GORDON WHITE
CONSULTING ENGINEERS

# PROPOSED RESIDENTIAL DEVELOPMENT

# AT

# ROOKWOOD, STOCKING LANE, DUBLIN 14

## ACCESS & SERVICES REPORT

## TO ACCOMPANY PLANNING APPLICATION

**Project Number:** G1162

**Date:** 30 November 2020

**Revision:** 1.1

**Status:** For Planning

**Prepared By:**

Gordon White BA BAI, CEng MIEI, RConsEI

| Rev | Date | By | Revision |
|---|---|---|---|
| 0.2 | 07/04/21 | GW | Amended to reflect latest layouts |
| 1.0 | 12/05/21 | GW | Minor Amendments. For issue with Planning Application |
| 1.1 | 18/06/21 | GW | Minor Amendment to Contributing Areas in Section D3 |

# TABLE OF CONTENTS

# SECTION A INTRODUCTION & DEVELOPMENT CONSTRAINTS

## A.1 Introduction and Site Description

At the request of Donald & Brenda Weir of Rookwood, Stocking Lane, Gordon White Consulting Engineers have carried out a design of foul drainage, surface water drainage & potable water supply to serve a proposed residential development within their property.

The overall site for development comprises part of the gardens (inc. tennis court, swimming pool & outbuildings) of a large detached period residence.

The development comprises the construction of eleven new houses within the property, including new road and services to serve them as well as the realignment of the existing access road serving the existing property to serve it and the new development.

This report covers the following areas:

- Access
- Foul Water Drainage
- Potable Water supply
- Surface Water Drainage & Flood Risk
- Site Levels

# SECTION B ACCESS AND SITE LEVELS

## B.1 Existing situation

The existing property is served by a private access road from a gate at Stocking Lane.

## B.2 Proposed Access to the Development

The layout of the proposed access, including sight-lines drawn up in accordance with the Design Manual for Urban Roads and Streets (DMURS) is shown on the following drawings:

G1162-05 Rev G: Sight Triangles and Main Access Road at 1:500
G1162-06 Reg G: Sight Triangles at 1:200

Sightlines at the existing access gate are extremely poor due to the location of the gate and the existing curved walls at the gate leading to piers that are at the edge of the carriageway at Stocking Lane. As part of this proposed development it is proposed to relocate this gate to provide a safer access to Rookwood House onto Stocking Lane and provide access to the proposed development within the lands. Following consultation with South Dublin County Council the layout of the new entrance has been designed to reflect the existing entrance and has been set back 3.0m from the carriageway of Stocking Lane to allow for a future footpath and / or cycle-path here, an objective of South Dublin County Council for access to the Dublin Mountains, and the location been adjusted in order to allow the required sightlines without the need to modify the existing frontages of either of the properties on either side.

## B.3 Main Access Road

The main access road, Road 1, to serve the existing house and the two areas of the proposed development is proposed as a 5m wide access road with standard SMA surfacing. This leads from the proposed gate at Stocking Lane to the junction between this road, the access to Rookwood House, Road 2 serving Houses 2 to 5 and Road 3 serving houses 6 to 10. Road 1 also serves House No. 1.

It is a priority of the proposed development to preserve the exiting mature trees within the grounds and that the layout, levels and construction of the proposed roads take this into account.

This proposed road rises at a steady gradient of 1:50 from the junction with Stocking Lane then at an increased gradient of 1:12.5 (8%) to bring the road level up to above existing ground level. From there the gradient approximately follows the existing topography with levels set somewhat above existing ground level. This is to allow for the road to be constructed over the existing topsoil layer without disturbing the roots of the large oak tree at the top of the road. In order to provide for accessible pedestrian access working alongside this road, and most particularly with respect to the section at the 1:12.5 gradient, the footpath is decoupled from the roadway in order that it can follow a shallower gradient over a more circuitous route.

The road will be generally of standard construction however in areas where the roots of large mature trees which are to be preserved as part of the works pass below the proposed road it is proposed that a cell-web sub-base be used to allow the road to be constructed over the roots and topsoil. The main access roadway is a minimum of 6m from the axis of the existing tree and, as such, would be outside the extent of the tap roots, but it would be expected that there would be lateral roots within the soil below the road. It is intended that these be left in situ and the new road built over them using the cell-web system. A brochure for this Cell-web is included in Appendix C of this report.

We have included a swept path analysis of the main road showing that a fire tender and a refuge truck can enterm turn and leave within the constraints of the main access road

## B.4 Minor Access Roads

Roads 2 & 3, the minor access roads, serve house numbers 2 to 5 and 6 to 10 respectively. It is proposed that these be of a different appearance and character to that of the main access road. It is not proposed that these roads be taken in charge.

The proposed surfacing of this road is to be coloured to differentiate them from the main access road. This may be achieved by a coloured macadam, a black macadam with a coloured chip or mastic-applied surface coloured grit material.

The levels of the proposed internal road are generally set to follow the exiting topography, however in areas close to existing trees that are to be retained the road level is set to above the existing ground level. It is proposed in these areas that the existing topsoil, and tree routes within it, be retained and the road built, using the cell-web system referred to in Section B.3, entirely above the topsoil. Note whilst the large oak tree referred to in Section B.3 is 6m from the proposed road some of the trees to be retained at the minor access road are much closer, hence the need to ensure that the road level is well above the topsoil.

## B.5 Parking

The car spaces provided are as per the maximum parking rates for residential development (Zone 1) set out in the 2016-2022 Development Plan, i.e. 1.5 spaces for 2-bedroom houses and 2.0 spaces for 3+ bedroom houses.

Excluding the existing house and its parking, in total the new development provides 22no. spaces, of which four are visitors' spaces, four have EV charging points, and three are designated accessible.

In accordance with the Development Plan, up to 10% of spaces are to have EV charge points, and the remainder of parking spaces are to be constructed to be capable of accommodating future charge points.

Note there is a 6m minimum distance provided for turning into perpendicular parking spaces along the shared surfaces.

## B.6 Drawings submitted

The following drawings cover the layout and levels of the proposed roads.

G1162-05 Rev G: Sight Triangles and Main Access Road at 1:500
G1162-06 Reg G: Sight Triangles at 1:200
G1162-07 – Swept Paths
G1162-10 – Proposed Road Layout and Levels
G1162-20 – Proposed Road Longitudinal and Typical Cross Sections

# SECTION C FOUL WATER DRAINAGE

## C.1 Existing Situation

The foul drainage from the existing residence on the property, Rookwood House, discharges by way of a 100mm private drain to an existing private sewer within the Rookwood View apartment development. This private drain also collects the foul drainage from the adjacent house, "Rookwood Lodge"

## C.2 Proposed New Foul Sewer Outfall

It is proposed that the foul drainage from the proposed new development, including the connections from the existing houses Rookwood House and Rookwood Lodge, be discharged from the point of exit from the development to a new connection to the existing public sewer at an existing manhole at the bottom of Stocking Lane by way of a new 225mm sewer within Stocking Lane.

## C.3 Capacity of Existing Network

Irish Water have confirmed, by way of confirmation of feasibility, that there is capacity in the drainage network to provide drainage for these proposed houses. This confirmation of feasibility is appended to this report.

## C.4 Proposed Foul Drainage Within the Development

It is proposed that new foul drainage within the development be of 150mm sewers at the minimum gradients set out in the table in Section 3.6 of The Irish Water Code of Practice for Wastewater Infrastructure.

As with the roads it is a priority of the development that the layout and design of the proposed new foul sewers take into account the objective that existing trees within the property be preserved and retained. The layout of and detailing of the sewers has taken into account the Irish Water drawing STD-WW-06 Rev 2 – "Restrictions on Wastewater Infrastructure Works Adjacent to Trees". In particular:

- No new sewer is proposed within 1m of the external face of a tree trunk,
- New sewers are kept to a practical minimum within the "precaution area" of radius 4 times that of the girth of an existing tree
- Where sewers are to be laid within the "precaution area" they are to be:
    - Of welded polyethylene pipes to prevent root ingress at joints and
    - Excavated by air-spade or trenchless technology, or a combination of both to avoid damage to existing roots

## C.5 Foul Sewerage Drawings

The following drawings cover the layout and levels of the proposed foul sewers and drains.

G1162-11 – Proposed Foul Sewer Layout Plan
G1162-21 – Proposed Foul Sewer Longitudinal Sections & Typical Details

# SECTION D SURFACE WATER DRAINAGE AND MANAGEMENT

## D.1 Existing Situation

The existing house within the property appears to drain to an existing soak-away within the garden. There is a small, partially piped and partially channelised, ditch passing through the Southern periphery of the garden. This provides drainage to a part of the existing property. There is also some background flow from the adjacent property to the South West. Note the small flow in this channel from upstream of the proposed development lands is from lands which are the subject to either current or recent planning applications for development and the surface water design for these proposed developments will eliminate discharge from those lands to this channel. It is proposed that this pipe / channel be retained as is until such time as it is made redundant as a result of the development the small area of lands that is within its catchment but outside the lands the subject of this application at which point it will be closed off.

There is an existing 225mm public surface water sewer in Stocking Lane on the frontage of the development.

## D.2 Proposed Surface Water Outfall & Masterplan

It is proposed to provide a new surface water discharge, attenuated to assessed green-field flow, to the existing surface water sewer in Stocking Lane.

It is proposed that the drainage of the existing house be left as it is and that any residual flow in the channel / pipe on the Southern periphery of the site be collected and diverted to the proposed swale through the development.

## D.3 Proposed Surface Water Drainage, Attenuation & Management for the development

### Discharge Attenuation and Balancing Storage

It is proposed that the discharge to the existing surface water sewer in Stocking Lane be attenuated to assessed green-field flow with balancing storage being provided within an underground surface water storage and soakage system within the main green.

In order to provide balancing storage to the attenuated discharge it is proposed to provide StormTech system attenuation storage areas below the main green area of the development. The location and layout of this attention storage system has been set in order that it not interfere with the roots of trees which are to be protected and retained. It is acknowledged that other similar systems are available. The StormTech System provides storage in a combination of rows of arched permeable underground chambers and high-voids stone above, below, between and around these chambers. This system has been chosen as it provides the following advantages

- In the un-tanked scenario, which is proposed here, the system allows stored water to percolate to ground whilst it is being stored which reduces the total discharge to the surface water sewerage network
- The modular system is flexible and can be laid out to suit landscaping
- The storage area is protected from silt build-up by water entering the system through an isolator row which is surrounded with a geotextile. This isolator row is accessible and can be surveyed and, if required, flushed out with relative ease.
- Percolation of water through the high-voids store reduces any pollution in the run-off

A brochure for this is included in Appendix E.

Surface water drainage and attenuation calculations are included in Appendix D and are summarised below:

**Greenfield Flow**

**A** = Catchment Area = 0.64 Ha (Note: excludes the existing house & gardens not being developed)

**SAAR** = 1,046mm

**Soil** = 0.3 (Soil Type 2)

**Qbar** = 1000 X {0.00108 x A^0.89 x (SAAR)^1.17 x (SOIL)^2.17} = 3.02 l/s

30-Year Growth factor = 2.13

**Greenfield Flow** (30-year) = 6.42 l/s

**Developed Areas**

| Contributing Areas | | | | |
|---|---|---|---|---|
| Road/ Car Parking | 0.173 | Hectares | 90 | % Runoff Coefficient |
| Paths | 0.055 | Hectares | 90 | % Runoff Coefficient |
| Roof Areas | 0.076 | Hectares | 95 | % Runoff Coefficient |
| Public Open Space/ Verges | 0.180 | Hectares | 17* | % Runoff Coefficient |
| Private Open Space | 0.200 | Hectares | 17* | % Runoff Coefficient |
| **Total** | **0.64** | Hectares | 0.33 | Ha Equivalent Impermeable Area |

*pre-development run-off coefficient based on the greenfield flow rate for the critical storm

**Source Control prior to entry to the surface water drainage system**

In addition to the attenuation of the discharge prior to connection to the existing surface water sewer and provision of balancing storage the following source control measures are proposed to reduce or slow the discharge to the surface water drainage system:

- Use of water butts on downpipes to the rear of houses
- Use of permeable brick paving for on-curtilage parking areas
- Drainage of the run-off from Road 3 into a swale alongside the road rather than via gullies directly into the surface water sewerage

## D.4 Materials and Construction

All new sewers and drains, and the connection into the existing drain will be constructed in accordance with the Greater Dublin Regional Code of Practice for Drainage Works

## D.5 Scoping Flood Risk Assessment

The site in question is covered by the corners of OPW Flood Extents Mapping maps OSWS/EXT/EXT/UA/CURS/103 and falls well above the 1000-year EAP Level. The 1000-year flood level is circa 82.25m OD whereas the lowest proposed house level is 88.0m OD for No 1.

There are no recorded past flood levels on the site.

We, therefore, do not see any significant risk of the flooding of the proposed properties.

## D.6 Surface Water Drainage Drawings

The layout of existing and proposed surface water drainage is shown on drawing G1162-12 E with the design areas referred to above shown on drawing G1162-15 Rev B

# SECTION E POTABLE WATER SUPPLY

## E.1 Introduction

There are a number of watermains in Stocking Lane at the proposed development access. It is proposed to connect to whichever on of these Irish Water consider to be appropriate.

## E.2 Proposed Development

Per the above it is proposed to connect the development from the appropriate existing watermain in Stocking Lane. The proposed layout of watermain network is shown on drawing G1162-13 Rev B and is based on Irish Water Standards.

As noted in Section C4 of this report the retention of existing mature trees as part of this proposed development is an objective of the design. It is proposed that the relationship of watermains to the existing trees be in accordance with the principles set out on Irish Water drawing STD-W-12 Rev 2. Additional protections to the watermains within the "Precaution" area, where such a location is unavoidable, to be agreed with Irish Water

## E.3 Capacity of Existing Network

Irish Water have confirmed, by way of confirmation of feasibility, that there is capacity in the watermain network to provide service to these proposed houses. This confirmation of feasibility is appended to this report. Note is it not clear in this to which of the watermains in Stocking Lane the connection is to be made, but this can be clarified with the Connection Application.

## E.4 Materials and Construction

All new watermains and fittings, and the connection into the existing watermain, will be constructed in accordance the requirements the latest revision of the Irish Water publication "Water Infrastructure Standard Details"

# SECTION F CONCLUSION

The proposed development can be readily facilitated by existing available roads and services and developed in accordance with current guidelines.

# Appendix A

## Drawing schedule

| Drawing No. | Rev | Drawing Title |
|---|---|---|
| G1162-05 | H | Site Triangles and Main Access Road at 1:500 |
| G1162-06 | H | Site Triangles at 1:200 |
| G1162-07 | H | Swept Path (AutoTrack) Assessment of Access Road |
| G1162-10 | D | Proposed Road Layout and Levels |
| G1162-11 | D | Proposed Foul Drainage Layout Plan |
| G1162-12 | E | Proposed Surface Water Drainage Layout Plan |
| G1162-13 | D | Proposed Watermain Layout Plan |
| G1162-15 | B | Surface Water Attenuation Contribution Areas |
| G1162-20 | B | Proposed Road, Longitudinal and Typical Cross Sections |
| G1162-21 | B | Proposed Foul Drainage Longitudinal Sections |
| G1162-22 | B | Proposed Surface Water Drainage Longitudinal Sections |

# Appendix B

# Irish Water Confirmation of Feasibility

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

Gordan White
1st Floor, 8 Riverwalk
Citywest Campus
Dublin 24. Co. Dublin

1 April 2019

Dear Gordan White,

**Re: Connection Reference No CDS19001046 pre-connection enquiry - Subject to contract | Contract denied**

**Connection for Mixed Use Development of 13 unit(s) at Rookwood House, 1 Stocking Lane, Co. Dublin.**

Irish Water has reviewed your pre-connection enquiry in relation to a water connection at Rookwood House. 1 Stocking Lane. Co. Dublin.

Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the network(s), as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network(s) can be facilitated.

In order to complete the proposed connection at the Premises, the Irish Water Sewer network will have to be extended by approximately 85m. Irish Water currently does not have any plans to extend its network in this area. Should you wish to consider extending your private water infrastructure to a point to connect to the Irish Water network, please contact Irish Water.

There is an ongoing development across the road from this site. If this progresses and the infrastructure is taken in charge this could present an alternative connection point for the sewer in the future pending access and landowner permission. This would require a shorter sewer extension depending on the layout within the site across the road.

All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details. A design proposal for the water and/or wastewater infrastructure should be submitted to Irish Water for assessment. Prior to submitting your planning application, you are required to submit these detailed design proposals to Irish Water for review.

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 at a later date.

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 of Utilities.

If you have any further questions, please contact Brian O'Mahony from the design team on 022 52205 or email bomahony@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,

**Maria O'Dwyer**

**Connections and Developer Services**

# Appendix C

# Cellweb Brochure

# Cellweb® TRP

## Tree root protection


**Cellweb® Tree Root Protection System provides a flexible and permeable solution for protecting tree roots whilst creating a robust and stable platform when creating vehicular or pedestrian access paths.**

Cellweb® TRP has a unique cellular structure and perforated cell walls which reduces the vertical load pressure on sub soils to tree roots, therefore preventing damage. With clean granular materials as infill, air and moisture can reach the roots to encourage healthy prolonged growth.

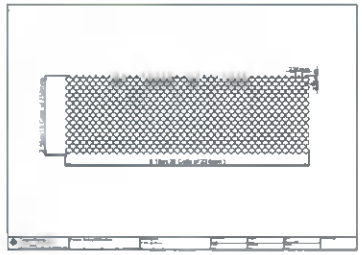
With no-dig solutions being the preferred option, Cellweb® TRP is ideal as only the surface vegetation need be removed. As well as avoiding disruption to the roots, this reduces construction times and costs.

By using the Cellweb®TRP, sub base depths can be reduced significantly, in most cases by as much as 50%, providing further cost savings. The use of Cellweb®TRP also prevents surface rutting; increasing the long-term performance and aesthetics of the final surface.

Geosynthetics Limited provides a full engineering service, including the provision of surveys, structural designs, CAD drawings and installation supervision at no cost to the client.

### Benefits

- No dig solution
- Prevents compaction of sub soils
- Only guaranteed system of its kind on the market
- Provides moisture and air paths
- Reduces sub base depths
- Independently tested
- Environmentally friendly
- Simple to install



# Appendix D

## Surface water drainage and attenuation calculations

| | | | |
|---|---|---|---|
| **Project No.:** | G1162 | **Project** | Lands at Rookwood<br>SAAR from UKSuds.co.uk, rainfall from Met Eireann |
| | | **Drawing Ref.** | G1162 |

## DESIGN FOR ROOF, LANDSCAPE AND CARPARK AREAS


| | | | |
|---|---|---|---|
| GORDON WHITE | | **Design by:** | GW |
| **Consulting Engineers** | | **Date:** | 12/11/2020 |
| 1st Floor, 8 Riverwalk | tel. (01) 479 6396 | **Revision:** | - |
| Citywest Business Campus | mob. 086 230 6216 | **Date:** | - |
| Dublin 24 | E-mail: | **Rev. by:** | - |
| | mail@gwce.ie | | |


## DESIGN SUMMARY SHEET

| | |
|---|---|
| DESIGN DEVELOPMENT AREA | 0.68 Ha |
| ATTENUATED DISCHARGE; 30-YEAR RETURN PERIOD STORM | 6.80 l/s |
| ATTENUATION BALANCING STORAGE REQUIRED; 30-YEAR STORM | 107 m3 |
| ATTENUATED DISCHARGE; 100-YEAR RETURN PERIOD STORM | 8.34 l/s |
| ATTENUATION STORAGE REQUIRED; 100-YEAR STORM | 176 m3 |
| ADDITIONAL STORAGE FOR 100-YEAR OVER 30-YEAR STORM | 69 m3 |

**Project No.:** G1162 **Project** Lands at Rookwood
**Drawing Ref.** G1162

| | | | |
|---|---|---|---|
| **Gordon White** | | **Design by:** | GW |
| **Consulting Engineers** | | **Date:** | 12/11/2020 |
| 1st Floor, 8 Riverwalk | tel. (01) 479 6396 | **Revision:** | - |
| Citywest Business Campus | mob. 086 230 6216 | **Date:** | - |
| Dublin 24 | E-mail: | **Rev. by:** | - |
| | [redacted] | | |

# ASSESSMENT OF GREENFIELD RUN-OFF

## STEP 1

**Contribution Areas**

| | | | Impermable Area |
|---|---|---|---|
| Road/ Car Parking | 0.173 | Hectares | |
| Paths | 0.055 | Hectares | |
| Roof Areas | 0.076 | Hectares | |
| Public Open Space/ Verges | 0.180 | Hectares | |
| Private Open Space | 0.200 | Hectares | |
| Total | **0.6833** | **Hectares** | [redacted] |
| Area = | **0.0068** | **km2** | |

## STEP 2

Standard Annual Average Rainfall
SAAR = 1045 mm

Data taken from UKSuds website Naas Road, Newbridge
https://uksuds.worldsecuresystems.com/drainage-calculation-tools/greenfield-runoff-rate-estimation

## STEP 3

Percentage of Each Soil Type

| | | |
|---|---|---|
| G1 % | = | 0 |
| G2 % | = | 100 |
| G3 % | = | 0 |
| G4 % | = | 0 |
| G5 % | = | 0 |

## STEP 4

SOIL = Soil Index = (0.1591 * 0.3052 + 0.40S3 + 0.45 S4 + 0.50S5)/(S2 + ) = 0.30

## STEP 5

$Q_{BAR}$ = 1000 X (0.00108 x A^0.89(SAAR)^1.17(SOIL)^2.17) (l/s)

| | | | |
|---|---|---|---|
| $Q_{BAR}$ | **0.0032 m3/s** | **3.19 l/s** | |

## STEP 6

Calculate Maximum Allowable Discharges:

| Growth Factors: | |
|---|---|
| 1 Year | 0.85 |
| 30 Year | 2.13 |
| 100 Year | 2.61 |

| **Return Period** | **1yr** | **30 year** | **100 year** |
|---|---|---|---|
| **Calcualted Max Allowable Discharge (l/s)** | **2.72** | **6.80** | **8.34** |

**Project No.:** G1162 **Project** Lands at Rookwood
**Drawing Ref.** G1162

| | | | |
|---|---|---|---|
| Gordon White | | **Design by:** | GW |
| Consulting Engineers | | **Date:** | 12/11/2020 |
| 1st Floor, 8 Riverwalk | tel (01) 479 6396 | **Revision:** | - |
| Citywest Business Campus | mob 086 230 6216 | **Date:** | - |
| Dublin 24 | E-mail | **Rev. by:** | - |

## SURFACE WATER ATTENUATION DESIGN FOR A 30-YEAR RETURN PERIOD STORM

**AREA:** 0.68 Ha

Notes Rainfall Data used, was issued By Met Eireann for Naas Road, Newbridge

Design Outflow = Allowable Outflow based planning permissio[illegible] for 30 year storm

**Greenfield Flow** 6.80 l/s

**Area of Attenuation** 295.00 m2

**Infiltration Rate** 0.0000013 m/s

| Duration | Rainfall | Plus 10% for climate change | Rainfall | Runoff (m3) | | | | | Total Inflow | Allowable Outflow | Inflow - Outflow | Percolation to Ground | Storage Required | Duration (hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Minutes | mm | mm | m3/ha | Road/ Car Parking | Paths | Roof Areas | Public Open Space/ Verges | Private Open Space | m3 | m3 | m3 | m3 | m3 | hrs |
| 5 | 12.40 | 13.64 | 136.40 | 21.24 | 6.73 | 9.85 | 4.16 | 4.64 | 46.61 | 2.04 | 44.57 | 0.12 | 44.45 | 0.08 |
| 10 | 17.30 | 19.03 | 190.30 | 29.63 | 9.39 | 13.74 | 5.80 | 6.47 | 65.03 | 4.08 | 60.94 | 0.23 | 60.71 | 0.17 |
| 15 | 20.40 | 22.44 | 224.40 | 34.94 | 11.07 | 16.20 | 6.84 | 7.63 | 76.68 | 6.12 | 70.55 | 0.35 | 70.21 | 0.25 |
| 30 | 26.00 | 28.60 | 286.00 | 44.53 | 14.11 | 20.65 | 8.72 | 9.72 | 97.73 | 12.25 | 85.48 | 0.70 | 84.78 | 0.5 |
| 60 | 33.10 | 36.41 | 364.10 | 56.69 | 17.96 | 26.29 | 11.10 | 12.37 | 124.41 | 24.50 | 99.92 | 1.39 | 98.53 | 1 |
| 120 | 42.20 | 46.42 | 464.20 | 72.28 | 22.89 | 33.52 | 14.16 | 15.77 | 158.62 | 48.99 | 109.62 | 2.78 | 106.84 | 2 |
| 240 | 53.80 | 59.18 | 591.80 | 92.14 | 29.19 | 42.73 | 18.05 | 20.11 | 202.22 | 97.99 | 104.23 | 5.56 | 98.67 | 4 |
| 360 | 62.00 | 68.20 | 682.00 | 106.19 | 33.64 | 49.24 | 20.80 | 23.18 | 233.04 | 146.98 | 86.06 | 8.35 | 77.71 | 6 |
| 720 | 79.00 | 86.90 | 869.00 | 135.30 | 42.86 | 62.74 | 26.50 | 29.53 | 296.94 | 293.97 | 2.97 | 16.69 | -13.72 | 12 |
| 1440 | 100.80 | 110.88 | 1108.80 | 172.64 | 54.69 | 80.06 | 33.82 | 37.68 | 378.88 | 587.93 | -209.05 | 33.39 | -242.44 | 24 |
| 2880 | 114.80 | 126.28 | 1262.80 | 196.62 | 62.28 | 91.17 | 38.51 | 42.91 | 431.50 | 1175.86 | -744.36 | 66.78 | -811.14 | 48 |

**Critical Storm Duration (hrs)** 2

### Contribution Areas

| | | | | |
|---|---|---|---|---|
| Road/ Car Parking | 0.173 | Hectares | 90 | % Runoff Coefficient |
| Paths | 0.055 | Hectares | 90 | % Runoff Coefficient |
| Roof Areas | 0.076 | Hectares | 95 | % Runoff Coefficient |
| Public Open Space/ Verges | 0.180 | Hectares | 17 | % Runoff Coefficient |
| Private Open Space | 0.200 | Hectares | 17 | % Runoff Coefficient |
| Total | 0.683 | Hectares | 0.29 | Eq Imp Area (Ha) |

| | | | | |
|---|---|---|---|---|
| Greenfield flow = | | 6.80 | GDSDS Formula | |
| Rainfall for Critical Duration, 30 year storm = | | 42.20 | mm = | 40.05 l/s |
| | => runoff coeficient for greenfield area = | 6.80 / 40.05 | 17.0% | |

**Project No.:** G1162 **Project** Lands at Rookwood
**Drawing Ref.** G1162

| | | | |
|---|---|---|---|
| Gordon White | | **Design by:** | MW |
| Consulting Engineers | | **Date:** | 12/11/2020 |
| 1st Floor, 8 Riverwalk | tel (01) 479 6396 | **Revision:** | - |
| Citywest Business Campus | mob 086 230 6216 | **Date:** | - |
| Dublin 24 | E-mail: | **Rev. by:** | - |

## SURFACE WATER ATTENUATION DESIGN FOR A 100-YEAR RETURN PERIOD STORM

**AREA:** 0.68 Ha

Notes Rainfall Data used was Issued By Met Eireann for **Naas Road, Newbridge**

Design Outflow = Allowable Outflow based planning permission for 100 year storm

**Greenfield Flow** 8.34 l/s

**Area of Attenuation** 295.00 m2

**Infiltration Rate** 0.0000013 m/s

| Duration | Rainfall | Plus 10% for climate change | Rainfall | Runoff (m3) | | | | | Total Inflow | Allowable Outflow | Inflow - Outflow | Percolation to Ground | Storage Required | Duration (hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Minutes | mm | mm | m3/Ha | Road/ Car Parking | Paths | Roof Areas | Public Open Space/ Verges | Private Open Space | m3 | m3 | m3 | m3 | m3 | hrs |
| 5 | 17.90 | 19.69 | 196.90 | 30.66 | 9.71 | 14.22 | 8.31 | 9.26 | 72.16 | 2.50 | 69.66 | 0.12 | 69.54 | 0.08 |
| 10 | 24.90 | 27.39 | 273.90 | 42.65 | 13.51 | 19.78 | 11.57 | 12.89 | 100.38 | 5.00 | 95.38 | 0.23 | 95.15 | 0.17 |
| 15 | 29.30 | 32.23 | 322.30 | 50.18 | 15.90 | 23.27 | 13.61 | 15.16 | 118.12 | 7.50 | 110.62 | 0.35 | 110.27 | 0.25 |
| 30 | 37.00 | 40.70 | 407.00 | 63.37 | 20.07 | 29.39 | 17.19 | 19.15 | 149.16 | 15.01 | 134.15 | 0.70 | 133.46 | 0.5 |
| 60 | 46.80 | 51.48 | 514.80 | 80.15 | 25.39 | 37.17 | 21.74 | 24.22 | 188.67 | 30.02 | 158.65 | 1.39 | 157.26 | 1 |
| 120 | 59.10 | 65.01 | 650.10 | 101.22 | 32.06 | 46.94 | 27.45 | 30.59 | 238.26 | 60.04 | 178.22 | 2.78 | 175.44 | 2 |
| **240** | **74.70** | **82.17** | **821.70** | **127.94** | **40.53** | **59.33** | **34.70** | **38.66** | **301.15** | **120.07** | **181.08** | **5.56** | **175.51** | **4** |
| 360 | 85.70 | 94.27 | 942.70 | 146.78 | 46.49 | 68.06 | 39.81 | 44.35 | 345.49 | 180.11 | 165.39 | 8.35 | 157.04 | 6 |
| 720 | 108.30 | 119.13 | 1191.30 | 185.49 | 58.75 | 86.01 | 50.30 | 56.05 | 436.60 | 360.21 | 76.39 | 16.69 | 59.70 | 12 |
| 1440 | 137.00 | 150.70 | 1507.00 | 234.64 | 74.33 | 108.81 | 63.63 | 70.90 | 552.30 | 720.42 | -168.12 | 33.39 | -201.51 | 24 |
| 2880 | 152.50 | 167.75 | 1677.50 | 261.19 | 82.73 | 121.12 | 70.85 | 78.92 | 614.79 | 1440.85 | -826.05 | 66.78 | -892.83 | 48 |

Critical Storm Duration (hrs) **4**

### Contribution Areas

| | | | | |
|---|---|---|---|---|
| Road/ Car Parking | 0.17 | Hectares | 90 | % Runoff Coefficient |
| Paths | 0.05 | Hectares | 90 | % Runoff Coefficient |
| Roof Areas | 0.08 | Hectares | 95 | % Runoff Coefficient |
| Public Open Space/ Verges | 0.18 | Hectares | 23.5 | % Runoff Coefficient |
| Private Open Space | 0.20 | Hectares | 23.5 | % Runoff Coefficient |
| Total | 0.68 | Hectares | 0.32 | Eq Imp Area (Ha) |

| | | | | |
|---|---|---|---|---|
| Greenfield flow = | | 8.34 | GDSDS Formula | |
| Rainfall for Critical Duration, 100 year storm = | | 74.70 | mm = | 35.45 l/s |
| | => runoff coeficient for greenfield area = | 8.34 / 35.45 | 23.5% | |

**Project:** G1162 - Rookwood

StormTech
Detention • Retention • Water Quality
A division of ADS

| | | | | | |
|---|---|---|---|---|---|
| Chamber Model - | SC-740 | | | | |
| Units - | Metric | Click Here for Imperial | | | |
| Number of chambers - | 78 | | | | |
| Voids in the stone (porosity) - | 40 | % | | | |
| Base of Stone Elevation - | 85.44 | m | ☑ Include Perimeter Stone in Calculations | | |
| Amount of Stone Above Chambers - | 152 | mm | | | |
| Amount of Stone Below Chambers - | 152 | mm | | | |
| Area of system - | 271 | sq.meters | Min. Area - | 244.96 | sq.meters |

## StormTech SC-740 Cumulative Storage Volumes

| Height of System *(mm)* | Incremental Single Chamber *(cubic meters)* | Incremental Total Chamber *(cubic meters)* | Incremental Stone *(cubic meters)* | Incremental Ch & St *(cubic meters)* | Cumulative Chamber *(cubic meters)* | Elevation *(meters)* |
|---|---|---|---|---|---|---|
| 1067 | 0.00 | 0.00 | 2.75 | 2.75 | 176.536 | 86.51 |
| 1041 | 0.00 | 0.00 | 2.75 | 2.75 | 173.782 | 86.48 |
| 1016 | 0.00 | 0.00 | 2.75 | 2.75 | 171.029 | 86.46 |
| 991 | 0.00 | 0.00 | 2.75 | 2.75 | 168.276 | 86.43 |
| 965 | 0.00 | 0.00 | 2.75 | 2.75 | 165.522 | 86.41 |
| 940 | 0.00 | 0.00 | 2.75 | 2.75 | 162.769 | 86.38 |
| 914 | 0.00 | 0.12 | 2.70 | 2.83 | 160.016 | 86.35 |
| 889 | 0.00 | 0.36 | 2.61 | 2.97 | 157.189 | 86.33 |
| 864 | 0.01 | 0.62 | 2.50 | 3.13 | 154.220 | 86.30 |
| 838 | 0.02 | 1.33 | 2.22 | 3.55 | 151.093 | 86.28 |
| 813 | 0.02 | 1.77 | 2.05 | 3.82 | 147.539 | 86.25 |
| 787 | 0.03 | 2.10 | 1.91 | 4.01 | 143.724 | 86.23 |
| 762 | 0.03 | 2.37 | 1.80 | 4.18 | 139.710 | 86.20 |
| 737 | 0.03 | 2.61 | 1.71 | 4.32 | 135.533 | 86.18 |
| 711 | 0.04 | 2.80 | 1.64 | 4.43 | 131.215 | 86.15 |
| 686 | 0.04 | 2.99 | 1.56 | 4.55 | 126.785 | 86.13 |
| 660 | 0.04 | 3.21 | 1.47 | 4.68 | 122.236 | 86.10 |
| 635 | 0.04 | 3.37 | 1.41 | 4.77 | 117.555 | 86.08 |
| 610 | 0.04 | 3.49 | 1.36 | 4.85 | 112.781 | 86.05 |
| 584 | 0.05 | 3.63 | 1.30 | 4.93 | 107.931 | 86.02 |
| 559 | 0.05 | 3.75 | 1.25 | 5.01 | 103.001 | 86.00 |
| 533 | 0.05 | 3.87 | 1.20 | 5.08 | 97.996 | 85.97 |
| 508 | 0.05 | 3.98 | 1.16 | 5.14 | 92.919 | 85.95 |
| 483 | 0.05 | 4.10 | 1.11 | 5.21 | 87.777 | 85.92 |
| 457 | 0.05 | 4.18 | 1.08 | 5.26 | 82.565 | 85.90 |
| 432 | 0.05 | 4.27 | 1.04 | 5.32 | 77.303 | 85.87 |
| 406 | 0.06 | 4.36 | 1.01 | 5.37 | 71.987 | 85.85 |
| 381 | 0.06 | 4.44 | 0.98 | 5.42 | 66.616 | 85.82 |

# Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

| | |
|---|---|
| Calculated by: | Matheus Leal |
| Site name: | Rookwood House |
| Site location | Rookwood |

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: | 53.27894° N |
| Longitude: | 6.29993° W |
| Reference: | 810783231 |
| Date: | Sep 24 2019 10:50 |

**Runoff estimation approach** IH124

**Site characteristics**

Total site area (ha): 0.5288

**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) | 1046 | 1046 |
| 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) | 1.54 | 1.54 |
| 1 in 1 year (l/s) | 1.31 | 1.31 |
| 1 in 30 years (l/s) | 3.28 | 3.28 |
| 1 in 100 year (l/s) | 4.02 | 4.02 |
| 1 in 200 years (l/s) | 4.41 | 4.41 |

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 313452, Northing: 226686,

| | Interval | | Years | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DURATION | 6months, | 1year, | 2, | 3, | 4, | 5, | 10, | 20, | 30, | 50, | 75, | 100, | 150, | 200, | 250, | 500, |
| 5 mins | 2.7, | 3.9, | 4.6, | 5.6, | 6.4, | 6.9, | 8.8, | 11.0, | 12.4, | 14.5, | 16.4, | 17.9, | 20.2, | 22.0, | 23.5, | N/A , |
| 10 mins | 3.7, | 5.4, | 6.4, | 7.9, | 8.9, | 9.6, | 12.3, | 15.3, | 17.3, | 20.2, | 22.9, | 24.9, | 28.1, | 30.6, | 32.7, | N/A , |
| 15 mins | 4.4, | 6.4, | 7.5, | 9.2, | 10.4, | 11.3, | 14.4, | 18.0, | 20.4, | 23.8, | 26.9, | 29.3, | 33.1, | 36.0, | 38.5, | N/A , |
| 30 mins | 5.8, | 8.4, | 9.8, | 12.0, | 13.5, | 14.7, | 18.5, | 23.0, | 26.0, | 30.2, | 34.0, | 37.0, | 41.7, | 45.3, | 48.3, | N/A , |
| 1 hours | 7.6, | 11.0, | 12.8, | 15.6, | 17.5, | 18.9, | 23.8, | 29.4, | 33.1, | 38.4, | 43.1, | 46.8, | 52.5, | 57.0, | 60.7, | N/A , |
| 2 hours | 10.1, | 14.4, | 16.7, | 20.2, | 22.6, | 24.5, | 30.6, | 37.5, | 42.2, | 48.7, | 54.6, | 59.1, | 66.2, | 71.6, | 76.2, | N/A , |
| 3 hours | 11.9, | 16.8, | 19.5, | 23.5, | 26.3, | 28.4, | 35.4, | 43.3, | 48.6, | 56.0, | 62.7, | 67.8, | 75.7, | 81.9, | 87.0, | N/A , |
| 4 hours | 13.3, | 18.8, | 21.8, | 26.2, | 29.3, | 31.6, | 39.3, | 48.0, | 53.8, | 61.9, | 69.1, | 74.7, | 83.4, | 90.1, | 95.7, | N/A , |
| 6 hours | 15.7, | 22.0, | 25.5, | 30.6, | 34.0, | 36.7, | 45.5, | 55.4, | 62.0, | 71.2, | 79.4, | 85.7, | 95.5, | 103.1, | 109.3, | N/A , |
| 9 hours | 18.5, | 25.8, | 29.7, | 35.6, | 39.6, | 42.7, | 52.7, | 64.0, | 71.4, | 81.9, | 91.1, | 98.3, | 109.3, | 117.9, | 124.9, | N/A , |
| 12 hours | 20.7, | 28.9, | 33.2, | 39.7, | 44.1, | 47.5, | 58.5, | 70.9, | 79.0, | 90.4, | 100.5, | 108.3, | 120.4, | 129.7, | 137.4, | N/A , |
| 18 hours | 24.4, | 33.8, | 38.8, | 46.3, | 51.3, | 55.2, | 67.7, | 81.8, | 91.1, | 104.0, | 115.5, | 124.3, | 137.8, | 148.3, | 157.0, | N/A , |
| 24 hours | 27.4, | 37.8, | 43.4, | 51.6, | 57.1, | 61.4, | 75.2, | 90.6, | 100.8, | 114.9, | 127.4, | 137.0, | 151.8, | 163.2, | 172.6, | 205.4, |
| 2 days | 34.5, | 46.4, | 52.7, | 61.8, | 67.9, | 72.6, | 87.6, | 104.1, | 114.8, | 129.6, | 142.6, | 152.5, | 167.7, | 179.3, | 188.8, | 221.8, |
| 3 days | 40.2, | 53.4, | 60.2, | 70.1, | 76.6, | 81.7, | 97.6, | 115.1, | 126.4, | 141.8, | 155.3, | 165.6, | 181.2, | 193.1, | 202.9, | 236.5, |
| 4 days | 45.2, | 59.4, | 66.7, | 77.3, | 84.2, | 89.6, | 106.4, | 124.7, | 136.4, | 152.5, | 166.5, | 177.1, | 193.2, | 205.4, | 215.5, | 249.8, |
| 6 days | 54.0, | 70.0, | 78.1, | 89.8, | 97.5, | 103.3, | 121.6, | 141.4, | 153.9, | 171.1, | 185.9, | 197.1, | 214.0, | 226.9, | 237.3, | 273.0, |
| 8 days | 61.8, | 79.3, | 88.1, | 100.8, | 109.0, | 115.3, | 134.9, | 155.8, | 169.1, | 187.2, | 202.8, | 214.5, | 232.2, | 245.6, | 256.5, | 293.4, |
| 10 days | 69.0, | 87.8, | 97.3, | 110.8, | 119.5, | 126.1, | 146.9, | 168.9, | 182.9, | 201.8, | 218.0, | 230.2, | 248.6, | 262.4, | 273.7, | 311.8, |
| 12 days | 75.7, | 95.8, | 105.8, | 120.0, | 129.3, | 136.2, | 158.0, | 181.1, | 195.6, | 215.2, | 232.0, | 244.7, | 263.7, | 278.0, | 289.6, | 328.7, |
| 16 days | 88.2, | 110.4, | 121.5, | 137.1, | 147.2, | 154.7, | 178.3, | 203.1, | 218.7, | 239.7, | 257.6, | 271.0, | 291.1, | 306.2, | 318.4, | 359.5, |
| 20 days | 99.8, | 124.0, | 135.9, | 152.7, | 163.5, | 171.7, | 196.8, | 223.2, | 239.7, | 261.9, | 280.7, | 294.9, | 315.9, | 331.7, | 344.5, | 387.3, |
| 25 days | 113.4, | 139.8, | 152.7, | 170.9, | 182.5, | 191.3, | 218.2, | 246.4, | 263.9, | 287.4, | 307.3, | 322.2, | 344.3, | 360.9, | 374.3, | 419.0, |

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

# Appendix E

# Stormtech Brochure

# StormTech SC-740 Chamber

SC-740 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots thus maximizing land usage for commercial and municipal applications.

**StormTech SC-740 Chamber** (not to scale)

Nominal Chamber Specifications

| | |
|---|---|
| Size (L x W x H) | 85.4" x 51.0" x 30.0" (2170 x 1295 x 762 mm) |
| Chamber Storage | 45.9 ft³ (1.30 m³) |
| Min. Installed Storage* | 74.9 ft³ (2.12 m³) |
| Weight | 74.0 lbs (33.6 kg) |

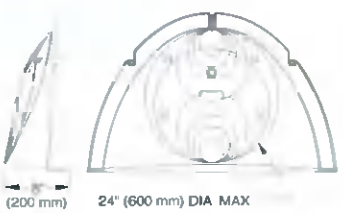
*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.

Shipping

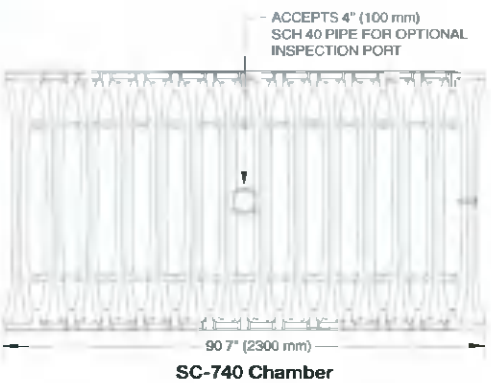
30 chambers/pallet

60 end caps/pallet

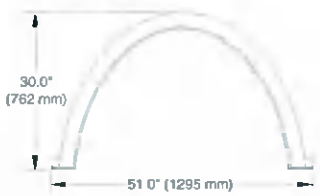
12 pallets/truck

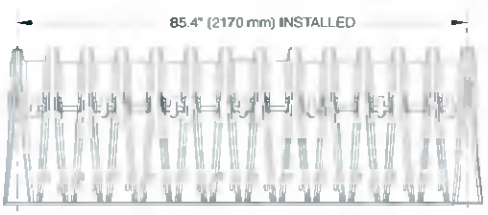



SC-740 End Cap




SC-740 Chamber



# StormTech SC-740 Chamber

**SC-740 Cumulative Storage Volumes Per Chamber**

*Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under the Chambers.*

| Depth of Water in System Inches (mm) | Cumulative Chamber Storage Ft³ (m³) | Total System Cumulative Storage Ft³ (m³) |
|---|---|---|
| 42 (1067) | 45.90 (1.300) | 74.90 (2.121) |
| 41 (1041) | 45.90 (1.300) | 73.77 (2.089) |
| 40 (1016) | Stone 45.90 (1.300) | 72.64 (2.057) |
| 39 (991) | Cover 45.90 (1.300) | 71.52 (2.025) |
| 38 (965) | 45.90 (1.300) | 70.39 (1.993) |
| 37 (948) | 45.90 (1.300) | 69.26 (1.961) |
| 36 (914) | 45.90 (1.300) | 68.14 (1.929) |
| 35 (889) | 45.85 (1.298) | 66.98 (1.897) |
| 34 (864) | 45.69 (1.294) | 65.75 (1.862) |
| 33 (838) | 45.41 (1.286) | 64.46 (1.825) |
| 32 (813) | 44.81 (1.269) | 62.97 (1.783) |
| 31 (787) | 44.01 (1.246) | 61.36 (1.737) |
| 30 (762) | 43.06 (1.219) | 59.66 (1.689) |
| 29 (737) | 41.98 (1.189) | 57.89 (1.639) |
| 28 (711) | 40.80 (1.155) | 56.05 (1.587) |
| 27 (686) | 39.54 (1.120) | 54.17 (1.534) |
| 26 (660) | 38.18 (1.081) | 52.23 (1.479) |
| 25 (635) | 36.74 (1.040) | 50.23 (1.422) |
| 24 (610) | 35.22 (0.977) | 48.19 (1.365) |
| 23 (584) | 33.64 (0.953) | 46.11 (1.306) |
| 22 (559) | 31.99 (0.906) | 44.00 (1.246) |
| 21 (533) | 30.29 (0.858) | 41.85 (1.185) |
| 20 (508) | 28.54 (0.808) | 39.67 (1.123) |
| 19 (483) | 26.74 (0.757) | 37.47 (1.061) |
| 18 (457) | 24.89 (0.705) | 35.23 (0.997) |
| 17 (432) | 23.00 (0.651) | 32.96 (0.939) |
| 16 (406) | 21.06 (0.596) | 30.68 (0.869) |
| 15 (381) | 19.09 (0.541) | 28.36 (0.803) |
| 14 (356) | 17.08 (0.484) | 26.03 (0.737) |
| 13 (330) | 15.04 (0.426) | 23.68 (0.670) |
| 12 (305) | 12.97 (0.367) | 21.31 (0.608) |
| 11 (279) | 10.87 (0.309) | 18.92 (0.535) |
| 10 (254) | 8.74 (0.247) | 16.51 (0.468) |
| 9 (229) | 6.58 (0.186) | 14.09 (0.399) |

**SC-740 Cumulative Storage Volumes Per Chamber (cont.)**

| Depth of Water in System Inches (mm) | Cumulative Chamber Storage Ft³ (m³) | Total System Cumulative Storage Ft³ (m³) |
|---|---|---|
| 8 (203) | 4.41 (0.125) | 11.66 (0.330) |
| 7 (178) | 2.21 (0.063) | 9.21 (0.264) |
| 6 (152) | 0 | 6.76 (0.191) |
| 5 (127) | 0 | 5.63 (0.160) |
| 4 (102) | Stone Foundation 0 | 4.51 (0.125) |
| 3 (76) | 0 | 3.38 (0.095) |
| 2 (51) | 0 | 2.25 (0.064) |
| 1 (25) | 0 | 1.13 (0.032) |

*Note: Add 1.13 cu. ft. (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.*

**Storage Volume Per Chamber ft³ (m³)**

| | Bare Chamber Storage ft³ (m³) | Chamber and Stone Stone Foundation Depth in. (mm) | | |
|---|---|---|---|---|
| | | 6 (150) | 12 (300) | 18 (450) |
| StormTech SC-740 | 45.9 (1.3) | 74.9 (2.1) | 81.7 (2.3) | 88.4 (2.5) |

*Note: Assumes 6" (150 mm) of stone above chambers, 6" (150 mm) row spacing and 40% porosity.*

**Amount of Stone Per Chamber**

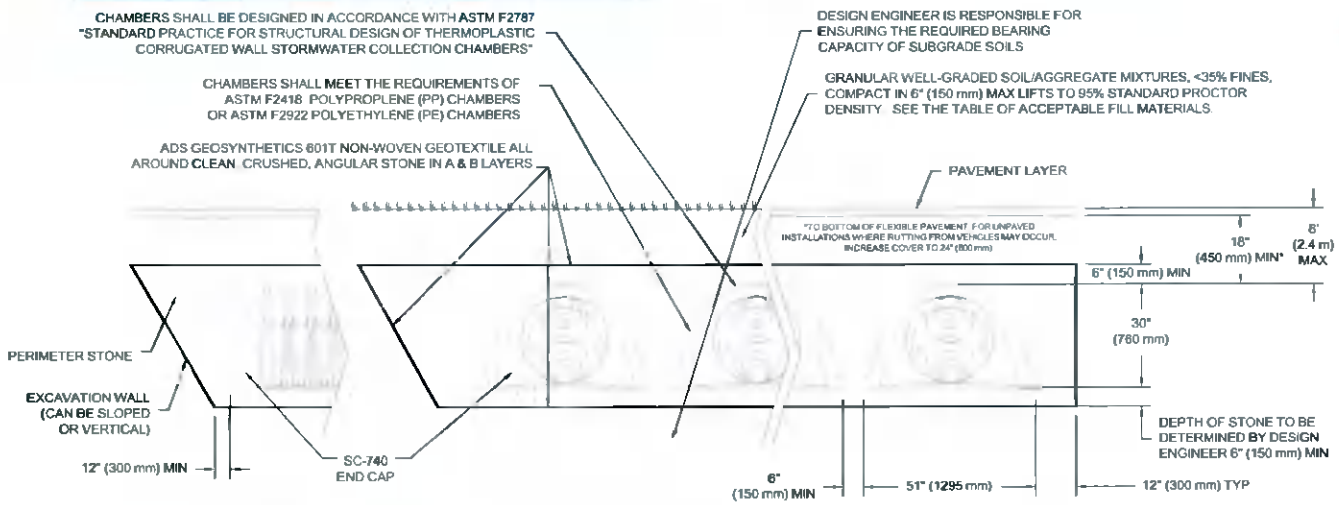
| | Stone Foundation Depth | | |
|---|---|---|---|
| ENGLISH TONS (yd³) | 6" | 12" | 18" |
| StormTech SC-740 | 3.8 (2.8 yd³) | 4.6 (3.3 yd³) | 5.5 (3.9 yd³) |
| METRIC KILOGRAMS (m³) | 150 mm | 300 mm | 450 mm |
| StormTech SC-740 | 3450 (2.1 m³) | 4170 (2.5 m³) | 4490 (3.0 m³) |

*Note: Assumes 6" (150 mm) of stone above, and between chambers.*

**Volume of Excavation Per Chamber yd³ (m³)**

| | Stone Foundation Depth | | |
|---|---|---|---|
| | 6" (150 mm) | 12" (300 mm) | 18" (450 mm) |
| StormTech SC-740 | 5.5 (4.2) | 6.2 (4.7) | 6.8 (5.2) |

*Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. Volume of excavation will vary as depth of cover increases.*




THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES