk Pumping Station

Appendix E

IRISH WATER PRE-CONNECTION ENQUIRY FORM, RESPONSE

&

STATEMENT OF DESIGN ACCEPTANCE

UISCE ÉIREANN : IRISH WATER

Westar Investments Ltd.
C/o Patrick Fadden
Abbeylands
Clane
Co. Kildare

10 October 2019

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

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

www.water.ie

Re: Design Submission for Capdoo Commons, Clane, Kildare (the "Development") (the "Design Submission") / Connection Reference No: CDS19006765

Dear Patrick Fadden,

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: Kevin McManmon
Phone: 018230374
Email: kmcmanmon@water.ie

Yours sincerely,

M O'Dwyer

Maria O'Dwyer
Connections and Developer Services

Appendix A

Document Title & Revision

- S_2018_18002 Le MONDE Capdoo_Sewer Design_18002 300Q Fadden Capdoo Site Layout - services only8-10-19 18002 303-2 - WATER MAINS SERVICES SHEET 1
- S_2018_18002 Le MONDE Capdoo_Sewer Design_18002 300Q Fadden Capdoo Site Layout - services only8-10-19 18002 303-2 - WATER MAINS SERVICES sheet 2
- S_2018_18002 Le MONDE Capdoo_Sewer Design_18002 300Q Fadden Capdoo Site Layout - services only8-10-19 18002 303-1 - Foul SERVICES (1)
- S_2018_18002 Le MONDE Capdoo_Sewer Design_18002 300Q Fadden Capdoo Site Layout - services only8-10-19 18002 303-1 - Foul SERVICES (2)
- S_2018_18002 Le MONDE Capdoo_Sewer Design_18001 Foul Sections 8-10-19 18002-303-1-1 (1)
- S_2018_18002 Le MONDE Capdoo_Sewer Design_18001 Foul Sections 8-10-19 18002-303-1-2 (1)
- S_2018_18002 Le MONDE Capdoo_Sewer Design_18001 Foul Sections 8-10-19 18002-303-1-3 (1)

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.

BCA Consulting Eng C/o Connolly, Brian
The Studio
Woods Way
Clane
Co. Kildare

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
Éire

Irish Water
PO Box 6000
Dublin 1
Ireland

T: +353 1 89 25000
F: +353 1 89 25001
www.water.ie

07 October 2019

Dear Sir/Madam,

Re: Customer Reference No 1000851652 pre-connection enquiry - Subject to contract | Contract denied
Connection for Strategic Housing Development of 305 no. houses at Capdoo Commons, Clane, Co.Kildare

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connections at Capdoo Commons, Clane, Co.Kildare (the Premises). Based upon the details you have provided with your pre-connection enquiry and on the capacity currently available as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place and the conditions listed below, your proposed connection to the Irish Water network can be facilitated.

Strategic Housing Development
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.

Wastewater: It is feasible for 230 units to connect prior to the Upper Liffey Valley Sewerage Scheme (Contract 2B) and associated upgrades in Clane being completed in 2022 (programme subject to statutory process and change). Upon completion of the Upper Liffey Valley Sewerage Scheme, the remaining 75 units can be accomodated.

A connection agreement can be applied for by completing the connection application form available 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

If you have any further questions, please contact Kevin McManmon from the design team on kmcmanmon@water.ie or email 018230374. For further information, visit **www.water.ie/connections**

Yours sincerely,

Maria O'Dwyer
Connections and Developer Services

Pre-connection enquiry form

Large industrial & commercial, mixed use developments, housing developments, non domestic developments

This form is to be filled out by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure. Please complete this form in BLOCK letters using a black ink ballpoint pen.

Section A Applicant details

1 **Applicant details**:

Contact name: __PAtrick Fadden________________________________

Company name (if relevant):_____WESTAR INVESTMENTS LTD________________________

Postal address:_____Rushbrook House, Dublin Road, Clane, Co. Kildare________________

____

____

Telephone:__087 977 2869_________Email:____patrickg@westargroup.ie_____________________

2 **Correspondence address (if different from applicants above):**

Contact name: _____Brian Connolly_____

Company name (if relevant):____Brian Connolly Associates_____

Postal address: ____The Studio, Woods Way, Clane, Co. Kildare_____

Telephone: _045 892211_____ Email:_____bcassoc@eircom.net_____

3 **Engineering Consultant**

Contact name: _____ Brian Connolly _____

Company name (if relevant):_____ Brian Connolly Associates _____

Postal address: _____ The Studio, Woods Way, Clane, Co. Kildare

Telephone: _____045 892211_____Email:_____ bcassoc@eircom.net _____

Section B Site details

4 **Site address:** _____Capdoo Commons, Clane, Co. Kildare_____

5 **Name of Local Authority:** ____Kildare Co Council_____

6 **Has full planning permission been granted?** Yes ☐ No X

If 'Yes' please indicate the Planning reference number: _____

7 **Irish National Grid co-ordinates:** Eastings___688309___ Northings___727982___

8 **Previous use of site (if applicable):** ___Agriculture_____

9 **Date previous development was last occupied (if applicable):** _____

10 **Are there poor ground condition issues?** Yes ☐ No X

If Yes please include site investigation report and a detailed site specific report on the approach being taken to deal with ground conditions specifically with regard to pipe support and trenching.

11 **Are there potential contaminated land issues?** Yes ☐ No X

If Yes please include a detailed site specific report on the approach being taken to deal with contaminated land and the measures to mitigate impact on the infrastructure.

12 **Is the development in accordance with the local area/development plan?** Yes X No ☐

Section C Service details

13 **Request for connection** Water ☐ Wastewater ☐ Both X

14 **Is this application for an additional water connection to the one already installed?** Yes ☐ No X

15 **Is this application for an additional wastewater connection to the one already installed?** Yes ☐ No X

16 **Please provide WPRN No. (If there is an existing connection):** ____________________

17 **Do you require an upgrade/increase in size to an existing water connection?** Yes ☐ No X

18 **Do you require an upgrade/increase in size to an existing wastewater connection?** Yes ☐No X

19 **Please indicate water demand (include calculations on attached calculation sheet)**

Pre-development peak water demand	*0*	*l/s*
Pre development average water demand	*0*	*l/s*
Post development peak water demand	*1.172*	*l/s*
Post development average water demand	*0.9375*	*l/s*
Normal demand	*3.5*	*l/s*

Pre-development refers to brownfield sites only. Demand rates (Peak & Average) are site specific. Average demand is the total daily volume divided by a 24 hour time period and expressed in litres per second l/s. However, this might not be the normal flow that would arise. Normal demand is the total daily demand during business hours (over say an 8-hour period with very little demand during the other 16 hours).

20 **Wastewater Hydraulic Load** (include calculations on attached calculation sheet)

Pre-development peak discharge	*0*	*l/s*
Pre-development average discharge	*0*	*l/s*
Post development peak discharge	*1.38*	*l/s*
Post-development average discharge	*8.33*	*l/s*

Pre -development refers to brownfield sites only. Demand rates (Peak & Average) are site specific. Average demand is the total daily volume divided by a 24 hour time period and expressed in litres per second l/s.

21 **Organic Load:**

Characteristic	Max concentration	Average concentration
Biochemical Oxygen Demand (BOD), mg/l		
Suspended Solids (SS), mg/l		
Total Nitrogen (N), mg/l		
Total Phosphorus (P), mg/l		
Other, mg/l		

22 **Storm/surface water will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer. In the case of such brownfield sites please indicate if it is proposed that the development intends discharging surface water to the combined wastewater collection system?**

Yes ☐ No X

If yes, give reason for discharge and comment on adequacy of SUDS/attenuation measures proposed

____

____

____

23 What is the reduced level at the property boundary at connection point above Malin Head ordnance datum?

________________65.25________ (m)

24 What is the lowest finished floor level on site above Malin Head ordnance datum?____65.1________(m)

25 Is on site water storage being provided? Yes ☐ No X

Please include calculations on attached calculation sheet. Please note on site water storage may not be required. See guidance notes.

26 **Are there fire flow requirements?** Yes X No ☐

Additional Fire Flow requirements over and above those identified in Q19	l/s

Please include calculations on attached calculation sheet and confirmation of requirements from the Fire Authority.

27 **Please identify if you propose to supplement your potable water supply from other sources?**

Yes ☐ No X

If yes please indicate how you propose to supplement your potable water supply from other sources:

____

____

Section D Development details

28 **Please indicate property types:**

Total Number of Properties for this application	Number
Property Type - Domestic	200
Property Type - Non Domestic	
office	
residential care home	
Hotel	
Factory	
School	
Institution	
Retail unit	
Commercial unit	
Industrial unit	
Other (please specify)	

29 **Approximate start date of proposed development:** ______March 2018___________________________

30 **Approximate date water connection is required:** __________September 2018_______________________

31 **Approximate date wastewater connection is required:** _______September 2018____________________

32 **Is the development multi-phased?** Yes X No ☐

If Yes please provide a master-plan with your application identifying the phases and current phase number.

If Yes please provide details of the variations in the water demand volumes due to the phasing requirements.

PHASE 1 ÷ 100 HOUSES

PHASE 2 ÷ 100 HOUSES

TOTAL 200 HOUSES

Section E Documentation to be submitted

A site location map to a scale of 1:1000, which identifies clearly the land or structure to which the application relates. The map shall include:

a) The **scale** shall be clearly indicated on the map.
b) The **boundaries** shall be delineated in red.
c) Adjacent **street names.**
d) The site **co-ordinates** shall be marked on the site location map.

Please provide the following additional information:

a) Calculations
b) Any other information that might help Irish Water assess this pre connection enquiry application.

Section F Declaration

The details I/we have given with this application are accurate.

I/We have enclosed all the necessary supporting documentation.

Your details

Signature: ____________________

Date: ______02 June 2017____________________

Your full name

(In Block Capitals): ___BRIAN CONNOLLY____________________

Irish Water will carry out a formal assessment based on the information provided in this form. Any future connection offer made by Irish Water will be based on the information provided.

Please submit a scanned copy (in pdf format) of the completed form and supporting information to your Regional New Connections Team for assessment.

Calculations

PHASE 1 & 2

WATER DEMAND

The average and peak water demand rates are calculated in accordance with Irish Water Pre-Connection Enquiry Form which assumes a loading rating of 150 litres/person/day and an average occupancy ratio= of 2.7 persons per dwelling. The average day, peak week demand is taken as 1.25 times the average daily domestic demand. The peak demand is taken to be 2.1 times the average day, peak week demand.

Number of properties	305	
Average Daily Domestic Demand (ADDD) =	150 l/day x No of houses x occupancy	
	123,525	litres / day
	1.430	l/s
Average Day Peak Week Demand (ADPWD) -	ADDD x 1.25	
	1.787	l/s
Peak Demand	ADPWD x 2.1	
	3.753	l/s

Normal Demand (assuming principal water usage over 8 hrs) = ADPWD x 24/8
5.361 l/s

Foul Wastewater Discharge

The aerage and peak discharge rates are calculated using loading rates provided by Irish Water:

Dry Weather Flow (DWF) = 600 litres per dwelling

Number of Properties =	305	
Total DWF = 600 x Number of properties	183,000	litres / day
	2.118	l/s
Peak Discharge = 6 x DWF	12.71	l/sec

On Site Storage (Water and Wastewater)

N/A.

Fire Flow requirements

22.5 l/sec.

Appendix F

IGSL SITE INFILTRATION REPORT

IGSL Limited

Westar Group

Dublin Road, Clane

Infiltration Test Report

Project No. 21680

April 2019

M7 Business Park
Naas
Co. Kildare
Ireland

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IGSL

Document Verification

Project: Dublin Road, Clane

Project No. 21680

Revision	Date	Title		
Rev 0	15/04/2019	Report		
	Copies	Document Format	Prepared By	Reviewed By
	1	Digital	Brian Green Chartered Engineer	David Green Chartered Engineer
	To	Westar Group		
Revision	**Date**	**Title**		
	Copies	Document Format	Prepared By	Reviewed By
	To			
Revision	**Date**	**Title**		
	Copies	Document Format	Prepared By	Reviewed By
	To			
Revision	**Date**	**Title**		
	Copies	Document Format	Prepared By	Reviewed By
	To			

Report on Infiltration Testing
At
Housing Development
Dublin Road, Clane
On behalf of
Westar Group

Report No. 21680

Contents

1.0 Introduction
2.0 Sub-soil Conditions
3.0 Infiltration Testing
4.0 Principles of Permeable Pavement
5.0 Results

Appendices

1 Infiltration Test Results
2 Photographs
3 Site Plan

Identity Code BG

Report on Infiltration Testing
At
Housing Development
Dublin Road, Clane
On behalf of
Westar Group

Report No. 21680 Date April 2019

1.0 Introduction

The proposed new housing development at Dublin Road, Clane will include a system for the storage and dispersion of storm water. Infiltration tests were, therefore, carried out to ascertain the suitability of the sub-soils for permeable pavement purposes.

2.0 Sub-soil conditions

The test pits revealed brown sandy clay with occasional gravel to the excavated depth of 0.65 metres. No groundwater was encountered during the course of excavation operations

3.0 Infiltration Testing

The infiltration tests were performed in accordance with BRE Digest 365 'Soakaway Design'.

To obtain a measure of the infiltration rate of the sub-soils, water was poured into each of the three test pits, and records taken of the fall in water level against time. This procedure was repeated twice more to ensure saturation of the sub-soils.

The infiltration rate is the volume of water dispersed per unit exposed area per unit of time, and is generally expressed as metres/minute or metres/second. Designs are based on the slowest infiltration rate, which is generally calculated from the final cycle.

The results for the final two stages of testing, following the saturation periods, are enclosed in appendix1.

4.0 Principles of Permeable Pavement

Permeable paving systems are designed to provide temporary storage of water in a reservoir of crushed stone underlying the paved area. In an attenuation system where the sub-soils are relatively impermeable the base and sides of the reservoir are lined with an impermeable membrane and the stored water is discharged through an outflow pipe to a suitable surface water system. Where the sub-soils can provide infiltration a geotextile replaces the impermeable liner. As an added precaution an overflow pipe can be installed to avoid flooding of the paved area in extreme storm conditions.

5.0 Results

The infiltration rates indicated by the field tests are shown in Table 1.

Location	Infiltration Rate (f-value)	
	* (First Cycle) (m/min)	* (Second Cycle) (m/min)
SA01	0.0003	0.0001
SA02	0.00007	0
SA03	0.00006	0
SA04	0.0002	0.00008
SA05	0.0023	0.002
SA06	0	
SA07	0	

* First and second measured cycles were preceded by saturation stages

Table 1

The results indicate that the soils in the vicinity of SA02, SA03, SA06 and SA07 are relatively impermeable.

Appendix 1 Infiltration Test Results

Soakaway Design f -value from field tests IGSL

Contract: Capdoo, Clane, Co. Kildare — Contract No. 21680
Test No. SA01 (First Cycle)
Engineer Westar Group
Date: 05.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Dry
0.20	0.65	Firm brown/light brown sandy CLAY with rare gravel, locally very sandy	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.220	0.00
0.220	1.00
0.230	2.00
0.230	3.00
0.230	4.00
0.230	5.00
0.230	6.00
0.230	7.00
0.230	8.00
0.230	9.00
0.230	10.00
0.230	12.00
0.230	14.00
0.230	16.00
0.230	18.00
0.240	20.00
0.250	25.00
0.250	30.00
0.260	40.00
0.270	50.00
0.270	60.00

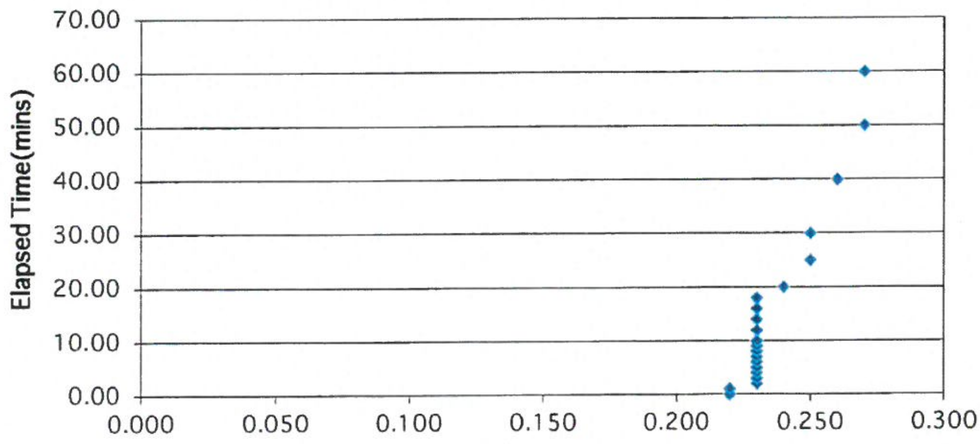
Field Test

Depth of Pit (D)	0.65	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.20	m
Initial depth to Water =	0.22	m
Final depth to water =	0.270	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.65	m
Base area=	0.72	m2
*Av. side area of permeable stratum over test perio	1.458	m2
Total Exposed area =	2.178	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.0003 m/min or 4.59137E-06 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests IGSL

Contract: Capdoo, Clane, Co. Kildare — Contract No. 21680
Test No. SA01 (Second Cycle)
Engineer Westar Group
Date: 05.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Dry
0.20	0.65	Firm brown/light brown sandy CLAY with rare gravel, locally very sandy	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.190	0.00
0.190	1.00
0.190	2.00
0.190	3.00
0.190	4.00
0.190	5.00
0.190	6.00
0.190	7.00
0.190	8.00
0.200	9.00
0.200	10.00
0.200	12.00
0.200	14.00
0.200	16.00
0.200	18.00
0.200	20.00
0.200	25.00
0.200	30.00
0.210	40.00
0.210	50.00
0.210	60.00

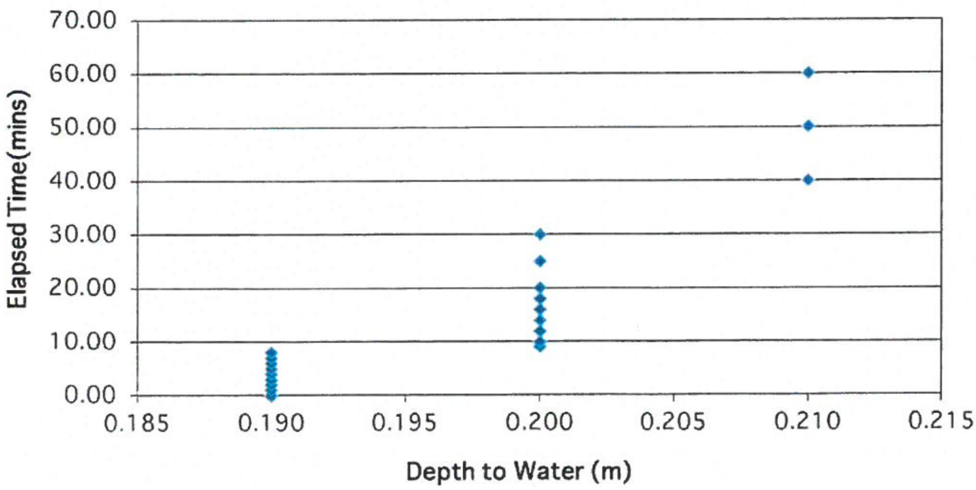
Field Test

Depth of Pit (D)	0.65	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.20	m
Initial depth to Water =	0.19	m
Final depth to water =	0.210	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.65	m
Base area=	0.72	m2
*Av. side area of permeable stratum over test perio	1.62	m2
Total Exposed area =	2.34	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.0001 m/min or 1.7094E-06 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests IGSL

Contract: Capdoo, Clane, Co. Kildare — Contract No. 21680
Test No. SA02 (First Cycle)
Engineer Westar Group
Date: 05.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Dry
0.20	0.60	Firm brown/light brown sandy CLAY with rare gravel	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.300	0.00
0.300	1.00
0.310	2.00
0.310	3.00
0.310	4.00
0.310	5.00
0.310	6.00
0.310	7.00
0.310	8.00
0.310	9.00
0.310	10.00
0.310	12.00
0.310	14.00
0.310	16.00
0.310	18.00
0.310	20.00
0.310	25.00
0.310	30.00
0.310	40.00
0.310	50.00
0.310	60.00

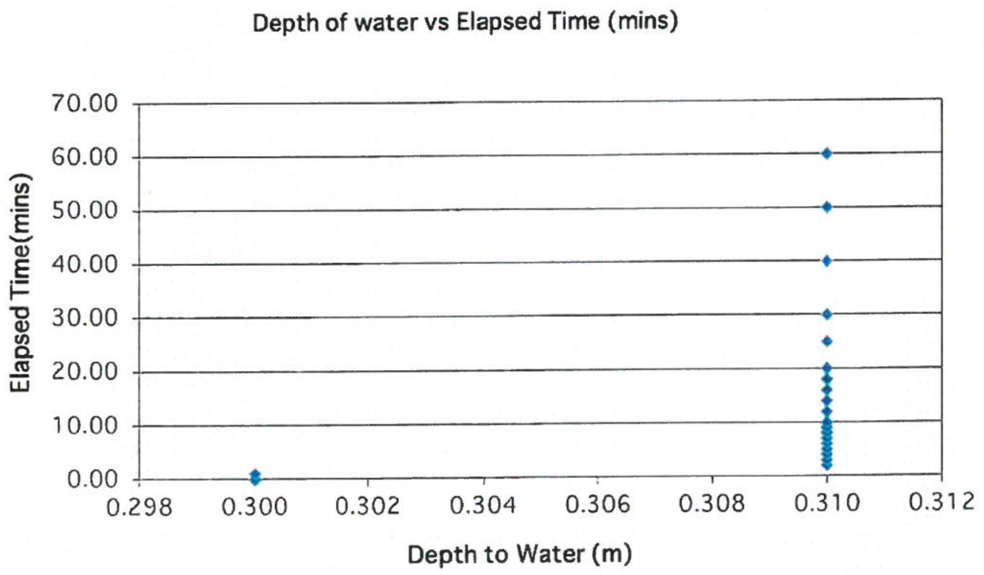
Field Test

Depth of Pit (D)	0.60	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.00	m
Initial depth to Water =	0.30	m
Final depth to water =	0.310	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.60	m

Base area=	0.8	m2
*Av. side area of permeable stratum over test perio	1.062	m2
Total Exposed area =	1.862	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 7E-05 m/min or 1.19346E-06 m/sec



Soakaway Design f -value from field tests IGSL

Contract: Capdoo, Clane, Co. Kildare — Contract No. 21680
Test No. SA02 (Second Cycle)
Engineer Westar Group
Date: 05.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Dry
0.20	0.60	Firm brown/light brown sandy CLAY with rare gravel	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.280	0.00
0.280	1.00
0.280	2.00
0.280	3.00
0.280	4.00
0.280	5.00
0.280	6.00
0.280	7.00
0.280	8.00
0.280	9.00
0.280	10.00
0.280	12.00
0.280	14.00
0.280	16.00
0.280	18.00
0.280	20.00
0.280	25.00
0.280	30.00
0.280	40.00
0.280	50.00
0.280	60.00

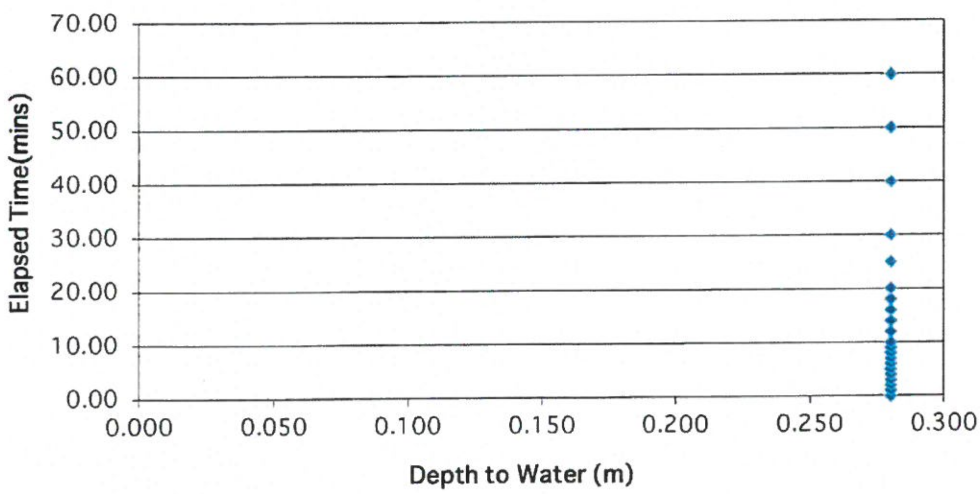
Field Test

Depth of Pit (D)	0.60	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.00	m
Initial depth to Water =	0.28	m
Final depth to water =	0.280	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.60	m
Base area=	0.8	m2
*Av. side area of permeable stratum over test perio	1.152	m2
Total Exposed area =	1.952	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design	f -value from field tests	IGSL

Contract: Capdoo, Clane, Co. Kildare — Contract No. 21680
Test No. SA03 (First Cycle)
Engineer Westar Group
Date: 04.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Dry
0.20	0.65	Firm brown/brownish grey very sandy SILT with occasional gravel, gravel content increases with depth	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.280	0.00
0.280	1.00
0.280	2.00
0.280	3.00
0.280	4.00
0.280	5.00
0.280	6.00
0.280	7.00
0.280	8.00
0.280	9.00
0.280	10.00
0.280	12.00
0.280	14.00
0.280	16.00
0.280	18.00
0.280	20.00
0.280	25.00
0.280	30.00
0.280	40.00
0.290	50.00
0.290	60.00

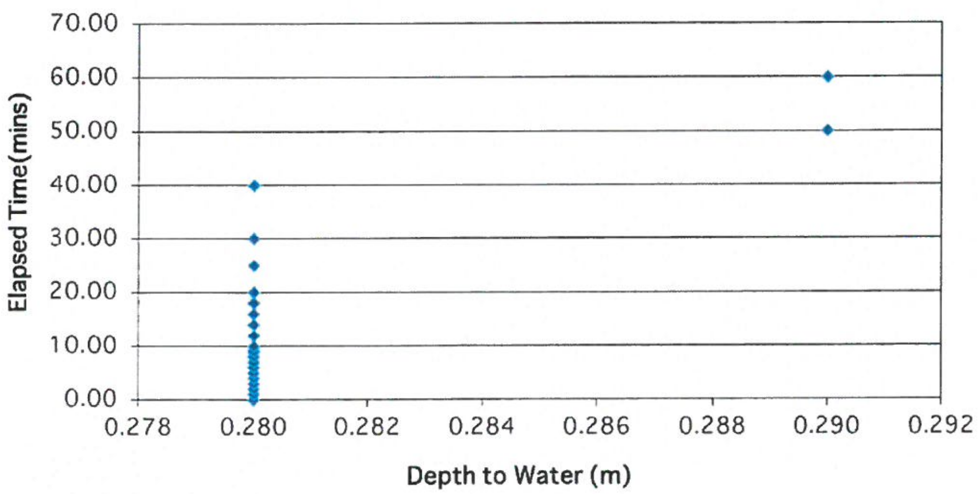
Field Test

Depth of Pit (D)	0.65	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.00	m
Initial depth to Water =	0.28	m
Final depth to water =	0.290	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.65	m
Base area=	0.8	m2
*Av. side area of permeable stratum over test perio	1.314	m2
Total Exposed area =	2.114	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 6E-05 m/min or 1.05119E-06 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design   f -value from field tests   IGSL

Contract: Capdoo, Clane, Co. Kildare   Contract No. 21680
Test No. SA03 (Second Cycle)
Engineer Westar Group
Date: 04.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Dry
0.20	0.65	Firm brown/brownish grey very sandy SILT with occasional gravel, gravel	
		content increases with depth	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.260	0.00
0.260	1.00
0.260	2.00
0.260	3.00
0.260	4.00
0.260	5.00
0.260	6.00
0.260	7.00
0.260	8.00
0.260	9.00
0.260	10.00
0.260	12.00
0.260	14.00
0.260	16.00
0.260	18.00
0.260	20.00
0.260	25.00
0.260	30.00
0.260	40.00
0.260	50.00
0.260	60.00

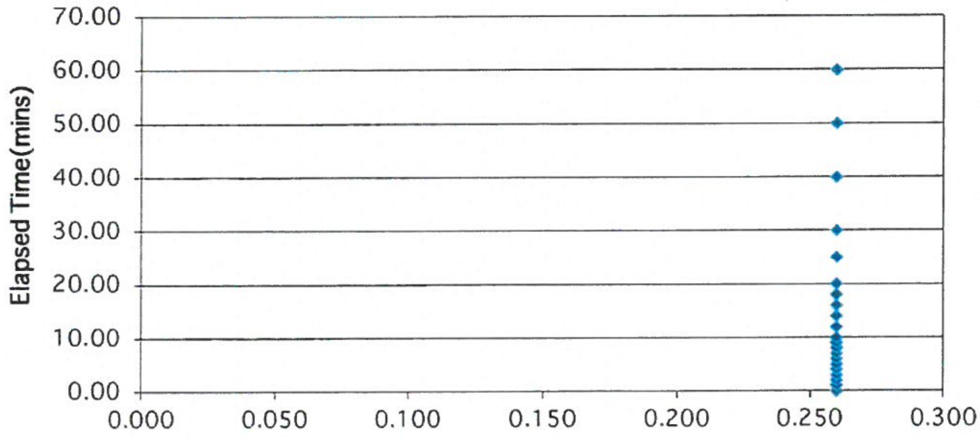
Field Test

Depth of Pit (D)	0.65	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.00	m
Initial depth to Water =	0.26	m
Final depth to water =	0.260	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.65	m
Base area=	0.8	m2
*Av. side area of permeable stratum over test perio	1.404	m2
Total Exposed area =	2.204	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests IGSL

Contract:	Capdoo, Clane, Co. Kildare	Contract No. 21680
Test No.	SA04 (First Cycle)	
Engineer	Westar Group	
Date:	04.04.2019	

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Dry
0.20	0.65	Firm brown slightly sandy SILT with rare gravel	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.480	0.00
0.480	1.00
0.480	2.00
0.480	3.00
0.480	4.00
0.480	5.00
0.480	6.00
0.480	7.00
0.480	8.00
0.480	9.00
0.480	10.00
0.480	12.00
0.480	14.00
0.480	16.00
0.480	18.00
0.480	20.00
0.480	25.00
0.490	30.00
0.490	40.00
0.490	50.00
0.500	60.00

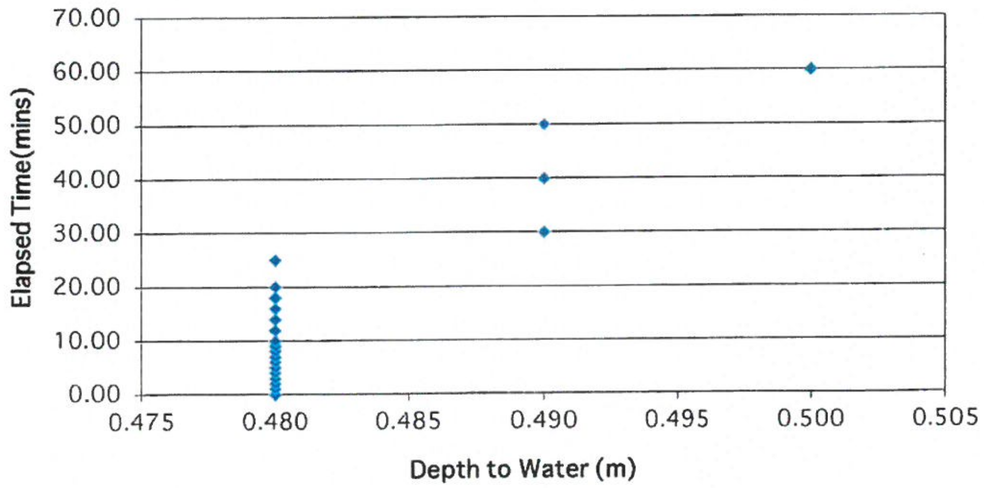
Field Test

Depth of Pit (D)	0.65	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.40	m
Initial depth to Water =	0.48	m
Final depth to water =	0.500	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.65	m
Base area=	1.12	m2
*Av. side area of permeable stratum over test perio	0.704	m2
Total Exposed area =	1.824	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.0002 m/min or 3.41131E-06 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests IGSL

Contract: Capdoo, Clane, Co. Kildare Contract No. 21680
Test No. SA04 (Second Cycle)
Engineer Westar Group
Date: 04.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Dry
0.20	0.65	Firm brown slightly sandy SILT with rare gravel	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.360	0.00
0.360	1.00
0.360	2.00
0.360	3.00
0.360	4.00
0.360	5.00
0.360	6.00
0.360	7.00
0.360	8.00
0.360	9.00
0.360	10.00
0.360	12.00
0.360	14.00
0.360	16.00
0.360	18.00
0.360	20.00
0.360	25.00
0.360	30.00
0.360	40.00
0.360	50.00
0.370	60.00

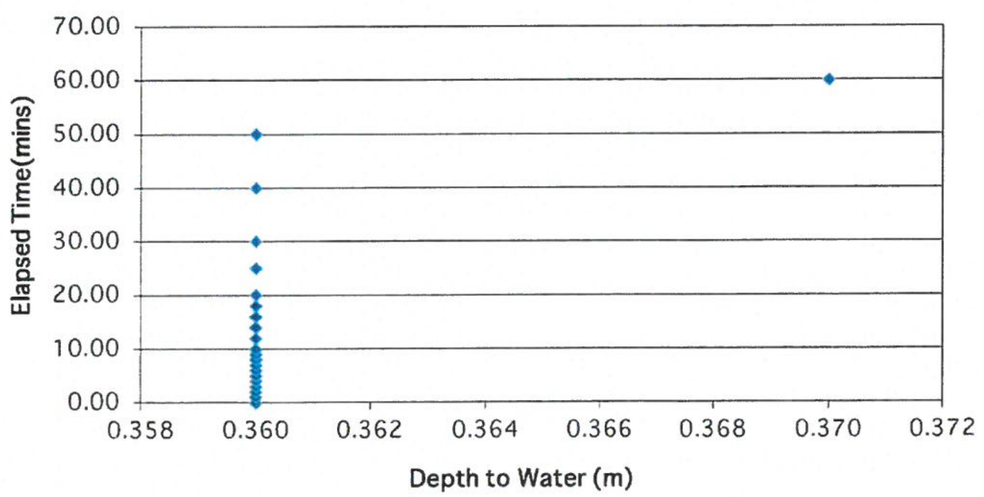
Field Test

Depth of Pit (D)	0.65	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.40	m
Initial depth to Water =	0.36	m
Final depth to water =	0.370	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.65	m
Base area=	1.12	m2
*Av. side area of permeable stratum over test perio	1.254	m2
Total Exposed area =	2.374	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 8E-05 m/min or 1.31049E-06 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests IGSL

Contract: Capdoo, Clane, Co. Kildare Contract No. 21680
Test No. SA05 (First Cycle)
Engineer Westar Group
Date: 04.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Medium dense grey very silty GRAVELwith brick fragments	Dry
0.20	0.70	Firm brownish grey/grey sandy very gravelly SILT with rare cobbles up to 1	

Field Data

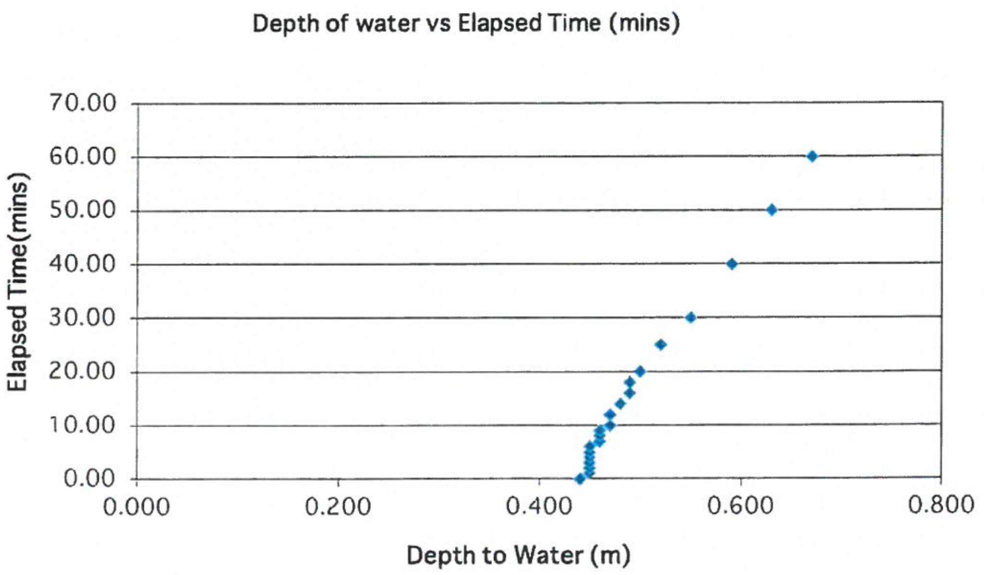
Depth to Water (m)	Elapsed Time (min)
0.440	0.00
0.450	1.00
0.450	2.00
0.450	3.00
0.450	4.00
0.450	5.00
0.450	6.00
0.460	7.00
0.460	8.00
0.460	9.00
0.470	10.00
0.470	12.00
0.480	14.00
0.490	16.00
0.490	18.00
0.500	20.00
0.520	25.00
0.550	30.00
0.590	40.00
0.630	50.00
0.670	60.00

Field Test

Depth of Pit (D)	0.70	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.00	m
Initial depth to Water =	0.44	m
Final depth to water =	0.670	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.70	m
Base area=	0.8	m2
*Av. side area of permeable stratum over test perio	0.522	m2
Total Exposed area =	1.322	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.0023 m/min or 3.8662E-05 m/sec



Soakaway Design f -value from field tests IGSL

Contract: Capdoo, Clane, Co. Kildare — Contract No. 21680
Test No. SA05 (Second Cycle)
Engineer Westar Group
Date: 04.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Medium dense grey very silty GRAVELwith brick fragments	Dry
0.20	0.70	Firm brownish grey/grey sandy very gravelly SILT with rare cobbles up to 1	

Field Data

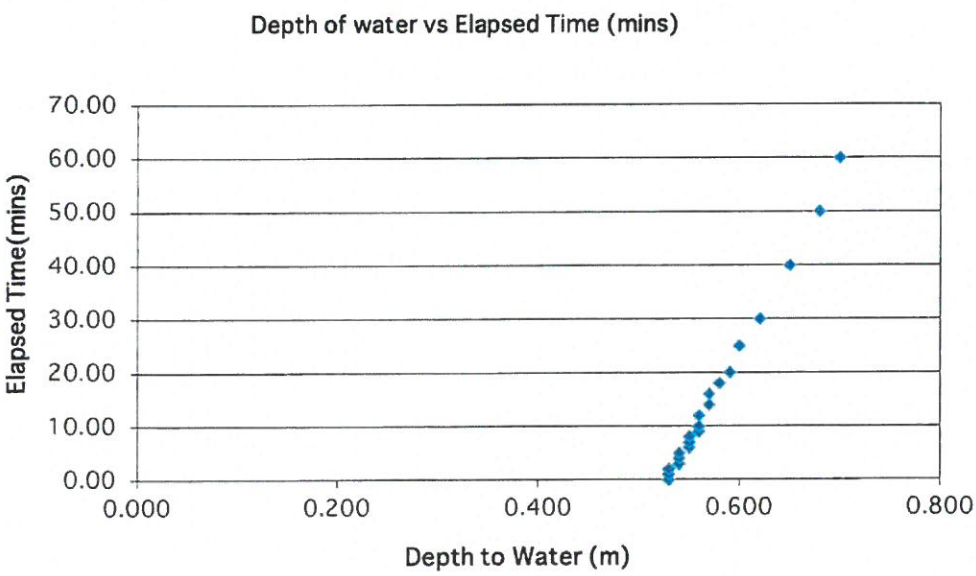
Depth to Water (m)	Elapsed Time (min)
0.530	0.00
0.530	1.00
0.530	2.00
0.540	3.00
0.540	4.00
0.540	5.00
0.550	6.00
0.550	7.00
0.550	8.00
0.560	9.00
0.560	10.00
0.560	12.00
0.570	14.00
0.570	16.00
0.580	18.00
0.590	20.00
0.600	25.00
0.620	30.00
0.650	40.00
0.680	50.00
0.700	60.00

Field Test

Depth of Pit (D)	0.70	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.00	m
Initial depth to Water =	0.53	m
Final depth to water =	0.700	m
Elapsed time (mins)=	60.00	
Top of permeable soil	0.20	m
Base of permeable soil	0.70	m
Base area=	0.8	m2
*Av. side area of permeable stratum over test perio	0.306	m2
Total Exposed area =	1.106	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.002 m/min or 3.41571E-05 m/sec



Soakaway Design f -value from field tests IGSL

Contract: Capdoo, Clane, Co. Kildare — Contract No. 21680
Test No. SA06 (First Cycle)
Engineer Westar Group
Date: 04.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Seepage at 1.8m
0.20	0.70	Stiff brown/brownish grey sandy CLAY with rare to occasional gravel	
0.70	1.30	Firm brownsh grey very sandy CLAY with occasional gravel	
1.30	2.00	Firm light brownish grey clayey SAND with rare gravel	

Field Data

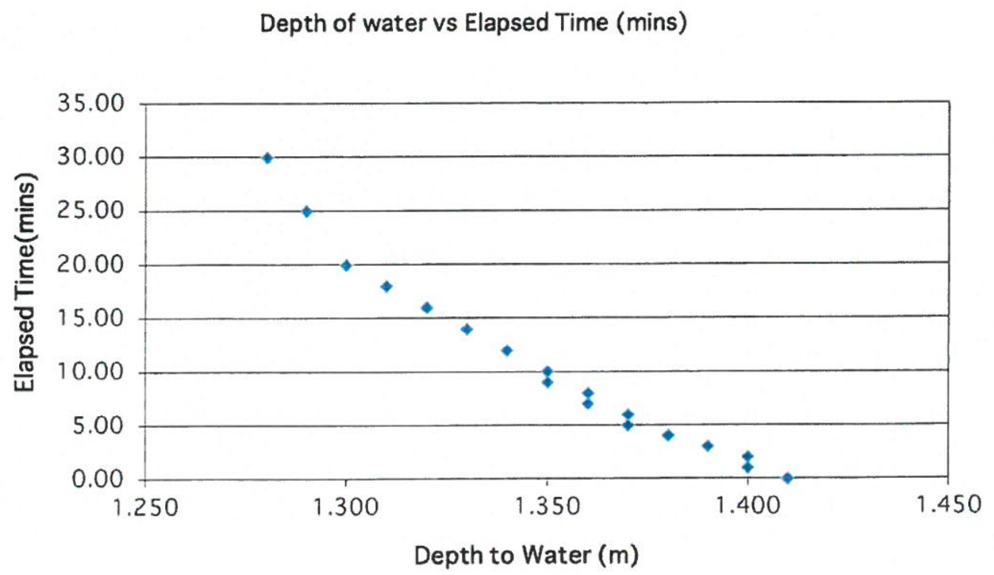
Depth to Water (m)	Elapsed Time (min)
1.410	0.00
1.400	1.00
1.400	2.00
1.390	3.00
1.380	4.00
1.370	5.00
1.370	6.00
1.360	7.00
1.360	8.00
1.350	9.00
1.350	10.00
1.340	12.00
1.330	14.00
1.320	16.00
1.310	18.00
1.300	20.00
1.290	25.00
1.280	30.00

Field Test

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.50	m
Initial depth to Water =	1.41	m
Final depth to water =	1.280	m
Elapsed time (mins)=	30.00	
Top of permeable soil	0.20	m
Base of permeable soil	2.00	m
Base area=	1.2	m2
*Av. side area of permeable stratum over test perio	3.013	m2
Total Exposed area =	4.213	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec



Soakaway Design f -value from field tests IGSL

Contract: Capdoo, Clane, Co. Kildare   Contract No. 21680
Test No. SA07 (First Cycle)
Engineer Westar Group
Date: 05.04.2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	Firm brown TOPSOIL	Seepage at 1.75m
0.20	0.90	Firm brown/light brown sandy CLAY with rare gravel	
0.90	2.10	Firm grey/brownish grey very sandy CLAY with occasional gravel, contains	
		very clayey sand pockets	

Field Data

Depth to Water (m)	Elapsed Time (min)
1.120	0.00
1.120	1.00
1.110	2.00
1.110	3.00
1.110	4.00
1.110	5.00
1.110	6.00
1.110	7.00
1.100	8.00
1.100	9.00
1.100	10.00
1.100	12.00
1.090	14.00
1.090	16.00
1.080	18.00
1.070	20.00
1.070	25.00
1.070	30.00

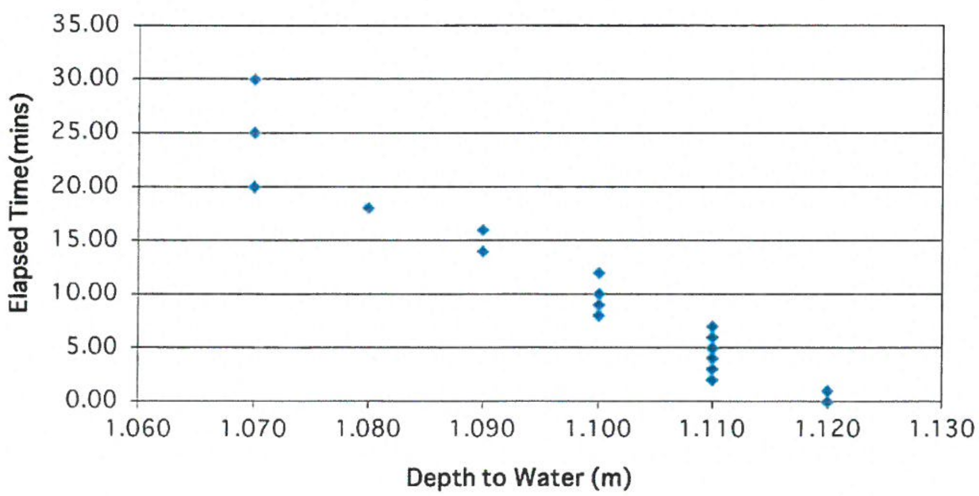
Field Test

Depth of Pit (D)	2.10	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.40	m
Initial depth to Water =	1.12	m
Final depth to water =	1.070	m
Elapsed time (mins)=	30.00	
Top of permeable soil	0.20	m
Base of permeable soil	2.10	m
Base area=	0.84	m2
*Av. side area of permeable stratum over test perio	4.02	m2
Total Exposed area =	4.86	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec

Depth of water vs Elapsed Time (mins)



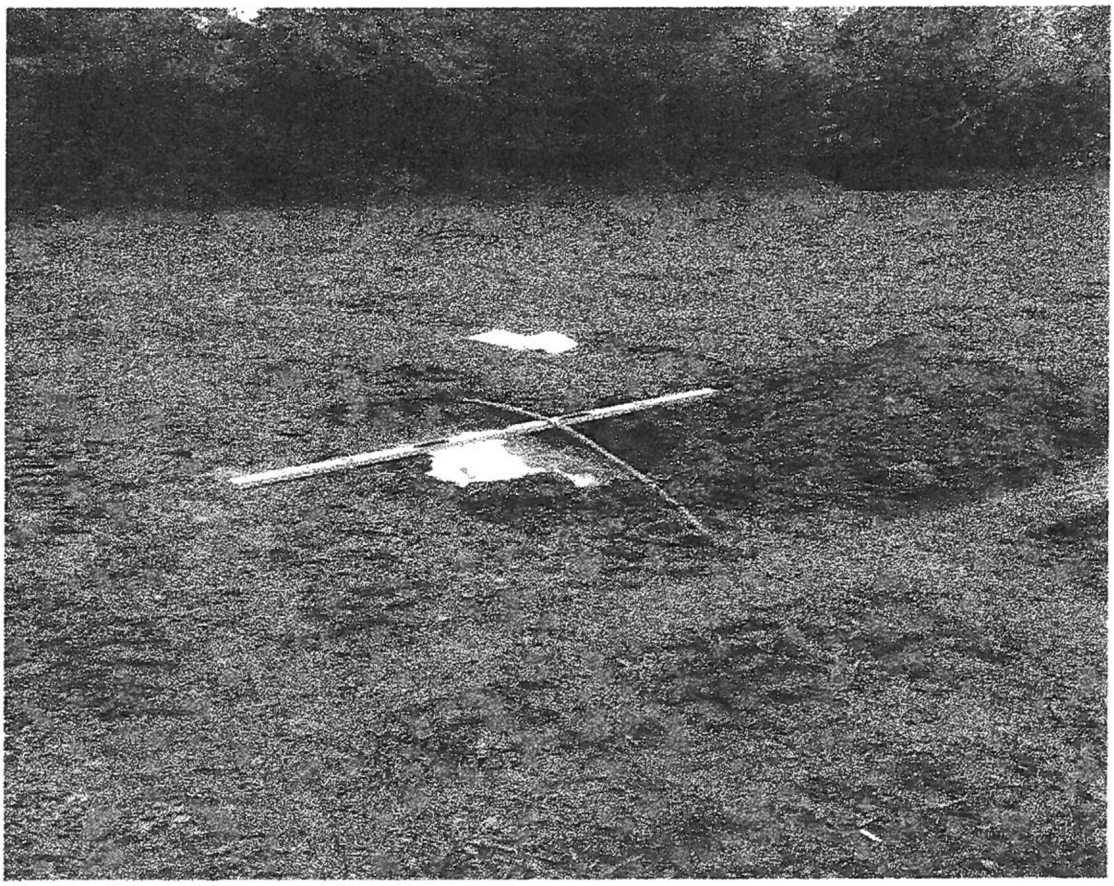
Appendix 2 Photographs

SA01 1 of 4

SA01 2 of 4

SA01 3 of 4

SA01 4 of 4



SA02 1 of 4

SA02 2 of 4

SA02 3 of 4

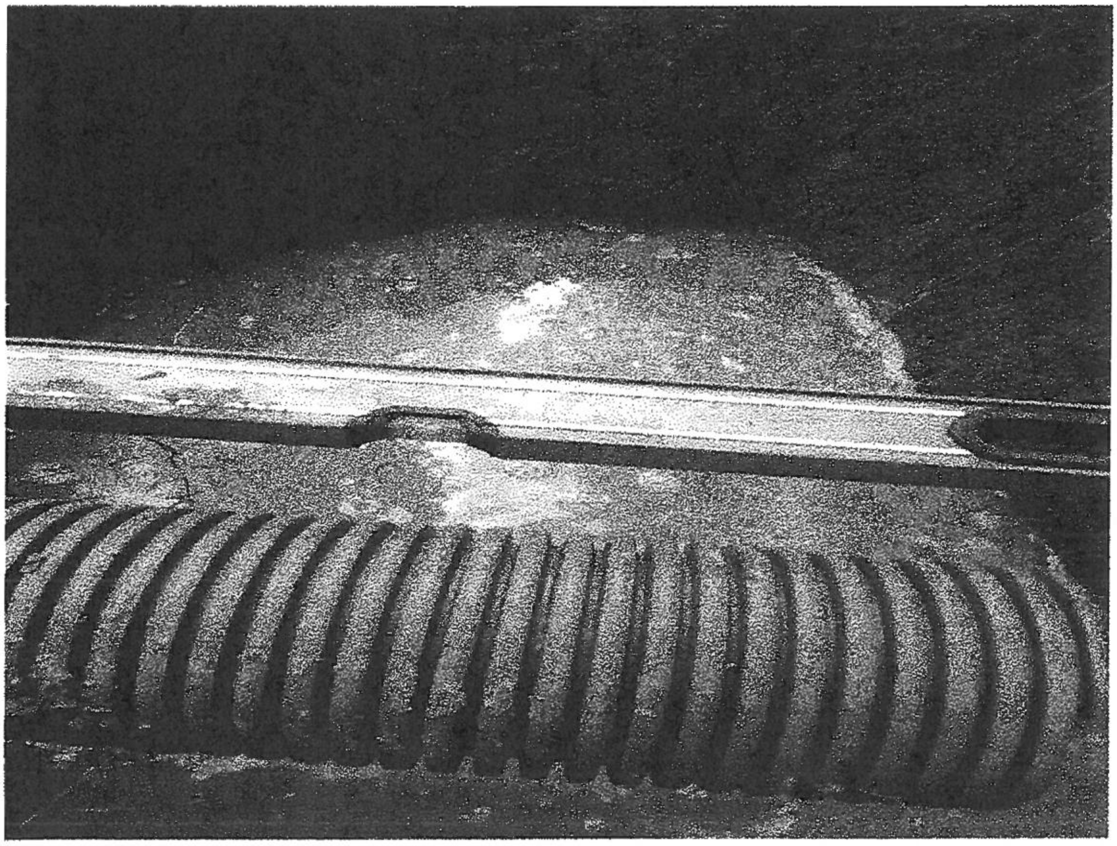
SA02 4 of 4

SA03 1 of 4

SA03 2 of 4

SA03 3 of 4

SA03 4 of 4



SA04 1 of 3

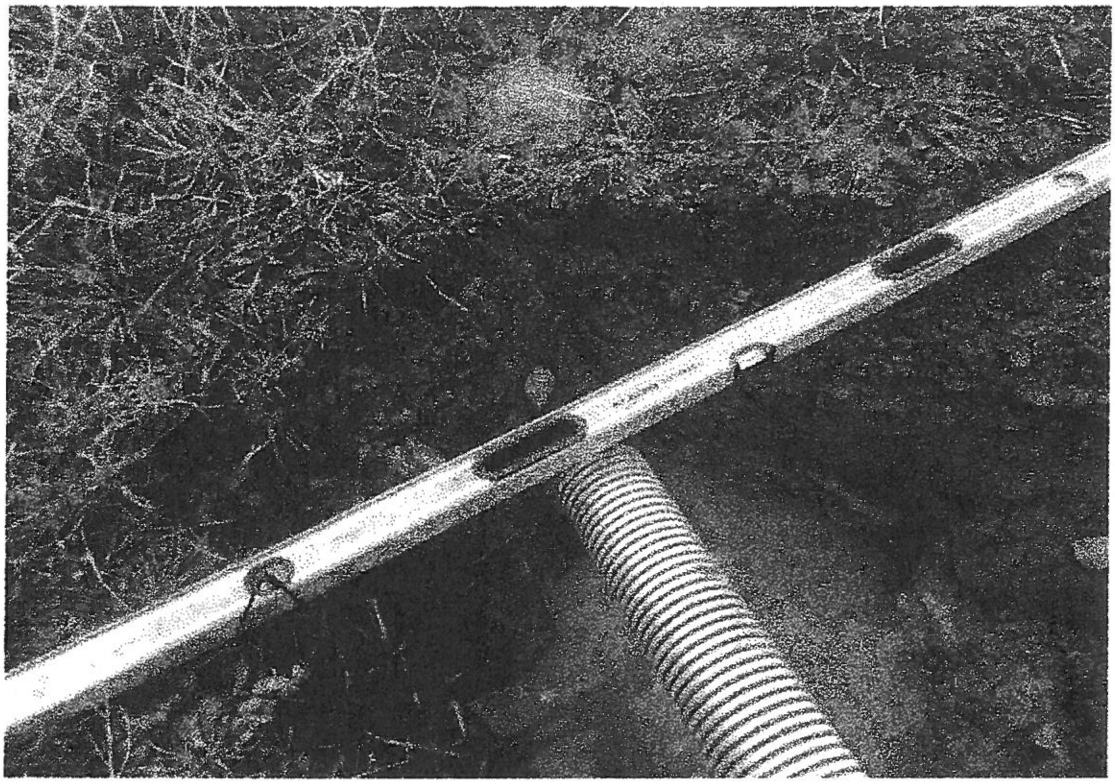
SA04 2 of 3

SA04 3 of 3

SA05 1 of 3

SA05 2 of 3

SA05 3 of 3



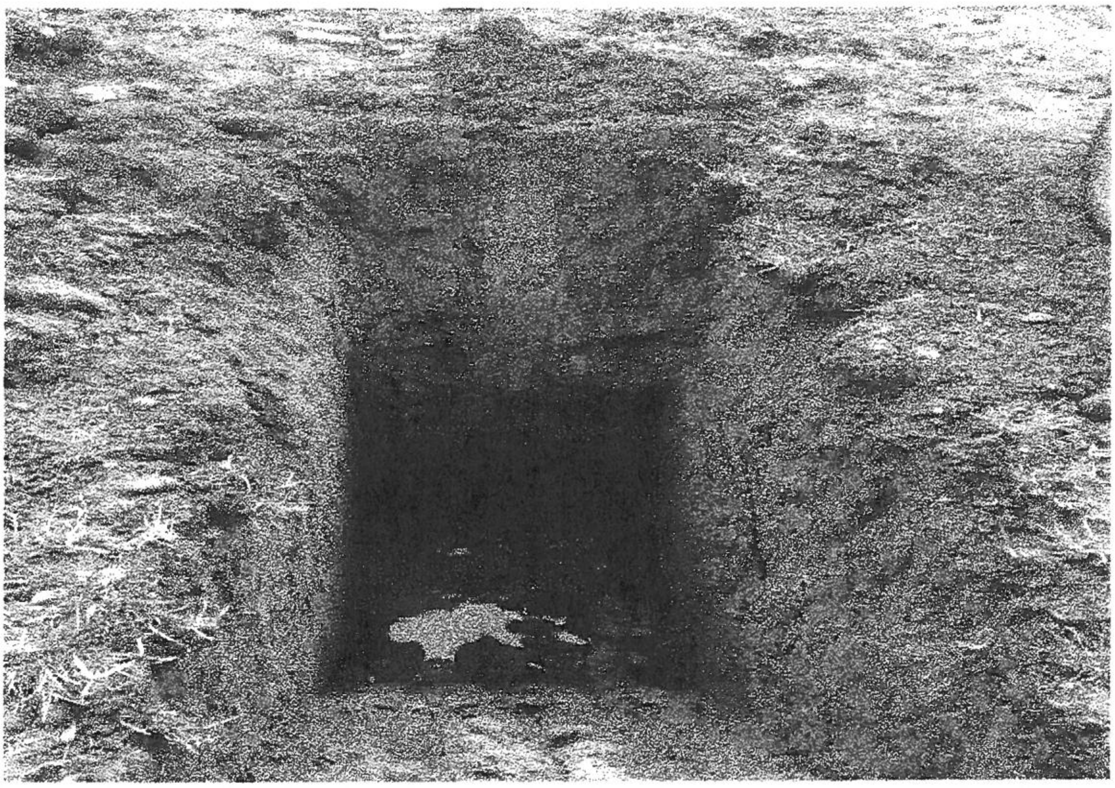
SA06 1 of 4

SA06 2 of 4

SA06 3 of 4

SA06 4 of 4

SA07 1 of 5



SA07 2 of 5

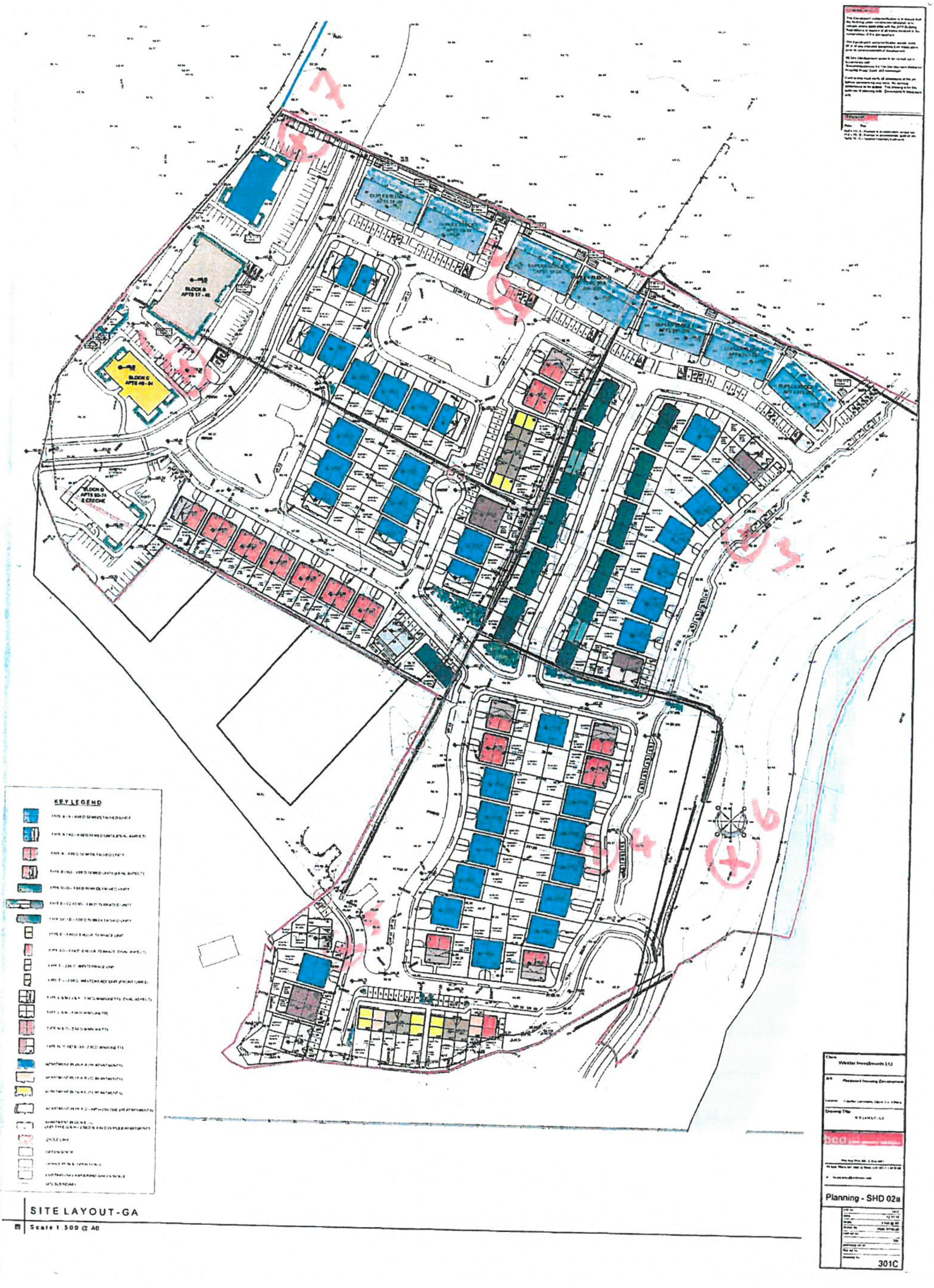
SA07 3 of 5

SA07 4 of 5

SA07 5 of 5

Appendix 3 Site Plan

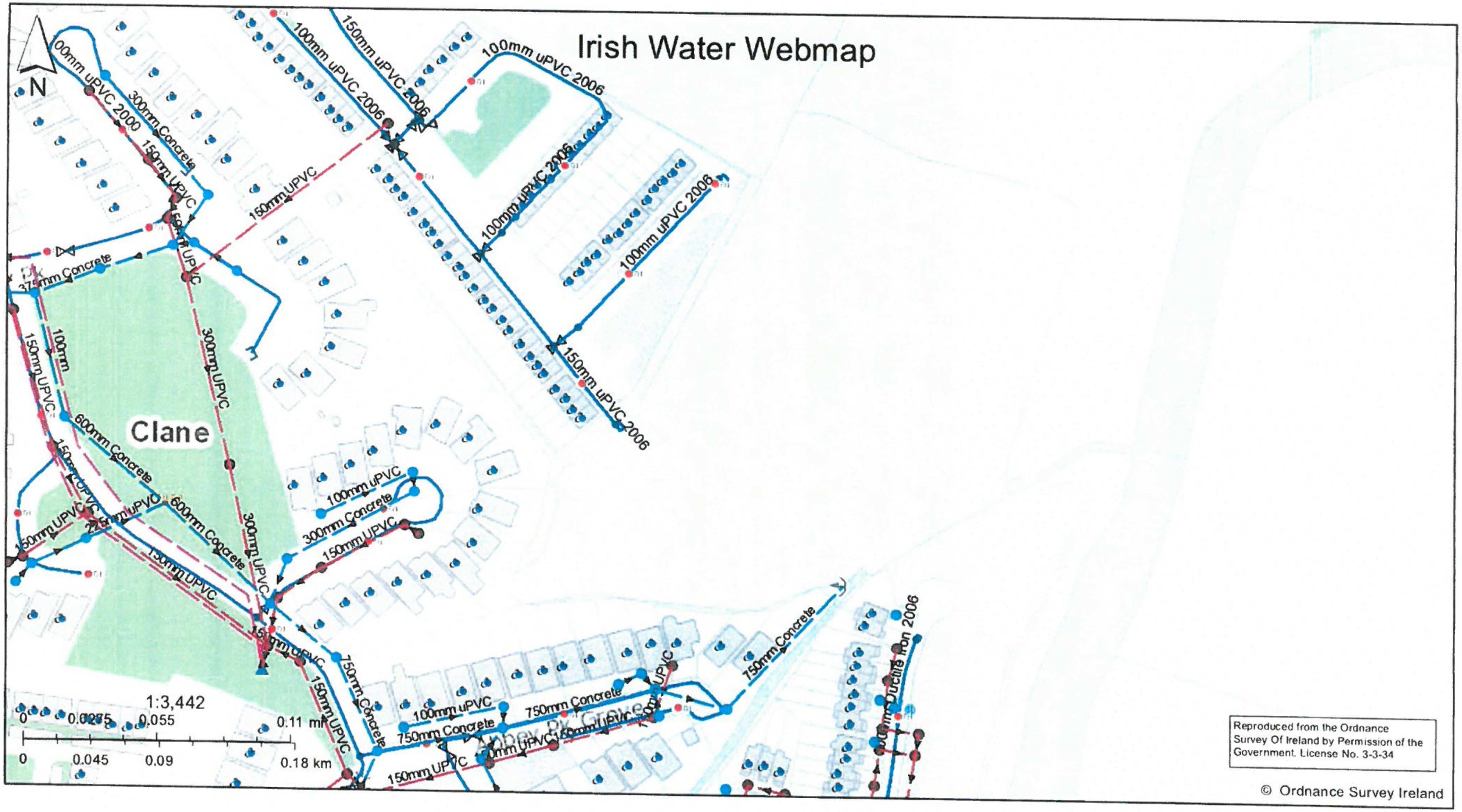

See travel times, traffic and nearby places
Autoline Car Sales
Lidl
Maxol Behan's
Capdoo Park
Capdoo Ave
R403
Tesco Metro
Kinesicare
Clane Motor Factors
Clane Tennis Club
Abbey Park View
Central Park
Central Park Ave
SA1
SA2
SA3
SA4
SA5
SA6
SA7
Map
Google
3D
Imagery ©2019 Google, Map data ©2019 Google Ireland Terms Send feedback 100 m



BLOCK B
APTS 17 - 40
BLOCK C
BLOCK D
& CRECHE
KEY LEGEND
SITE LAYOUT-GA
Scale 1:500 @ A0
Planning - SHD 02a
301C

Appendix G

IRISH WATER MAPS



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Legend

Stormwater Gravity Mains (Irish Water Owned)

Surface

Stormwater Gravity Mains (Non-Irish Water Owned)

Surface

Storm Manholes

Cascade

Catchpit

Hatchbox

Lamphole

Standard

Other; Unknown

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be

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