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# Engineering Service Report

## St Patrick's Park – Rathangan, Co Kildare

# Engineering Service Report

## St Patrick's Park – Rathangan, Co Kildare

## October 2022

### Notice

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### Document History

| JOB NUMBER: 1668 | | | DOCUMENT REF: 1668_ESR R0.docx | | | |
|---|---|---|---|---|---|---|
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| | | | | | | |
| | | | | | | |
| R0 | Part 8 Planning Issue | NM | CB | PM | PM | 19/10/2022 |
| Revision | Purpose Description | Originated | Checked | Reviewed | Authorised | Date |

**Contents**

## 1.0 INTRODUCTION

The subject site is located at St Patrick's Park, Rathangan, County Kildare. The rectangular shaped site is approximately 3.6 Ha in size and is currently forms part of the existing St Patrick's Park housing estate. The Kildare Road (R401) bounds the site to the North, agricultural lands to the West and South, and residential units to the East. The topography of the site is relatively flat with a slight slope from South East to North West falling 1m over a length of 195m giving an approximate slope of 1:195.

As part of this Part VIII Application, it is proposed to demolish a number of existing houses, construct 7 new dwellings and refurbish 25 units at the site. Road upgrade works, additional car parking, drainage, wastewater and watermain works are also proposed.


**Figure 1.1** Proposed Site Plan

This report should be read in conjunction with POGA Consulting Engineers drawings and all other Consultants' reports and drawings.

The engineering drainage design philosophy is outlined below and detailed calculations are contained in the Appendices of this report.

## 2.0 EXISTING SERVICES

Appendix A shows the Irish Water map of the existing drainage and watermain networks in the vicinity of the subject site.

**Wastewater Sewer**

There is an existing ø225mm uPVC sewer network which flows northwards through the existing development outfalling into the public sewer on Kildare Road (R401). It is proposed to connect to the existing network at several points where new housing is provided.

**Surface Water**

There is an existing Ø150mm uPVC surface network at the site servicing the existing dwellings, please refer to Appendix A for existing drainage mapping. From our review of the existing mapping, existing drawings and site walk over it was established that there is a Ø450mm surface water network flowing around the perimeter of the site which connects to an attenuation system located at the south eastern boundary. The surface water flows south in a Ø450mm pipe and outfalls into an open ditch 150m to the South of the site.

**Water**

There is an existing Ø100mm uPVC watermain servicing the existing site. It is proposed to upgrade sections of the existing network to include for the seven new dwellings.

**Flooding**

Appendix B contains the predicted 1:100 year flood risk draft maps produced as part of the South Eastern CFRAM program. The mapping highlights fluvial flooding events in the vicinity of the site. The predicted 1:100 flooding on the River Slate however, occurs approximately 0.75km to the North of the site. The 1:100 year flood levels at the River Slate are over 12m below the lowest level of the subject site. The risk of flooding at the site is deemed to be extremely low.

## 3.0 PROPOSED SURFACE WATER MANAGEMENT

The management of surface water for the proposed development has been designed to comply with the policies and guidelines of the Greater Dublin Strategic Drainage Study (GDSDS). The overall objective is to minimise stormwater runoff and to collect and treat this minimised amount of runoff as close to the source as possible.

### 3.1 Existing Surface Water Strategy

From our discussions with the local authority and our site walk over it was noted that in the past St Patrick's Park has suffered from some localised flooding where some storm water gullies surcharged during storm events. Remedial works were carried out by Kildare County Council to alleviate the surface water issues. A Ø450mm perimeter drainage system was constructed to carry the surface water run off into an attenuation tank system, located at the south eastern boundary of the site. The perimeter drainage, petrol interceptor and attenuation system were installed, please refer to Appendix G for the existing details.

### 3.2 SuDS Techniques

As part of the "grey to green" surface water treatment philosophy, it is proposed to use tree pits as a form of interception, treatment and attenuation for the surface water run off from the proposed car parks at the site, please refer to Drawing 1668 101 for locations. It is proposed to use 8No tree pits at the subject site. Each tree pit is filled with 14m³ of urban soil with a capacity for 6.3m³ of surface water attenuation (50.4m³ in total), please refer to Drawing 1668 106 for details. The use of the urban soil tree pits will reduce the demand on the existing attenuation system by providing 50.4m³ of added storage capacity.

Each tree pit is designed to be fitted with an overflow pipe connecting back to surface water network to ensure that the tree is not flooded in storm events. In extreme events the flooded tree pit could lead to the roots dying. However, it is proposed to add a permanent plug on the outflow from each tree pit to ensure that there is always a certain level water to sustain the tree, refer to Drawing 1668 101 for details.

### 3.3 Surface Water Drainage Design

It is proposed to intercept, treat and attenuate the rainfall water falling on the site using the methods mentioned in section 3.2. The outflow from the varies hardstanding areas and SuDS systems will then be collected in a pipe system and be routed to the existing attenuation system on the South Eastern boundary of the site before discharging into the existing surface water network. The existing Ø450mm surface network outfalls into a ditch 200m to the South East of the site.

It is proposed to install a Hydrobreak on the new outfall manhole (S52) located after the attenuation systems located at the south eastern boundary of the site. The GDSDS allows for development sites to discharge surface water at either the greenfield or brownfield run off rate. We are proposing to use the GDSDS recommended Qbar formula as described in the Institute of Hydrology Report No 124 and then apply an interpolated rate for site less than 50ha. This gives a total outflow of 5.7l/s, please refer to Appendix D for Qbar calculations.

**Attenuation Capacity Check**

As part of his planning application, we have completed a capacity check on the existing attenuation system. The attenuation system check was to store the 1 in 100 year storm event plus 20% for climate change for the drained area of 2.48ha. The capacity of the existing Stormtech system is 273m³ (refer to Appendix G), from our calculations a volume of 433m³ is required to service the subject site. It is proposed to add a new Stormtech attenuation system downstream of the existing to increase the attenuation capacity, please refer to Figure 3.1 for details.

Refer to Appendix C for rainfall runoff rates and the calculation of Qbar and Appendix D for Paved Area Factors. The following runs off rates factors have been applied to the scheme to calculate the Percentage Run off or PIMP:

1. 95% from existing and proposed roofs
2. 85% from existing and proposed roads/hardstanding
3. 5% from grassed areas
4. 40% from parking areas & roads draining to tree pits.

| STORAGE PROVISION | | | |
|---|---|---|---|
| **SUDS techniques** | **Interception+Treatment** | **Required** | **Provided** |
| **Tree pits** | 50.4m³ | X | 50.4m |
| **Existing Attenuation Tank** | X | 416m³ | 273m³ |
| **Proposed Attenuation Tank** | X | X | 97m³ |
| **TOTAL** | **420.4m³ > 416m³ OK!** | | |

**Figure 3.1** Storage requirement and provision

**Pipe Design**

All surface water pipes sizes and gradients are designed in accordance with the Department of Environment Recommendation for Site Development Works, Building Regulations and Irish Water Standards.

Please refer to drawing 1668 101 P0 for a drainage layout and. Also refer to drawing 1668 104 P0 for manhole and typical drainage details.

## 4.0 WASTEWATER

All wastewater pipes sizes and gradients are designed in accordance with the Department of Environment Recommendation for Site Development Works, Building Regulations and Irish Water Standards.

It is proposed to form new connections into the existing ø225mm wastewater sewer that flows through the site outfalling at the Kildare Road (R401) to the North. There are sections of existing domestic wastewater drainage that will be diverted in order to construct the new dwellings.

All connections to the public wastewater infrastructure will be made following a connection agreement with Irish Water and under their direction. Refer to drawing 1668 101 P0 for drainage details.

## 5.0 WATER SUPPLY

It is proposed to upgrade sections of the existing Ø100mm uPVC watermain at the site. The proposed new loop of watermain will be Ø100mm HDPE or as directed by Irish Water. An individual boundary box will be provided at each new dwelling, in accordance with Irish Water standards.

All connection to the public water infrastructure will be made following a connection agreement with Irish Water and under their direction. Refer to Drawing 1668 102 P0 for the watermain layout.

### 5.1 Water Conservation and Management

To conserve water the following is proposed;

1. All bathroom and staff facilities to be fitted with low flow fittings such as taps, shower head, etc.
2. All electrical appliances will be A energy rated.
3. All bathrooms will be fitted with dual flush toilet cisterns

## 6.0 ACCESS AND SIGHT LINES

The site is accessed of the existing St Patrick's Park Road. It is proposed to upgrade sections of the internal roads in accordance with the Design Manual for Urban Road and Streets (DMURS) for a 30kph main road speed limit. New car parking spaces and sections of footpath are also provided at the site, please refer to drawings 1668 100 & 103 for road layout.

A swept path analysis was completed for a Fire Tender and Refuse truck access, please refer to drawing 1668 103 for details.

**Report by;**
Noel Mahon
MEng MIEI

## 7.0 APPENDICES

## 7.1 APPENDIX A – EXISTING SERVICE MAPPING


1/30/2018 2:03:36 PM



Legend

**Stormwater Gravity Mains (Irish Water Owned)**

- Surface

**Stormwater Gravity Mains (Non-Irish Water Owned)**

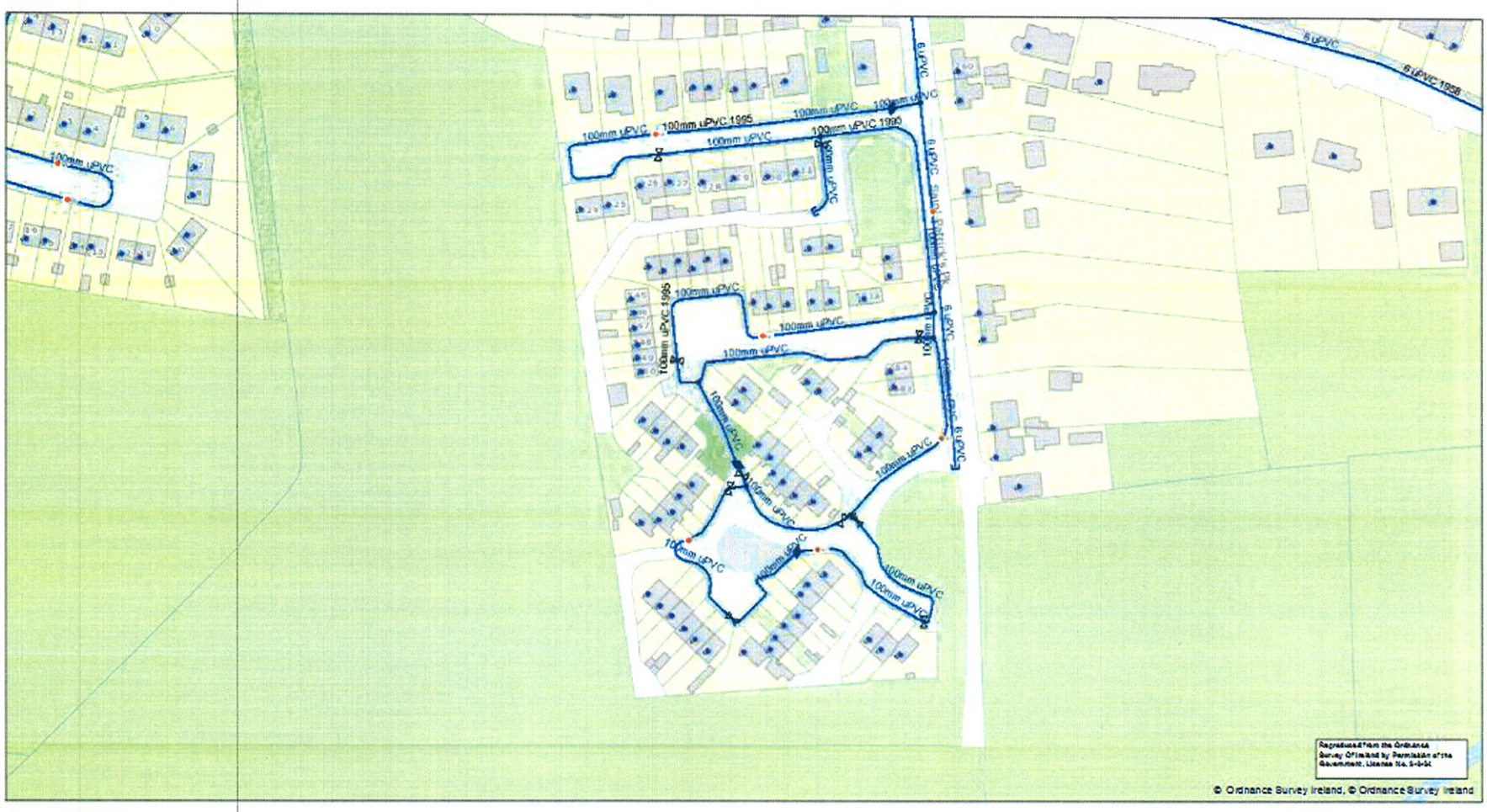
- Surface

**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

# Irish Water Web Map




January 29, 2018

1:2,257

0 0.0275 0.055 0.11 mi

0 0.0425 0.085 0.17 km

**Legend**

**Flow Control Valves**
- Non-return
- Hydro
- Orifice Plate
- PRV
- PSV
- Other

**Boundary Valves**
- Open
- Closed
- Part Closed

**Non Boundary Valves**
- Open
- Closed
- Part Closed

- Air Control Valves
- Water Stop Valves

**Non Boundary Meter**
- Meter
- Group Scheme
- Source

**Boundary Meter**
- District (Boundary Meter)

**Water Hydrants**
- Fire Hydrant
- Fire Hydrant/Washout
- Washout
- Treatment Plant

**Reservoir**
- Potable
- Raw Water

- Pump Stations
- Water Network Structures
- Abstraction Point
- Kiosk
- Water Service Connections

**Water Fittings**
- Cap
- Other Fitting

- Water Distribution Chambers
- Pressure Monitoring Point

**Water Mains(Irish Water Owned)**
- Untreated
- Potable Water

**Water Mains(Non Irish Water Owned)**
- Untreated
- Potable Water

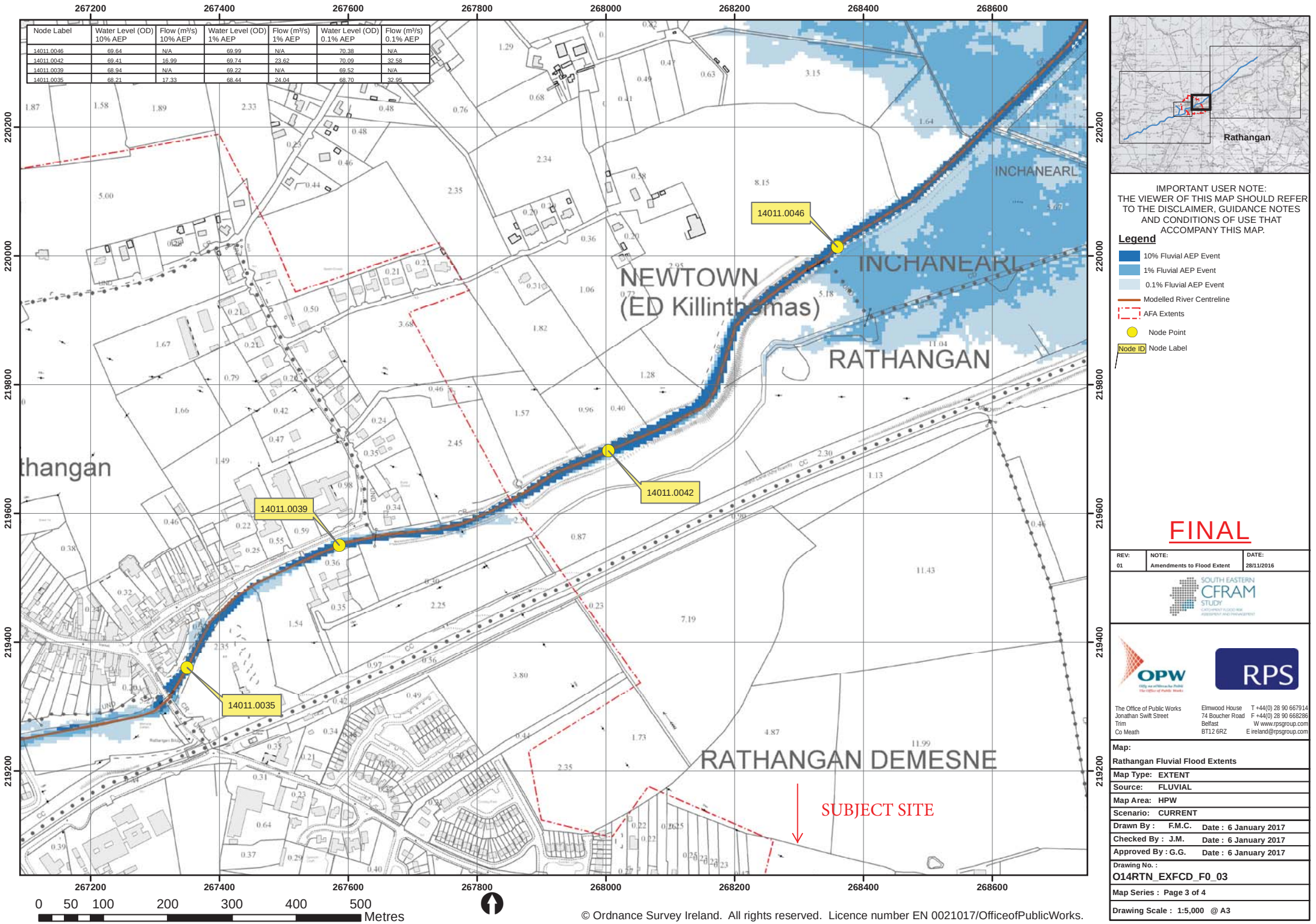
**Water Lateral Lines**
- Irish Water
- Non IW
- Water Abandoned Lines
- Water Casings

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



UISCE ÉIREANN : IRISH WATER

## 7.2 APPENDIX B – FLOOD MAPPING CFRAM STUDY




| Node Label | Water Level (OD) 10% AEP | Flow (m³/s) 10% AEP | Water Level (OD) 1% AEP | Flow (m³/s) 1% AEP | Water Level (OD) 0.1% AEP | Flow (m³/s) 0.1% AEP |
|---|---|---|---|---|---|---|
| 14011.0046 | 69.64 | N/A | 69.99 | N/A | 70.38 | N/A |
| 14011.0042 | 69.41 | 16.99 | 69.74 | 23.62 | 70.09 | 32.58 |
| 14011.0039 | 68.94 | N/A | 69.22 | N/A | 69.52 | N/A |
| 14011.0035 | 68.21 | 17.33 | 68.44 | 24.04 | 68.70 | 32.95 |




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

**Legend**

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

**FINAL**

| REV: | NOTE: | DATE: |
|---|---|---|
| 01 | Amendments to Flood Extent | 28/11/2016 |

SOUTH EASTERN CFRAM STUDY

OPW

RPS

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Co Meath

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F +44(0) 28 90 668286
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**Map:**
**Rathangan Fluvial Flood Extents**

| | |
|---|---|
| Map Type: | EXTENT |
| Source: | FLUVIAL |
| Map Area: | HPW |
| Scenario: | CURRENT |
| Drawn By : F.M.C. | Date : 6 January 2017 |
| Checked By : J.M. | Date : 6 January 2017 |
| Approved By : G.G. | Date : 6 January 2017 |
| Drawing No. : | O14RTN_EXFCD_F0_03 |
| Map Series : | Page 3 of 4 |
| Drawing Scale : | 1:5,000 @ A3 |

## 7.3 APPENDIX C – RAINFALL DATA

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 267934, Northing: 218876,

| | Interval | | Years | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DURATION | 6months, | 1year, | 2, | 3, | 4, | 5, | 10, | 20, | 30, | 50, | 75, | 100, | 150, | 200, | 250, | 500, |
| 5 mins | 2.7, | 3.7, | 4.2, | 5.0, | 5.5, | 5.9, | 7.1, | 8.5, | 9.4, | 10.6, | 11.7, | 12.6, | 13.9, | 14.9, | 15.7, | N/A , |
| 10 mins | 3.8, | 5.1, | 5.9, | 6.9, | 7.6, | 8.2, | 9.9, | 11.8, | 13.1, | 14.8, | 16.4, | 17.5, | 19.3, | 20.7, | 21.9, | N/A , |
| 15 mins | 4.5, | 6.1, | 6.9, | 8.1, | 9.0, | 9.6, | 11.6, | 13.9, | 15.4, | 17.5, | 19.3, | 20.6, | 22.8, | 24.4, | 25.7, | N/A , |
| 30 mins | 5.9, | 7.9, | 8.9, | 10.5, | 11.5, | 12.3, | 14.8, | 17.5, | 19.3, | 21.7, | 23.9, | 25.5, | 28.0, | 29.9, | 31.5, | N/A , |
| 1 hours | 7.8, | 10.3, | 11.6, | 13.5, | 14.7, | 15.7, | 18.7, | 22.0, | 24.2, | 27.1, | 29.6, | 31.6, | 34.5, | 36.7, | 38.6, | N/A , |
| 2 hours | 10.3, | 13.4, | 15.0, | 17.4, | 18.9, | 20.0, | 23.7, | 27.7, | 30.2, | 33.7, | 36.7, | 39.0, | 42.5, | 45.1, | 47.2, | N/A , |
| 3 hours | 12.1, | 15.7, | 17.5, | 20.1, | 21.8, | 23.1, | 27.3, | 31.7, | 34.5, | 38.3, | 41.7, | 44.2, | 48.0, | 50.8, | 53.2, | N/A , |
| 4 hours | 13.6, | 17.5, | 19.5, | 22.4, | 24.2, | 25.6, | 30.1, | 34.8, | 37.9, | 42.0, | 45.5, | 48.2, | 52.3, | 55.4, | 57.9, | N/A , |
| 6 hours | 16.0, | 20.5, | 22.7, | 25.9, | 28.0, | 29.6, | 34.5, | 39.8, | 43.2, | 47.7, | 51.7, | 54.6, | 59.0, | 62.4, | 65.1, | N/A , |
| 9 hours | 18.8, | 23.9, | 26.4, | 30.0, | 32.4, | 34.2, | 39.7, | 45.6, | 49.3, | 54.3, | 58.6, | 61.8, | 66.7, | 70.3, | 73.3, | N/A , |
| 12 hours | 21.1, | 26.7, | 29.4, | 33.4, | 35.9, | 37.8, | 43.8, | 50.1, | 54.1, | 59.5, | 64.1, | 67.5, | 72.7, | 76.6, | 79.8, | N/A , |
| 18 hours | 24.9, | 31.2, | 34.3, | 38.7, | 41.5, | 43.7, | 50.3, | 57.3, | 61.7, | 67.6, | 72.7, | 76.4, | 82.1, | 86.3, | 89.8, | N/A , |
| 24 hours | 27.9, | 34.8, | 38.2, | 43.0, | 46.0, | 48.3, | 55.5, | 63.0, | 67.7, | 74.1, | 79.4, | 83.5, | 89.5, | 94.0, | 97.7, | 109.9, |
| 2 days | 33.5, | 41.1, | 44.7, | 49.9, | 53.2, | 55.7, | 63.3, | 71.2, | 76.1, | 82.7, | 88.2, | 92.4, | 98.5, | 103.1, | 106.8, | 119.2, |
| 3 days | 38.4, | 46.6, | 50.5, | 56.1, | 59.6, | 62.3, | 70.3, | 78.7, | 83.9, | 90.8, | 96.6, | 100.9, | 107.3, | 112.1, | 115.9, | 128.7, |
| 4 days | 42.8, | 51.6, | 55.8, | 61.7, | 65.5, | 68.3, | 76.8, | 85.6, | 91.1, | 98.3, | 104.3, | 108.8, | 115.5, | 120.5, | 124.4, | 137.7, |
| 6 days | 50.8, | 60.7, | 65.4, | 72.0, | 76.1, | 79.2, | 88.6, | 98.2, | 104.1, | 111.9, | 118.5, | 123.4, | 130.5, | 135.8, | 140.1, | 154.2, |
| 8 days | 58.2, | 69.0, | 74.2, | 81.3, | 85.8, | 89.2, | 99.3, | 109.7, | 116.0, | 124.4, | 131.4, | 136.6, | 144.2, | 149.8, | 154.4, | 169.3, |
| 10 days | 65.1, | 76.8, | 82.4, | 90.1, | 94.9, | 98.5, | 109.3, | 120.4, | 127.1, | 136.0, | 143.4, | 148.9, | 156.9, | 162.9, | 167.7, | 183.4, |
| 12 days | 71.7, | 84.2, | 90.2, | 98.4, | 103.5, | 107.3, | 118.8, | 130.5, | 137.6, | 147.0, | 154.8, | 160.6, | 169.0, | 175.3, | 180.3, | 196.7, |
| 16 days | 84.2, | 98.3, | 105.0, | 114.1, | 119.8, | 124.0, | 136.7, | 149.6, | 157.4, | 167.7, | 176.2, | 182.5, | 191.7, | 198.5, | 203.9, | 221.7, |
| 20 days | 96.1, | 111.7, | 119.0, | 129.0, | 135.2, | 139.8, | 153.6, | 167.6, | 176.0, | 187.1, | 196.3, | 203.0, | 212.9, | 220.2, | 226.0, | 245.0, |
| 25 days | 110.5, | 127.7, | 135.7, | 146.7, | 153.5, | 158.6, | 173.7, | 188.9, | 198.1, | 210.1, | 220.0, | 227.3, | 238.0, | 245.9, | 252.1, | 272.6, |

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

M5 60 = 15.7
M5 2day = 55.7
Ratio = 0.28

## 7.4 APPENDIX D – QBAR CALCULATION

## IH 124 Mean Annual Flood

Input

| | | | |
|---|---|---|---|
| Return Period (years) | 100 | Soil | 0.300 |
| Area (ha) | 50.000 | Urban | 0.000 |
| SAAR (mm) | 847 | Region Number | Ireland National |

| Results | l/s |
|---|---|
| QBAR Rural | 113.9 |
| QBAR Urban | 113.9 |
| Q100 years | 209.6 |
| Q1 year | 96.8 |
| Q2 years | 109.3 |
| Q5 years | 136.7 |
| Q10 years | 153.8 |
| Q20 years | 171.0 |
| Q25 years | 176.5 |
| Q30 years | 181.0 |
| Q50 years | 193.6 |
| Q100 years | 209.6 |
| Q200 years | 226.6 |
| Q250 years | n/a |
| Q1000 years | n/a |

WARNING: Irish growth curves are not defined above 200 years.

Drained Area = 2.49 ha
50ha = 113.9 l/s
Qbar = (113.9/50)x2.49
Qbar = 5.7l/s

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## 7.5 APPENDIX E- PAVED AREA FACTORS EXISTING & PROPOSED

| | |
|---|---|
| Project : | St Patrick's Park |
| POGA Ref: | 1668 |
| Title: | Paved Area Factors |
| Date: | Oct-22 |

**Element**

**Existing**

| | | |
|---|---|---|
| Roofs (m²) | 2058 | |
| Existing Roofs to be Demolished (m²) | 785 | |
| Roads (m²) | 3314 | |
| Roads to be Demolished (m²) | 1166 | |
| Hardstanding (m²) | 733 | |
| Hardstanding to be Demolished (m²) | 1657 | |
| Grass (m²) | 11631 | |
| Existing Drained Area (m²) | 21344 | |
| PAF | 0.43 | |
| Existing Impermeable Area (m²) | 9071 | m² |

**Proposed**

| | | |
|---|---|---|
| Existing Roofs (m²) | 2058 | |
| Proposed Roofs (m²) | 655 | |
| Existing Roads (m²) | 2707 | |
| Proposed Roads (m²) | 1411 | |
| Hardstanding (m²) | 1540 | |
| Roads/Parking SuDS (m²) | 2398 | |
| Grass (m²) | 14109 | |
| Proposed Drained Area (m²) | 24878 | m² |

**Paved Area Factors (PIMP Factors)**

| | | |
|---|---|---|
| Roofs | = | 0.95 |
| Roads | = | 0.85 |
| Hardstanding | = | 0.85 |
| Roads/Parking SuDS | = | 0.40 |
| Grass | = | 0.05 |

**PIMP factor for Catchment**

**Element**

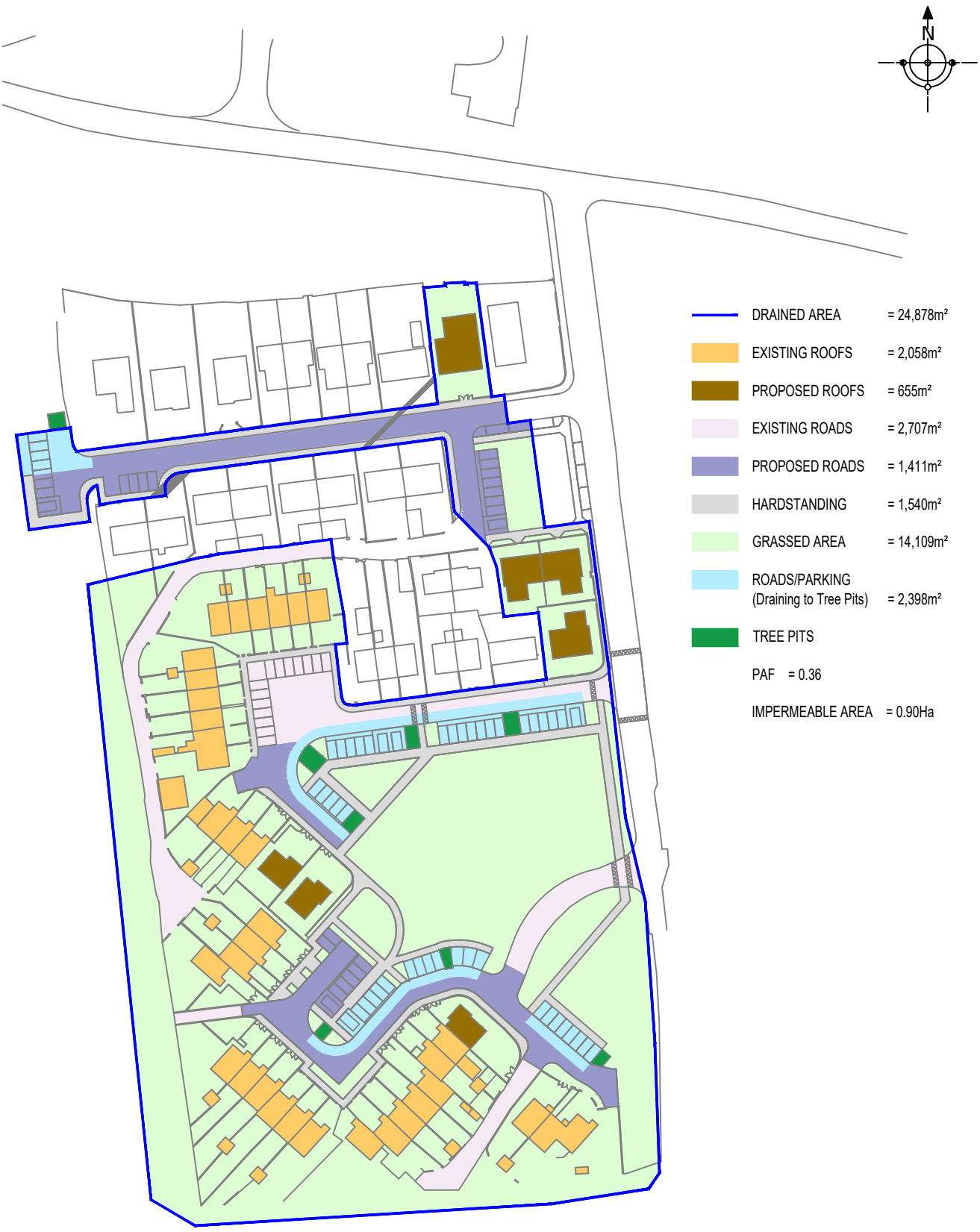
| | | |
|---|---|---|
| Roofs | 10.4% | |
| Roads | 14.1% | |
| Hardstanding | 5.3% | |
| Roads/Parking SuDS | 3.9% | |
| Grass | 2.8% | |
| Average PIMP Factor Per site | **36%** | |
| Total Proposed Impermeable Area | **8956** | m² |
| | **0.90** | Ha |

**Greenfield Outflow**

Interpolated from 50ha

Qbar = {(113.9/50)x2.49}

| | | |
|---|---|---|
| **Qbar allowed ouflow for Total Area (l/s)** | **5.7** | **l/s** |




| Rev. | Date | Description | By |
|---|---|---|---|

Project Title
ST PATRICKS PARK
RATHANGAN, Co. KILDARE

Architect
MCORM ARCHITECTS

| Date | By | Checked | Scale @ A4 |
|---|---|---|---|
| OCT 2022 | CB | NM | 1:1500 |

Drawing Title
PAVED ARE FACTORS

Drawing Status
PLANNING

| Job No. | Drawing No. | Issue |
|---|---|---|
| 1668 | 107 | P0 |

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## 7.6 APPENDIX F – EXISTING ATTENUATION CAPACITY CHECK 1,30,100 YEAR STORMS +20% CLIMATE CHANGE

## Summary of Results for 1 year Return Period (+20%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 77.990 | 0.204 | 4.7 | 44.8 | O K |
| 30 min Summer | 78.057 | 0.271 | 4.9 | 59.6 | O K |
| 60 min Summer | 78.126 | 0.340 | 5.0 | 74.9 | O K |
| 120 min Summer | 78.188 | 0.402 | 5.0 | 88.4 | O K |
| 180 min Summer | 78.216 | 0.430 | 5.0 | 94.5 | O K |
| 240 min Summer | 78.233 | 0.447 | 5.0 | 98.3 | O K |
| 360 min Summer | 78.251 | 0.465 | 5.0 | 102.2 | O K |
| 480 min Summer | 78.257 | 0.471 | 5.0 | 103.7 | O K |
| 600 min Summer | 78.257 | 0.471 | 5.0 | 103.7 | O K |
| 720 min Summer | 78.254 | 0.468 | 5.0 | 103.0 | O K |
| 960 min Summer | 78.240 | 0.454 | 5.0 | 99.9 | O K |
| 1440 min Summer | 78.198 | 0.412 | 5.0 | 90.7 | O K |
| 2160 min Summer | 78.133 | 0.347 | 5.0 | 76.4 | O K |
| 2880 min Summer | 78.076 | 0.290 | 4.9 | 63.7 | O K |
| 4320 min Summer | 77.991 | 0.205 | 4.7 | 45.1 | O K |
| 5760 min Summer | 77.936 | 0.150 | 4.4 | 33.1 | O K |
| 7200 min Summer | 77.902 | 0.116 | 4.1 | 25.5 | O K |
| 8640 min Summer | 77.883 | 0.097 | 3.9 | 21.3 | O K |
| 10080 min Summer | 77.872 | 0.086 | 3.6 | 18.8 | O K |
| 15 min Winter | 78.016 | 0.230 | 4.8 | 50.5 | O K |
| 30 min Winter | 78.093 | 0.307 | 5.0 | 67.4 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 28.887 | 0.0 | 48.4 | 22 |
| 30 min Summer | 19.778 | 0.0 | 66.3 | 36 |
| 60 min Summer | 13.113 | 0.0 | 87.9 | 64 |
| 120 min Summer | 8.546 | 0.0 | 114.6 | 120 |
| 180 min Summer | 6.626 | 0.0 | 133.3 | 158 |
| 240 min Summer | 5.527 | 0.0 | 148.3 | 192 |
| 360 min Summer | 4.279 | 0.0 | 172.2 | 260 |
| 480 min Summer | 3.568 | 0.0 | 191.5 | 330 |
| 600 min Summer | 3.100 | 0.0 | 208.0 | 402 |
| 720 min Summer | 2.764 | 0.0 | 222.5 | 470 |
| 960 min Summer | 2.303 | 0.0 | 247.2 | 610 |
| 1440 min Summer | 1.773 | 0.0 | 285.5 | 872 |
| 2160 min Summer | 1.365 | 0.0 | 329.7 | 1256 |
| 2880 min Summer | 1.133 | 0.0 | 365.1 | 1620 |
| 4320 min Summer | 0.873 | 0.0 | 421.8 | 2336 |
| 5760 min Summer | 0.726 | 0.0 | 467.4 | 3048 |
| 7200 min Summer | 0.627 | 0.0 | 505.2 | 3744 |
| 8640 min Summer | 0.557 | 0.0 | 538.2 | 4408 |
| 10080 min Summer | 0.504 | 0.0 | 567.9 | 5144 |
| 15 min Winter | 28.887 | 0.0 | 54.2 | 21 |
| 30 min Winter | 19.778 | 0.0 | 74.2 | 35 |

## Summary of Results for 1 year Return Period (+20%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 60 min Winter | 78.173 | 0.387 | 5.0 | 85.2 | O K |
| 120 min Winter | 78.249 | 0.463 | 5.0 | 101.8 | O K |
| 180 min Winter | 78.284 | 0.498 | 5.0 | 109.5 | O K |
| 240 min Winter | 78.301 | 0.515 | 5.0 | 113.2 | O K |
| 360 min Winter | 78.319 | 0.533 | 5.0 | 117.2 | O K |
| 480 min Winter | 78.322 | 0.536 | 5.0 | 117.9 | O K |
| 600 min Winter | 78.317 | 0.531 | 5.0 | 116.7 | O K |
| 720 min Winter | 78.306 | 0.520 | 5.0 | 114.4 | O K |
| 960 min Winter | 78.275 | 0.489 | 5.0 | 107.6 | O K |
| 1440 min Winter | 78.198 | 0.412 | 5.0 | 90.7 | O K |
| 2160 min Winter | 78.092 | 0.306 | 5.0 | 67.4 | O K |
| 2880 min Winter | 78.011 | 0.225 | 4.8 | 49.6 | O K |
| 4320 min Winter | 77.915 | 0.129 | 4.3 | 28.5 | O K |
| 5760 min Winter | 77.877 | 0.091 | 3.8 | 20.1 | O K |
| 7200 min Winter | 77.862 | 0.076 | 3.3 | 16.6 | O K |
| 8640 min Winter | 77.851 | 0.065 | 2.9 | 14.3 | O K |
| 10080 min Winter | 77.844 | 0.058 | 2.7 | 12.8 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 60 min Winter | 13.113 | 0.0 | 98.5 | 64 |
| 120 min Winter | 8.546 | 0.0 | 128.4 | 120 |
| 180 min Winter | 6.626 | 0.0 | 149.3 | 174 |
| 240 min Winter | 5.527 | 0.0 | 166.1 | 224 |
| 360 min Winter | 4.279 | 0.0 | 192.9 | 282 |
| 480 min Winter | 3.568 | 0.0 | 214.5 | 360 |
| 600 min Winter | 3.100 | 0.0 | 233.0 | 438 |
| 720 min Winter | 2.764 | 0.0 | 249.2 | 514 |
| 960 min Winter | 2.303 | 0.0 | 276.9 | 660 |
| 1440 min Winter | 1.773 | 0.0 | 319.8 | 940 |
| 2160 min Winter | 1.365 | 0.0 | 369.2 | 1320 |
| 2880 min Winter | 1.133 | 0.0 | 408.9 | 1676 |
| 4320 min Winter | 0.873 | 0.0 | 472.4 | 2340 |
| 5760 min Winter | 0.726 | 0.0 | 523.6 | 3000 |
| 7200 min Winter | 0.627 | 0.0 | 565.8 | 3680 |
| 8640 min Winter | 0.557 | 0.0 | 602.8 | 4408 |
| 10080 min Winter | 0.504 | 0.0 | 636.1 | 5136 |

## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 1 | Cv (Summer) | 0.750 |
| Region | Scotland and Ireland | Cv (Winter) | 0.840 |
| M5-60 (mm) | 15.800 | Shortest Storm (mins) | 15 |
| Ratio R | 0.280 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +20 |

## Time Area Diagram

Total Area (ha) 0.895

| Time (mins) From: | To: | Area (ha) | Time (mins) From: | To: | Area (ha) |
|---|---|---|---|---|---|
| 0 | 4 | 0.295 | 4 | 8 | 0.600 |

## Model Details

Storage is Online Cover Level (m) 81.011

## Tank or Pond Structure

Invert Level (m) 77.786

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|---|---|
| 0.000 | 220.0 | 0.700 | 220.0 | 1.400 | 220.0 | 2.100 | 220.0 |
| 0.100 | 220.0 | 0.800 | 220.0 | 1.500 | 220.0 | 2.200 | 220.0 |
| 0.200 | 220.0 | 0.900 | 220.0 | 1.600 | 220.0 | 2.300 | 220.0 |
| 0.300 | 220.0 | 1.000 | 220.0 | 1.700 | 220.0 | 2.400 | 220.0 |
| 0.400 | 220.0 | 1.100 | 220.0 | 1.800 | 220.0 | 2.500 | 220.0 |
| 0.500 | 220.0 | 1.200 | 220.0 | 1.900 | 220.0 | | |
| 0.600 | 220.0 | 1.300 | 220.0 | 2.000 | 220.0 | | |

## Hydro-Brake® Optimum Outflow Control

| | |
|---|---|
| Unit Reference | MD-SHE-0099-5700-1900-5700 |
| Design Head (m) | 1.900 |
| Design Flow (l/s) | 5.7 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 99 |
| Invert Level (m) | 77.761 |
| Minimum Outlet Pipe Diameter (mm) | 150 |
| Suggested Manhole Diameter (mm) | 1200 |

| Control Points | Head (m) | Flow (l/s) |
|---|---|---|
| Design Point (Calculated) | 1.900 | 5.7 |
| Flush-Flo™ | 0.431 | 5.0 |
| Kick-Flo® | 0.886 | 4.0 |
| Mean Flow over Head Range | - | 4.6 |

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 | 3.3 | 1.200 | 4.6 | 3.000 | 7.1 | 7.000 | 10.5 |
| 0.200 | 4.6 | 1.400 | 4.9 | 3.500 | 7.6 | 7.500 | 10.9 |
| 0.300 | 4.9 | 1.600 | 5.3 | 4.000 | 8.1 | 8.000 | 11.2 |
| 0.400 | 5.0 | 1.800 | 5.6 | 4.500 | 8.5 | 8.500 | 11.6 |
| 0.500 | 5.0 | 2.000 | 5.8 | 5.000 | 9.0 | 9.000 | 11.9 |
| 0.600 | 4.9 | 2.200 | 6.1 | 5.500 | 9.4 | 9.500 | 12.2 |
| 0.800 | 4.5 | 2.400 | 6.4 | 6.000 | 9.8 | | |
| 1.000 | 4.2 | 2.600 | 6.6 | 6.500 | 10.2 | | |

## Summary of Results for 30 year Return Period (+20%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 78.254 | 0.468 | 5.0 | 103.0 | O K |
| 30 min Summer | 78.421 | 0.635 | 5.0 | 139.7 | O K |
| 60 min Summer | 78.595 | 0.809 | 5.0 | 178.1 | O K |
| 120 min Summer | 78.773 | 0.987 | 5.0 | 217.1 | O K |
| 180 min Summer | 78.866 | 1.080 | 5.0 | 237.6 | O K |
| 240 min Summer | 78.923 | 1.137 | 5.0 | 250.1 | O K |
| 360 min Summer | 78.980 | 1.194 | 5.0 | 262.8 | O K |
| 480 min Summer | 78.999 | 1.213 | 5.0 | 266.9 | O K |
| 600 min Summer | 79.007 | 1.221 | 5.0 | 268.6 | O K |
| 720 min Summer | 79.008 | 1.222 | 5.0 | 268.9 | O K |
| 960 min Summer | 79.002 | 1.216 | 5.0 | 267.5 | O K |
| 1440 min Summer | 78.971 | 1.185 | 5.0 | 260.7 | O K |
| 2160 min Summer | 78.904 | 1.118 | 5.0 | 245.9 | O K |
| 2880 min Summer | 78.825 | 1.039 | 5.0 | 228.5 | O K |
| 4320 min Summer | 78.631 | 0.845 | 5.0 | 185.8 | O K |
| 5760 min Summer | 78.420 | 0.634 | 5.0 | 139.4 | O K |
| 7200 min Summer | 78.268 | 0.482 | 5.0 | 106.1 | O K |
| 8640 min Summer | 78.157 | 0.371 | 5.0 | 81.6 | O K |
| 10080 min Summer | 78.076 | 0.290 | 4.9 | 63.8 | O K |
| 15 min Winter | 78.313 | 0.527 | 5.0 | 115.9 | O K |
| 30 min Winter | 78.502 | 0.716 | 5.0 | 157.4 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 64.112 | 0.0 | 107.5 | 22 |
| 30 min Summer | 44.003 | 0.0 | 147.6 | 37 |
| 60 min Summer | 28.719 | 0.0 | 192.7 | 66 |
| 120 min Summer | 18.255 | 0.0 | 245.0 | 126 |
| 180 min Summer | 13.904 | 0.0 | 279.9 | 184 |
| 240 min Summer | 11.439 | 0.0 | 307.0 | 244 |
| 360 min Summer | 8.669 | 0.0 | 349.0 | 362 |
| 480 min Summer | 7.113 | 0.0 | 381.8 | 454 |
| 600 min Summer | 6.097 | 0.0 | 409.3 | 510 |
| 720 min Summer | 5.375 | 0.0 | 432.9 | 574 |
| 960 min Summer | 4.404 | 0.0 | 472.9 | 706 |
| 1440 min Summer | 3.324 | 0.0 | 535.5 | 984 |
| 2160 min Summer | 2.508 | 0.0 | 606.1 | 1408 |
| 2880 min Summer | 2.053 | 0.0 | 661.4 | 1820 |
| 4320 min Summer | 1.546 | 0.0 | 747.3 | 2640 |
| 5760 min Summer | 1.264 | 0.0 | 814.6 | 3336 |
| 7200 min Summer | 1.081 | 0.0 | 870.6 | 4032 |
| 8640 min Summer | 0.951 | 0.0 | 919.2 | 4672 |
| 10080 min Summer | 0.854 | 0.0 | 962.5 | 5352 |
| 15 min Winter | 64.112 | 0.0 | 120.4 | 22 |
| 30 min Winter | 44.003 | 0.0 | 165.3 | 37 |

## Summary of Results for 30 year Return Period (+20%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 60 min Winter | 78.702 | 0.916 | 5.0 | 201.6 | O K |
| 120 min Winter | 78.904 | 1.118 | 5.0 | 246.0 | O K |
| 180 min Winter | 79.015 | 1.229 | 5.0 | 270.4 | O K |
| 240 min Winter | 79.086 | 1.300 | 5.0 | 285.9 | O K |
| 360 min Winter | 79.164 | 1.378 | 5.0 | 303.1 | O K |
| 480 min Winter | 79.197 | 1.411 | 5.0 | 310.3 | O K |
| 600 min Winter | 79.205 | 1.419 | 5.0 | 312.3 | O K |
| 720 min Winter | 79.201 | 1.415 | 5.0 | 311.3 | O K |
| 960 min Winter | 79.191 | 1.405 | 5.0 | 309.1 | O K |
| 1440 min Winter | 79.135 | 1.349 | 5.0 | 296.9 | O K |
| 2160 min Winter | 79.018 | 1.232 | 5.0 | 271.0 | O K |
| 2880 min Winter | 78.884 | 1.098 | 5.0 | 241.5 | O K |
| 4320 min Winter | 78.535 | 0.749 | 5.0 | 164.7 | O K |
| 5760 min Winter | 78.250 | 0.464 | 5.0 | 102.1 | O K |
| 7200 min Winter | 78.080 | 0.294 | 4.9 | 64.6 | O K |
| 8640 min Winter | 77.983 | 0.197 | 4.7 | 43.2 | O K |
| 10080 min Winter | 77.926 | 0.140 | 4.3 | 30.7 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 60 min Winter | 28.719 | 0.0 | 215.8 | 66 |
| 120 min Winter | 18.255 | 0.0 | 274.5 | 124 |
| 180 min Winter | 13.904 | 0.0 | 313.6 | 182 |
| 240 min Winter | 11.439 | 0.0 | 344.0 | 238 |
| 360 min Winter | 8.669 | 0.0 | 391.0 | 352 |
| 480 min Winter | 7.113 | 0.0 | 427.8 | 462 |
| 600 min Winter | 6.097 | 0.0 | 458.4 | 564 |
| 720 min Winter | 5.375 | 0.0 | 484.9 | 608 |
| 960 min Winter | 4.404 | 0.0 | 529.7 | 746 |
| 1440 min Winter | 3.324 | 0.0 | 599.7 | 1058 |
| 2160 min Winter | 2.508 | 0.0 | 678.8 | 1520 |
| 2880 min Winter | 2.053 | 0.0 | 740.8 | 1968 |
| 4320 min Winter | 1.546 | 0.0 | 837.1 | 2772 |
| 5760 min Winter | 1.264 | 0.0 | 912.4 | 3408 |
| 7200 min Winter | 1.081 | 0.0 | 975.3 | 4040 |
| 8640 min Winter | 0.951 | 0.0 | 1029.6 | 4672 |
| 10080 min Winter | 0.854 | 0.0 | 1078.0 | 5344 |

## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 30 | Cv (Summer) | 0.750 |
| Region | Scotland and Ireland | Cv (Winter) | 0.840 |
| M5-60 (mm) | 15.800 | Shortest Storm (mins) | 15 |
| Ratio R | 0.280 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +20 |

## Time Area Diagram

Total Area (ha) 0.895

| Time (mins) From: | To: | Area (ha) | Time (mins) From: | To: | Area (ha) |
|---|---|---|---|---|---|
| 0 | 4 | 0.295 | 4 | 8 | 0.600 |

## Model Details

Storage is Online Cover Level (m) 81.011

## Tank or Pond Structure

Invert Level (m) 77.786

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|---|---|
| 0.000 | 220.0 | 0.700 | 220.0 | 1.400 | 220.0 | 2.100 | 220.0 |
| 0.100 | 220.0 | 0.800 | 220.0 | 1.500 | 220.0 | 2.200 | 220.0 |
| 0.200 | 220.0 | 0.900 | 220.0 | 1.600 | 220.0 | 2.300 | 220.0 |
| 0.300 | 220.0 | 1.000 | 220.0 | 1.700 | 220.0 | 2.400 | 220.0 |
| 0.400 | 220.0 | 1.100 | 220.0 | 1.800 | 220.0 | 2.500 | 220.0 |
| 0.500 | 220.0 | 1.200 | 220.0 | 1.900 | 220.0 | | |
| 0.600 | 220.0 | 1.300 | 220.0 | 2.000 | 220.0 | | |

## Hydro-Brake® Optimum Outflow Control

| | |
|---|---|
| Unit Reference | MD-SHE-0099-5700-1900-5700 |
| Design Head (m) | 1.900 |
| Design Flow (l/s) | 5.7 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 99 |
| Invert Level (m) | 77.761 |
| Minimum Outlet Pipe Diameter (mm) | 150 |
| Suggested Manhole Diameter (mm) | 1200 |

| Control Points | Head (m) | Flow (l/s) |
|---|---|---|
| Design Point (Calculated) | 1.900 | 5.7 |
| Flush-Flo™ | 0.431 | 5.0 |
| Kick-Flo® | 0.886 | 4.0 |
| Mean Flow over Head Range | - | 4.6 |

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 | 3.3 | 1.200 | 4.6 | 3.000 | 7.1 | 7.000 | 10.5 |
| 0.200 | 4.6 | 1.400 | 4.9 | 3.500 | 7.6 | 7.500 | 10.9 |
| 0.300 | 4.9 | 1.600 | 5.3 | 4.000 | 8.1 | 8.000 | 11.2 |
| 0.400 | 5.0 | 1.800 | 5.6 | 4.500 | 8.5 | 8.500 | 11.6 |
| 0.500 | 5.0 | 2.000 | 5.8 | 5.000 | 9.0 | 9.000 | 11.9 |
| 0.600 | 4.9 | 2.200 | 6.1 | 5.500 | 9.4 | 9.500 | 12.2 |
| 0.800 | 4.5 | 2.400 | 6.4 | 6.000 | 9.8 | | |
| 1.000 | 4.2 | 2.600 | 6.6 | 6.500 | 10.2 | | |

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

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 78.398 | 0.612 | 5.0 | 134.6 | O K |
| 30 min Summer | 78.626 | 0.840 | 5.0 | 184.8 | O K |
| 60 min Summer | 78.858 | 1.072 | 5.0 | 235.9 | O K |
| 120 min Summer | 79.086 | 1.300 | 5.0 | 286.1 | O K |
| 180 min Summer | 79.209 | 1.423 | 5.0 | 313.1 | O K |
| 240 min Summer | 79.286 | 1.500 | 5.1 | 330.0 | O K |
| 360 min Summer | 79.368 | 1.582 | 5.3 | 348.1 | O K |
| 480 min Summer | 79.400 | 1.614 | 5.3 | 355.1 | O K |
| 600 min Summer | 79.408 | 1.622 | 5.3 | 356.9 | O K |
| 720 min Summer | 79.411 | 1.625 | 5.3 | 357.5 | O K |
| 960 min Summer | 79.403 | 1.617 | 5.3 | 355.8 | O K |
| 1440 min Summer | 79.367 | 1.581 | 5.3 | 347.9 | O K |
| 2160 min Summer | 79.295 | 1.509 | 5.2 | 332.0 | O K |
| 2880 min Summer | 79.213 | 1.427 | 5.0 | 313.9 | O K |
| 4320 min Summer | 79.038 | 1.252 | 5.0 | 275.5 | O K |
| 5760 min Summer | 78.865 | 1.079 | 5.0 | 237.3 | O K |
| 7200 min Summer | 78.676 | 0.890 | 5.0 | 195.7 | O K |
| 8640 min Summer | 78.444 | 0.658 | 5.0 | 144.8 | O K |
| 10080 min Summer | 78.297 | 0.511 | 5.0 | 112.4 | O K |
| 15 min Winter | 78.474 | 0.688 | 5.0 | 151.3 | O K |
| 30 min Winter | 78.732 | 0.946 | 5.0 | 208.1 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 83.028 | 0.0 | 139.2 | 22 |
| 30 min Summer | 57.412 | 0.0 | 192.6 | 37 |
| 60 min Summer | 37.358 | 0.0 | 250.8 | 66 |
| 120 min Summer | 23.565 | 0.0 | 316.4 | 126 |
| 180 min Summer | 17.847 | 0.0 | 359.4 | 186 |
| 240 min Summer | 14.619 | 0.0 | 392.5 | 244 |
| 360 min Summer | 11.005 | 0.0 | 443.2 | 362 |
| 480 min Summer | 8.985 | 0.0 | 482.5 | 480 |
| 600 min Summer | 7.672 | 0.0 | 515.0 | 540 |
| 720 min Summer | 6.741 | 0.0 | 543.0 | 602 |
| 960 min Summer | 5.494 | 0.0 | 590.0 | 730 |
| 1440 min Summer | 4.116 | 0.0 | 663.0 | 1000 |
| 2160 min Summer | 3.083 | 0.0 | 744.9 | 1428 |
| 2880 min Summer | 2.509 | 0.0 | 808.4 | 1844 |
| 4320 min Summer | 1.875 | 0.0 | 906.0 | 2676 |
| 5760 min Summer | 1.523 | 0.0 | 981.4 | 3464 |
| 7200 min Summer | 1.296 | 0.0 | 1043.7 | 4320 |
| 8640 min Summer | 1.136 | 0.0 | 1097.6 | 4920 |
| 10080 min Summer | 1.015 | 0.0 | 1144.9 | 5544 |
| 15 min Winter | 83.028 | 0.0 | 155.9 | 22 |
| 30 min Winter | 57.412 | 0.0 | 215.7 | 37 |

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

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 60 min Winter | 78.994 | 1.208 | 5.0 | 265.8 | O K |
| 120 min Winter | 79.257 | 1.471 | 5.1 | 323.6 | O K |
| 180 min Winter | 79.403 | 1.617 | 5.3 | 355.7 | O K |
| 240 min Winter | 79.497 | 1.711 | 5.5 | 376.4 | O K |
| 360 min Winter | 79.605 | 1.819 | 5.6 | 400.2 | O K |
| 480 min Winter | 79.657 | 1.871 | 5.7 | 411.5 | O K |
| 600 min Winter | 79.676 | 1.890 | 5.7 | 415.8 | O K |
| 720 min Winter | 79.677 | 1.891 | 5.7 | 416.0 | O K |
| 960 min Winter | 79.662 | 1.876 | 5.7 | 412.8 | O K |
| 1440 min Winter | 79.607 | 1.821 | 5.6 | 400.6 | O K |
| 2160 min Winter | 79.484 | 1.698 | 5.4 | 373.7 | O K |
| 2880 min Winter | 79.347 | 1.561 | 5.2 | 343.4 | O K |
| 4320 min Winter | 79.067 | 1.281 | 5.0 | 281.8 | O K |
| 5760 min Winter | 78.781 | 0.995 | 5.0 | 218.9 | O K |
| 7200 min Winter | 78.397 | 0.611 | 5.0 | 134.5 | O K |
| 8640 min Winter | 78.177 | 0.391 | 5.0 | 86.0 | O K |
| 10080 min Winter | 78.048 | 0.262 | 4.9 | 57.7 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 60 min Winter | 37.358 | 0.0 | 280.8 | 66 |
| 120 min Winter | 23.565 | 0.0 | 354.3 | 124 |
| 180 min Winter | 17.847 | 0.0 | 402.5 | 182 |
| 240 min Winter | 14.619 | 0.0 | 439.6 | 240 |
| 360 min Winter | 11.005 | 0.0 | 496.4 | 354 |
| 480 min Winter | 8.985 | 0.0 | 540.4 | 464 |
| 600 min Winter | 7.672 | 0.0 | 576.8 | 572 |
| 720 min Winter | 6.741 | 0.0 | 608.1 | 674 |
| 960 min Winter | 5.494 | 0.0 | 660.8 | 764 |
| 1440 min Winter | 4.116 | 0.0 | 742.4 | 1074 |
| 2160 min Winter | 3.083 | 0.0 | 834.3 | 1540 |
| 2880 min Winter | 2.509 | 0.0 | 905.4 | 1992 |
| 4320 min Winter | 1.875 | 0.0 | 1014.7 | 2860 |
| 5760 min Winter | 1.523 | 0.0 | 1099.2 | 3744 |
| 7200 min Winter | 1.296 | 0.0 | 1169.1 | 4328 |
| 8640 min Winter | 1.136 | 0.0 | 1229.3 | 4928 |
| 10080 min Winter | 1.015 | 0.0 | 1282.5 | 5544 |

## 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) | 15.800 | Shortest Storm (mins) | 15 |
| Ratio R | 0.280 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +20 |

## Time Area Diagram

Total Area (ha) 0.895

| Time (mins) From: | To: | Area (ha) | Time (mins) From: | To: | Area (ha) |
|---|---|---|---|---|---|
| 0 | 4 | 0.295 | 4 | 8 | 0.600 |

## Model Details

Storage is Online Cover Level (m) 81.011

## Tank or Pond Structure

Invert Level (m) 77.786

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|---|---|
| 0.000 | 220.0 | 0.700 | 220.0 | 1.400 | 220.0 | 2.100 | 220.0 |
| 0.100 | 220.0 | 0.800 | 220.0 | 1.500 | 220.0 | 2.200 | 220.0 |
| 0.200 | 220.0 | 0.900 | 220.0 | 1.600 | 220.0 | 2.300 | 220.0 |
| 0.300 | 220.0 | 1.000 | 220.0 | 1.700 | 220.0 | 2.400 | 220.0 |
| 0.400 | 220.0 | 1.100 | 220.0 | 1.800 | 220.0 | 2.500 | 220.0 |
| 0.500 | 220.0 | 1.200 | 220.0 | 1.900 | 220.0 | | |
| 0.600 | 220.0 | 1.300 | 220.0 | 2.000 | 220.0 | | |

## Hydro-Brake® Optimum Outflow Control

| | |
|---|---|
| Unit Reference | MD-SHE-0099-5700-1900-5700 |
| Design Head (m) | 1.900 |
| Design Flow (l/s) | 5.7 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 99 |
| Invert Level (m) | 77.761 |
| Minimum Outlet Pipe Diameter (mm) | 150 |
| Suggested Manhole Diameter (mm) | 1200 |

| Control Points | Head (m) | Flow (l/s) |
|---|---|---|
| Design Point (Calculated) | 1.900 | 5.7 |
| Flush-Flo™ | 0.431 | 5.0 |
| Kick-Flo® | 0.886 | 4.0 |
| Mean Flow over Head Range | - | 4.6 |

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 | 3.3 | 1.200 | 4.6 | 3.000 | 7.1 | 7.000 | 10.5 |
| 0.200 | 4.6 | 1.400 | 4.9 | 3.500 | 7.6 | 7.500 | 10.9 |
| 0.300 | 4.9 | 1.600 | 5.3 | 4.000 | 8.1 | 8.000 | 11.2 |
| 0.400 | 5.0 | 1.800 | 5.6 | 4.500 | 8.5 | 8.500 | 11.6 |
| 0.500 | 5.0 | 2.000 | 5.8 | 5.000 | 9.0 | 9.000 | 11.9 |
| 0.600 | 4.9 | 2.200 | 6.1 | 5.500 | 9.4 | 9.500 | 12.2 |
| 0.800 | 4.5 | 2.400 | 6.4 | 6.000 | 9.8 | | |
| 1.000 | 4.2 | 2.600 | 6.6 | 6.500 | 10.2 | | |

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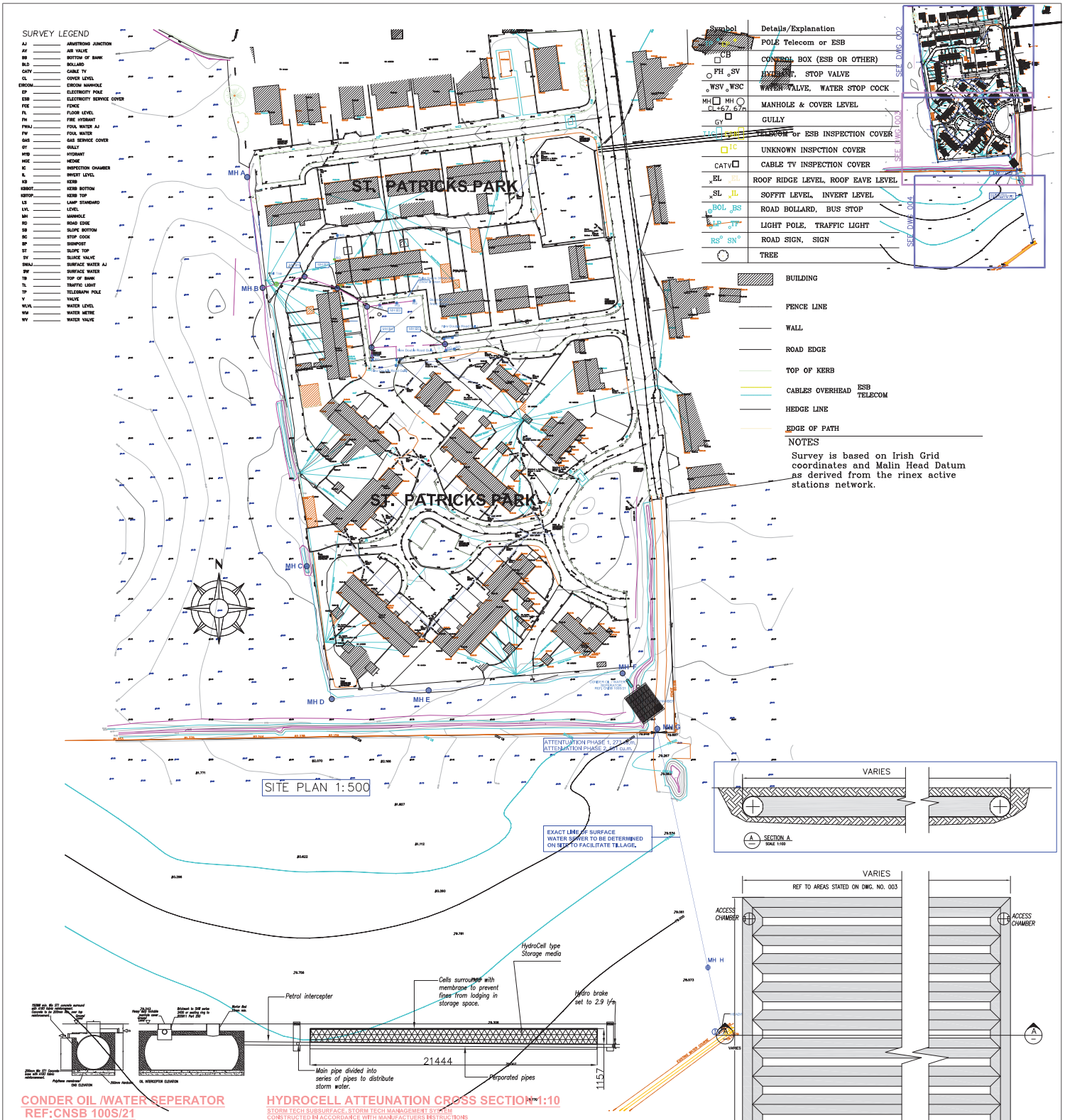
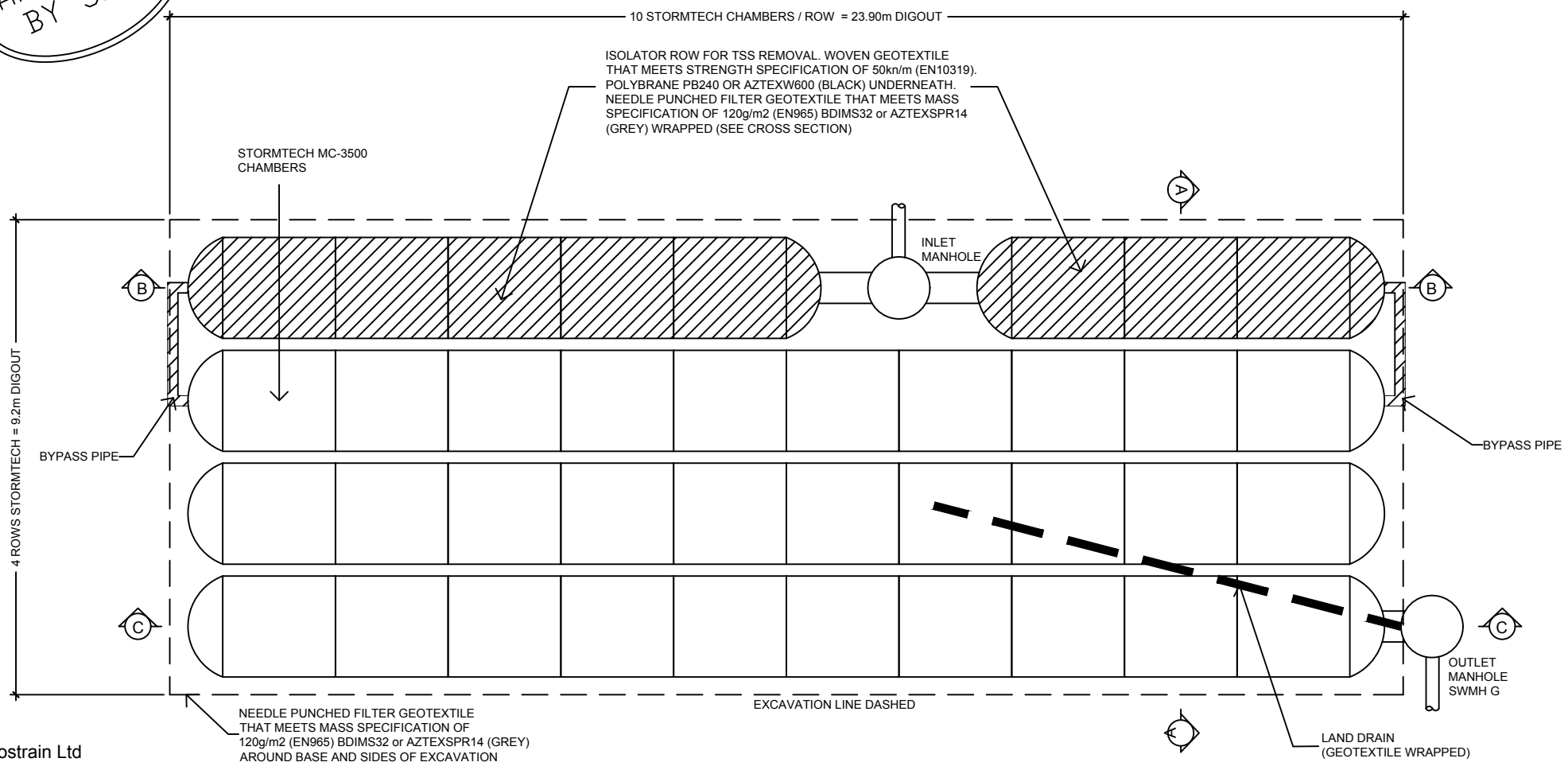
Rathfarnham, Dublin 14, D14CR20
**T.** 01 2051101 **E**. info@poga.ie **W**. poga.ie

## 7.7 APPENDIX G – EXISTING SW & ATTENUATION DETAILS




| | | | | | |
|---|---|---|---|---|---|
| ISSUE: TENDER | TITLE: ST. PATRICKS, RATHANGAN, CO.KILDARE | | | REVISIONS . | CLARKE & CO. Engineers & Architects Highlandview Tce. Fairgreen,Naas, Co. Kildare Tel+ (045) 866448, Faxt(045) 866166 www.clarkeng.ie |
| PROJECT NO: 4985-03 | DRAWING NO: 001 | REV NO: | CLIENT: KILDARE COUNTY COUNCIL | PROJECT ST. PATRICKS, RATHANGAN, CO.KILDARE | Civil & Structural Engineers. - Architecture - Fire Engineering - Planning Consultants - Project Management - Surveying |
| DRAWN / CHECKED IM/ RC | SCALE: VARIES@ A0 | DATE 26.08.2015 | LOCATION: ST. PATRICKS, RATHANGAN, CO.KILDARE | | |

APPROVED BY SITE





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## PROPOSED CHAMBER LAYOUT PLAN

not to scale

NOTE:
ALL LEVELS TO BE CHECKED AND CONFIRMED ON SITE.

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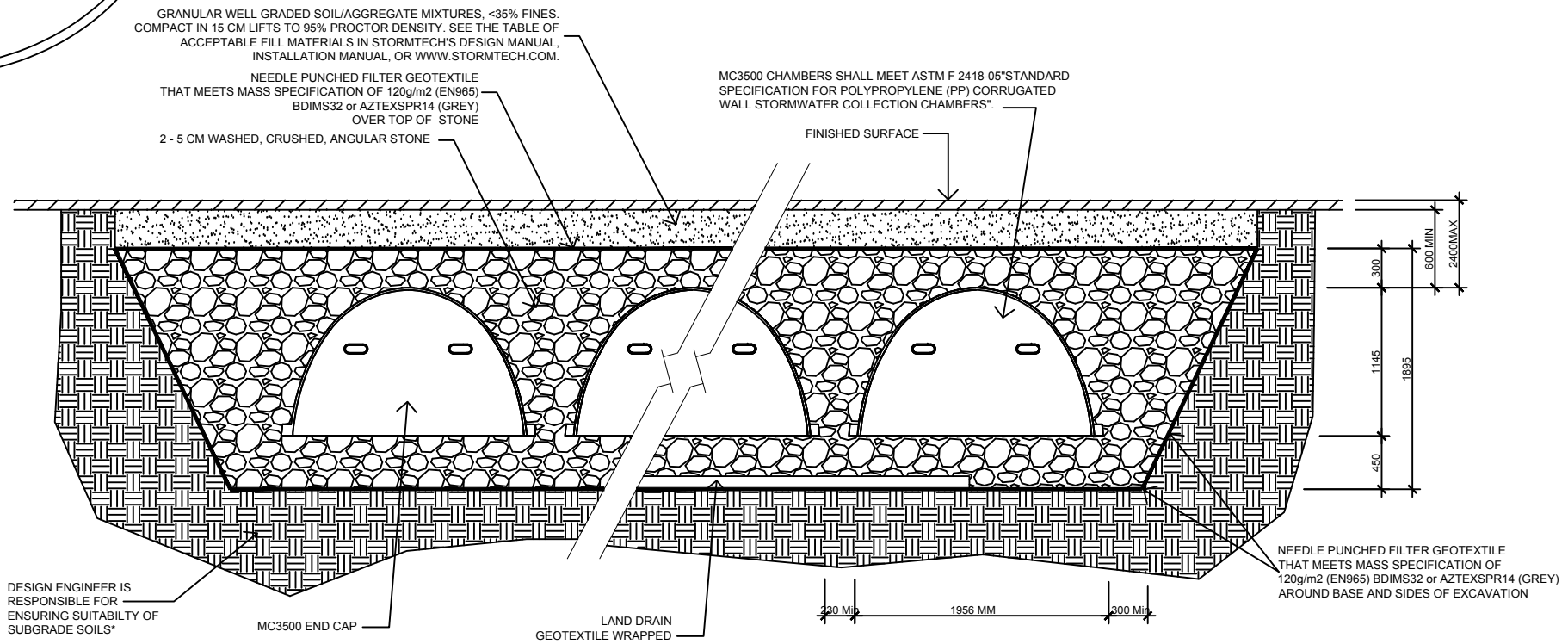
| | |
|---|---|
| CLIENT: EDDIE THOMAS | Page No :001 |
| PROJECT: RATHANGAN ESTATE | DRAWN BY: LP; REV: A |
| | SCALE: N.T.S |
| | SIZE: A4; DATE: 13-06-16 |
| DRAWING TITLE: Stormtech attenuation system Chamber layout plan - 273m³ | DRG. NO.: R6314-1 |
| CONTACT: IVAN MCFADDEN | |

APPROVED BY SITE

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# STORMTECH CHAMBER
## CROSS SECTION DETAIL A-A

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*SEE STORMTECH'S DESIGN MANUAL

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PROJECT: RATHANGAN ESTATE

Page No :002

DRAWN BY: LP

REV: A

SCALE: N.T.S

SIZE: A4

DATE: 13-06-16

DRAWING TITLE:
Stormtech attenuation system
Chamber cross section detail - 273m³

DRG. NO.: R6314-1

CONTACT: IVAN MCFADDEN

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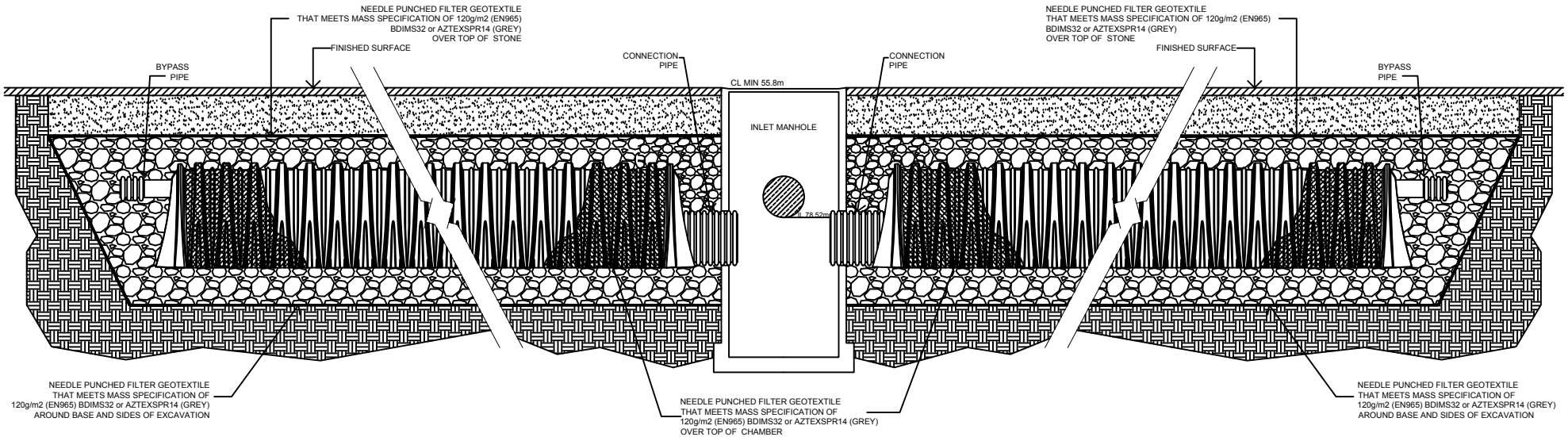


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# STORMTECH ISOLATOR™ ROW
# CROSS SECTION DETAIL B-B

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PROJECT: RATHANGAN ESTATE

Page No :003

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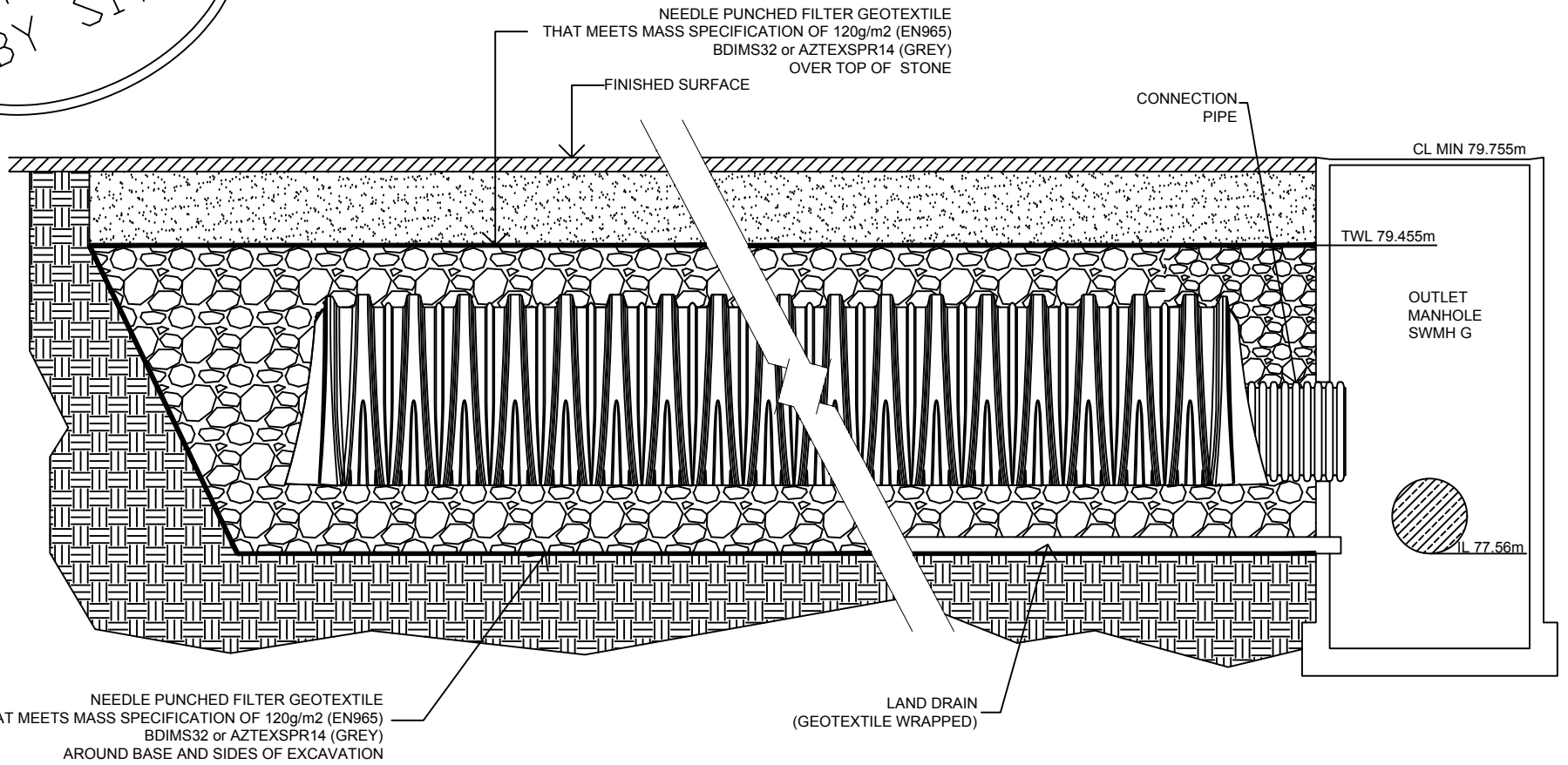
REV: A
SCALE: N.T.S
SIZE: A4
DATE: 13-06-16

DRAWING TITLE:
Stormtech attenuation system
Isolator row detail - 273m³

DRG. NO.: R6314-1

CONTACT: IVAN MCFADDEN

APPROVED BY SITE

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# STORMTECH OUTLET ROW CROSS SECTION DETAIL C-C

not to scale

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SCALE: N.T.S
SIZE: A4
DATE: 13-06-16

DRAWING TITLE:
Stormtech attenuation system
Outlet row detail - 273m³

DRG. NO.: R6314-1

CONTACT: IVAN MCFADDEN

## 7.8 APPENDIX H - **PROPOSED STORMTECH ATTENUATION SIZE**

# STORMTECH Stormwater Management System Design Tool

ver: Jan18

| | |
|---|---|
| PROJECT REF: | 1668 |
| LOCATION: | St Patricks Park |
| DATE: | 19-Oct-22 |
| CREATED BY: | NM |

## SYSTEM PARAMETERS

| | | |
|---|---|---|
| Required Total Storage | 92 | $m^3$ |
| Stormtech chamber model | SC740 | |
| Filtration Permeable Geo or Impermeable Geo | Filter geo | |
| Number of Isolator Rows (IR) | 1 | |

## SITE PARAMETERS

| | | | |
|---|---|---|---|
| Stone Porosity | 40% | | |
| Excavation Batter Angle (degrees) | 60 | ° | *Minimum Requirement* |
| Stone Above Chambers | 0.2 | m | *0.15* |
| Stone Below Chambers | 0.25 | m | *0.15* |
| In-between Row Spacing | 0.15 | m | *0.15* |
| Additional Storage outside Excavation. E.g manholes, Header Pipe | 0 | $m^3$ | |

## HEADER PIPE

| | | |
|---|---|---|
| Is Header pipe required within excavation | No | |
| Orientation of Header Pipe | Parrallel to IR | |
| Diameter of Header Pipe | 0.6 | m |
| Length of Header Pipe | 0 | m |

## CHAMBER SYSTEM DIMENSIONS

| | Calculated | Adopted | |
|---|---|---|---|
| Number of Rows | | 3 | ea |
| Number of units per Row | | 11 | ea |
| System Installed Storage Depth (effective storage depth) | 1.210 | | m |
| Tank overall installed Width at base | 4.79 | 5 | m |
| Tank overall installed Length at Base | 24.57 | 25 | m |
| Total Effective System Storage | 93.2 | 97.0 | $m^3$ |

## STORMTECH SYSTEM DETAIL

| | | |
|---|---|---|
| StormTech Chamber Model | SC740 | |
| Unit Width | 1.295 | m |
| Unit Length | 2.17 | m |
| Unit Height | 0.76 | m |
| Min Cover Over System | 0.3 | m |
| Max Cover Over Chamber (see StormTech for greater cover) | 2.4 | m |
| Chamber Internal Storage Vol. | 1.3 | $m^3$ |
| Header Pipe Internal Storage Vol in Excavation | 0.0 | $m^3$ |

## STONE AND EXCAVATION DETAIL

| | | |
|---|---|---|
| Volume of Dig for System | 178 | $m^3$ |
| Width at base | 5.00 | m |
| Width at top | 6.40 | m |
| Length at base | 25.00 | m |
| Length at top | 26.40 | m |
| Depth Of System | 1.21 | m |
| Area of Dig at Base of System | 125 | $m^2$ |
| Area of Dig at Top of System | 169 | $m^2$ |
| Void Ratio | 55% | |
| Stone Requirement - m3 | 134 | $m^3$ |
| Stone Requirement - tonne | 220 | tonne |

## 7.9 APPENDIX J – SURFACE WATER PIPE DESIGN

## STORM SEWER DESIGN by the Modified Rational Method

## Design Criteria for Surface Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

| | | | |
|---|---|---|---|
| Return Period (years) | 2 | PIMP (%) | 100 |
| M5-60 (mm) | 15.600 | Add Flow / Climate Change (%) | 20 |
| Ratio R | 0.280 | Minimum Backdrop Height (m) | 0.600 |
| Maximum Rainfall (mm/hr) | 50 | Maximum Backdrop Height (m) | 1.800 |
| 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) | 0.75 |
| Volumetric Runoff Coeff. | 0.750 | Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

## Time Area Diagram for Surface Network 1

| Time (mins) | Area (ha) | Time (mins) | Area (ha) | Time (mins) | Area (ha) | Time (mins) | Area (ha) |
|---|---|---|---|---|---|---|---|
| 0-4 | 0.006 | 4-8 | 0.261 | 8-12 | 0.418 | 12-16 | 0.038 |

Total Area Contributing (ha) = 0.724

Total Pipe Volume (m³) = 80.597

## Network Design Table for Surface Network 1

« - Indicates pipe capacity < flow

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 27.648 | 0.276 | 100.2 | 0.079 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.001 | 43.523 | 0.435 | 100.1 | 0.016 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.002 | 59.571 | 0.298 | 199.9 | 0.040 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.003 | 55.787 | 0.090 | 619.9 | 0.119 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| 1.004 | 47.527 | 0.100 | 475.3 | 0.036 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 49.75 | 4.35 | 80.458 | 0.079 | 0.0 | 0.0 | 2.1 | 1.31 | 51.9 | 12.8 |
| 1.001 | 47.66 | 4.91 | 80.181 | 0.095 | 0.0 | 0.0 | 2.5 | 1.31 | 52.0 | 14.7 |
| 1.002 | 44.16 | 5.99 | 79.713 | 0.135 | 0.0 | 0.0 | 3.2 | 0.92 | 36.6 | 19.4 |
| 1.003 | 41.07 | 7.13 | 79.190 | 0.254 | 0.0 | 0.0 | 5.7 | 0.81 | 128.7 | 33.9 |
| 1.004 | 39.09 | 7.99 | 79.100 | 0.290 | 0.0 | 0.0 | 6.1 | 0.93 | 147.3 | 36.8 |

## Network Design Table for Surface Network 1

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.005 | 44.204 | 0.130 | 340.0 | 0.042 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| 2.000 | 16.095 | 0.089 | 180.8 | 0.038 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 2.001 | 18.049 | 0.100 | 180.5 | 0.014 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 2.002 | 16.602 | 0.092 | 180.5 | 0.018 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 2.003 | 25.914 | 0.144 | 180.0 | 0.062 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 2.004 | 18.272 | 0.102 | 179.1 | 0.017 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 3.000 | 15.800 | 0.079 | 200.0 | 0.054 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 3.001 | 20.142 | 0.101 | 199.4 | 0.028 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 3.002 | 26.312 | 0.132 | 199.3 | 0.038 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 3.003 | 19.032 | 0.095 | 200.3 | 0.021 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 2.005 | 7.640 | 0.042 | 181.9 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 2.006 | 28.741 | 0.160 | 179.6 | 0.007 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 1.006 | 52.793 | 0.110 | 479.9 | 0.050 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| 1.007 | 33.683 | 0.075 | 449.1 | 0.014 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| 1.008 | 82.561 | 0.183 | 451.2 | 0.031 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| 1.009 | 5.969 | 0.030 | 200.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 1.010 | 3.488 | 0.017 | 200.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 1.011 | 6.580 | 0.033 | 200.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.005 | 37.70 | 8.66 | 79.000 | 0.332 | 0.0 | 0.0 | 6.8 | 1.10 | 174.4 | 40.7 |
| 2.000 | 50.00 | 4.28 | 80.653 | 0.038 | 0.0 | 0.0 | 1.0 | 0.97 | 38.5 | 6.2 |
| 2.001 | 48.84 | 4.59 | 80.563 | 0.052 | 0.0 | 0.0 | 1.4 | 0.97 | 38.6 | 8.3 |
| 2.002 | 47.79 | 4.87 | 80.463 | 0.070 | 0.0 | 0.0 | 1.8 | 0.97 | 38.6 | 10.9 |
| 2.003 | 46.26 | 5.32 | 80.371 | 0.132 | 0.0 | 0.0 | 3.3 | 0.97 | 38.6 | 19.8 |
| 2.004 | 45.25 | 5.63 | 80.227 | 0.149 | 0.0 | 0.0 | 3.7 | 0.97 | 38.7 | 21.9 |
| 3.000 | 50.00 | 4.29 | 81.174 | 0.054 | 0.0 | 0.0 | 1.5 | 0.92 | 36.6 | 8.8 |
| 3.001 | 48.60 | 4.65 | 81.095 | 0.082 | 0.0 | 0.0 | 2.2 | 0.92 | 36.7 | 13.0 |
| 3.002 | 46.90 | 5.13 | 80.995 | 0.120 | 0.0 | 0.0 | 3.0 | 0.92 | 36.7 | 18.3 |
| 3.003 | 45.75 | 5.47 | 80.863 | 0.141 | 0.0 | 0.0 | 3.5 | 0.92 | 36.6 | 21.0 |
| 2.005 | 44.91 | 5.74 | 80.125 | 0.290 | 0.0 | 0.0 | 7.1 | 1.16 | 82.2 | 42.3 |
| 2.006 | 43.69 | 6.15 | 80.083 | 0.297 | 0.0 | 0.0 | 7.1 | 1.17 | 82.7 | 42.3 |
| 1.006 | 35.91 | 9.62 | 78.870 | 0.679 | 0.0 | 0.0 | 13.2 | 0.92 | 146.5 | 79.2 |
| 1.007 | 34.91 | 10.21 | 78.760 | 0.693 | 0.0 | 0.0 | 13.2 | 0.95 | 151.5 | 79.2 |
| 1.008 | 32.72 | 11.65 | 78.685 | 0.724 | 0.0 | 0.0 | 13.2 | 0.95 | 151.2 | 79.2 |
| 1.009 | 32.53 | 11.79 | 78.502 | 0.724 | 0.0 | 0.0 | 13.2 | 0.71 | 12.5« | 79.2 |
| 1.010 | 32.42 | 11.88 | 78.472 | 0.724 | 0.0 | 0.0 | 13.2 | 0.71 | 12.5« | 79.2 |
| 1.011 | 32.21 | 12.03 | 78.454 | 0.724 | 0.0 | 0.0 | 13.2 | 0.71 | 12.5« | 79.2 |

## Network Design Table for Surface Network 1

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.012 | 5.204 | 0.026 | 200.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 1.013 | 94.939 | 0.345 | 275.2 | 0.000 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.012 | 32.04 | 12.15 | 78.421 | 0.724 | 0.0 | 0.0 | 13.2 | 0.71 | 12.5« | 79.2 |
| 1.013 | 30.43 | 13.45 | 77.560 | 0.724 | 0.0 | 0.0 | 13.2 | 1.22 | 194.1 | 79.2 |

## 7.10 APPENDIX K – WASTEWATER PIPE DESIGN

## FOUL SEWERAGE DESIGN

### Design Criteria for Foul Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

| | | | |
|---|---|---|---|
| Industrial Flow (l/s/ha) | 0.00 | Add Flow / Climate Change (%) | 0 |
| Industrial Peak Flow Factor | 0.00 | Minimum Backdrop Height (m) | 0.200 |
| Flow Per Person (l/per/day) | 222.00 | Maximum Backdrop Height (m) | 1.500 |
| Persons per House | 3.00 | Min Design Depth for Optimisation (m) | 1.200 |
| Domestic (l/s/ha) | 0.00 | Min Vel for Auto Design only (m/s) | 1.00 |
| Domestic Peak Flow Factor | 6.00 | Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

### Network Design Table for Foul Network 1

| PN | Length (m) | Fall (m) | Slope (1:X) | Area (ha) | Houses | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 32.321 | 0.200 | 161.6 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.001 | 32.595 | 0.260 | 125.4 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 2.000 | 18.177 | 0.120 | 151.5 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 2.001 | 13.804 | 0.080 | 172.5 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 2.002 | 6.957 | 0.035 | 198.8 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.002 | 10.708 | 0.050 | 214.2 | 0.000 | 17 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.003 | 9.945 | 0.070 | 142.1 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.004 | 9.787 | 0.040 | 244.7 | 0.000 | 8 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.005 | 30.119 | 0.155 | 194.3 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.006 | 20.218 | 0.137 | 147.6 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 3.000 | 12.509 | 0.108 | 115.8 | 0.000 | 0 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |

### Network Results Table

| PN | US/IL (m) | Σ Area (ha) | Σ Base Flow (l/s) | Σ Hse | Add Flow (l/s) | P.Dep (mm) | P.Vel (m/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 81.800 | 0.000 | 0.0 | 0 | 0.0 | 0 | 0.00 | 0.90 | 35.9 | 0.0 |
| 1.001 | 81.600 | 0.000 | 0.0 | 0 | 0.0 | 0 | 0.00 | 1.02 | 40.7 | 0.0 |
| 2.000 | 81.575 | 0.000 | 0.0 | 0 | 0.0 | 0 | 0.00 | 0.93 | 37.0 | 0.0 |
| 2.001 | 81.455 | 0.000 | 0.0 | 0 | 0.0 | 0 | 0.00 | 0.87 | 34.7 | 0.0 |
| 2.002 | 81.375 | 0.000 | 0.0 | 0 | 0.0 | 0 | 0.00 | 0.81 | 32.3 | 0.0 |
| 1.002 | 81.340 | 0.000 | 0.0 | 17 | 0.0 | 25 | 0.33 | 0.78 | 31.1 | 0.8 |
| 1.003 | 81.290 | 0.000 | 0.0 | 17 | 0.0 | 23 | 0.38 | 0.96 | 38.3 | 0.8 |
| 1.004 | 81.220 | 0.000 | 0.0 | 25 | 0.0 | 31 | 0.35 | 0.73 | 29.1 | 1.2 |
| 1.005 | 81.180 | 0.000 | 0.0 | 25 | 0.0 | 29 | 0.38 | 0.82 | 32.7 | 1.2 |
| 1.006 | 81.025 | 0.000 | 0.0 | 25 | 0.0 | 27 | 0.42 | 0.94 | 37.5 | 1.2 |
| 3.000 | 81.358 | 0.000 | 0.0 | 0 | 0.0 | 0 | 0.00 | 0.81 | 14.4 | 0.0 |

## Network Design Table for Foul Network 1

| PN | Length (m) | Fall (m) | Slope (1:X) | Area (ha) | Houses | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.001 | 17.290 | 0.144 | 119.8 | 0.000 | 0 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |
| 3.002 | 16.258 | 0.108 | 150.5 | 0.000 | 9 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |
| 3.003 | 5.151 | 0.034 | 150.0 | 0.000 | 0 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |
| 1.007 | 8.027 | 0.138 | 58.2 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 4.000 | 37.406 | 0.468 | 79.9 | 0.000 | 1 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |
| 1.008 | 26.157 | 0.200 | 130.8 | 0.000 | 6 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.009 | 18.847 | 0.112 | 167.9 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.010 | 13.103 | 0.088 | 149.3 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.011 | 34.290 | 0.750 | 45.7 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 5.000 | 13.768 | 0.615 | 22.4 | 0.000 | 12 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |
| 1.012 | 4.894 | 0.019 | 262.6 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 6.000 | 24.688 | 0.309 | 79.9 | 0.000 | 2 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |
| 6.001 | 43.586 | 0.545 | 80.0 | 0.000 | 0 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |
| 1.013 | 23.039 | 0.111 | 206.9 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 1.014 | 12.452 | 0.070 | 177.9 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |

## Network Results Table

| PN | US/IL (m) | Σ Area (ha) | Σ Base Flow (l/s) | Σ Hse | Add Flow (l/s) | P.Dep (mm) | P.Vel (m/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.001 | 81.250 | 0.000 | 0.0 | 0 | 0.0 | 0 | 0.00 | 0.80 | 14.1 | 0.0 |
| 3.002 | 81.106 | 0.000 | 0.0 | 9 | 0.0 | 19 | 0.32 | 0.71 | 12.6 | 0.4 |
| 3.003 | 80.997 | 0.000 | 0.0 | 9 | 0.0 | 19 | 0.32 | 0.71 | 12.6 | 0.4 |
| 1.007 | 80.888 | 0.000 | 0.0 | 34 | 0.0 | 25 | 0.64 | 1.51 | 59.9 | 1.6 |
| 4.000 | 82.224 | 0.000 | 0.0 | 1 | 0.0 | 6 | 0.19 | 0.98 | 17.3 | 0.0 |
| 1.008 | 80.750 | 0.000 | 0.0 | 41 | 0.0 | 34 | 0.51 | 1.00 | 39.9 | 1.9 |
| 1.009 | 80.550 | 0.000 | 0.0 | 41 | 0.0 | 36 | 0.47 | 0.88 | 35.2 | 1.9 |
| 1.010 | 80.438 | 0.000 | 0.0 | 41 | 0.0 | 35 | 0.49 | 0.94 | 37.3 | 1.9 |
| 1.011 | 80.350 | 0.000 | 0.0 | 41 | 0.0 | 26 | 0.74 | 1.70 | 67.6 | 1.9 |
| 5.000 | 80.290 | 0.000 | 0.0 | 12 | 0.0 | 14 | 0.68 | 1.86 | 32.8 | 0.6 |
| 1.012 | 79.600 | 0.000 | 0.0 | 53 | 0.0 | 45 | 0.43 | 0.71 | 28.1 | 2.5 |
| 6.000 | 80.510 | 0.000 | 0.0 | 2 | 0.0 | 8 | 0.24 | 0.98 | 17.3 | 0.1 |
| 6.001 | 80.201 | 0.000 | 0.0 | 2 | 0.0 | 8 | 0.24 | 0.98 | 17.3 | 0.1 |
| 1.013 | 79.581 | 0.000 | 0.0 | 55 | 0.0 | 43 | 0.48 | 0.80 | 31.7 | 2.5 |
| 1.014 | 79.470 | 0.000 | 0.0 | 55 | 0.0 | 42 | 0.50 | 0.86 | 34.2 | 2.5 |

## Network Design Table for Foul Network 1

| PN | Length (m) | Fall (m) | Slope (1:X) | Area (ha) | Houses | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.015 | 35.423 | 1.700 | 20.8 | 0.000 | 2 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| 7.000 | 53.648 | 0.298 | 180.0 | 0.000 | 5 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |
| 7.001 | 27.868 | 0.155 | 179.8 | 0.000 | 3 | 0.0 | 1.500 | o | 150 | Pipe/Conduit | |
| 1.016 | 48.110 | 0.550 | 87.5 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |

## Network Results Table

| PN | US/IL (m) | Σ Area (ha) | Σ Base Flow (l/s) | Σ Hse | Add Flow (l/s) | P.Dep (mm) | P.Vel (m/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.015 | 79.400 | 0.000 | 0.0 | 57 | 0.0 | 25 | 1.07 | 2.52 | 100.2 | 2.6 |
| 7.000 | 78.228 | 0.000 | 0.0 | 5 | 0.0 | 15 | 0.25 | 0.65 | 11.5 | 0.2 |
| 7.001 | 77.930 | 0.000 | 0.0 | 8 | 0.0 | 19 | 0.29 | 0.65 | 11.5 | 0.4 |
| 1.016 | 77.700 | 0.000 | 0.0 | 65 | 0.0 | 38 | 0.68 | 1.23 | 48.8 | 3.0 |

## 7.10 APPENDIX L – IW WATERMAIN & WASTEWATER DEMAND CALCULATIONS

poga Consulting Engineers

| | |
|---|---|
| Project Name: | St Patrick's Park |
| Project Reference: | 1668 |
| Calculation Date: | 16/02/2021 |
| Calculation By: | NM |

## CALCULATIONS - PROPOSED DEVELOPMENT

| Accomodation Schedule | | Average Occupancy Rate | Population (P) | Daily Water Consumption per Capita (G) | Daily Water Consumption (L/s) |
|---|---|---|---|---|---|
| Existing Residential Units (unit) | 0 | 2.7 people / unit | 0 | 150 L/capita/day | 0.000 |
| Existing Commercial area (m2) | 0 | 1 person / 25 m2 | 0 | 50 L/day/capita | 0.000 |
| Existing Light Industrial area (m2) | 0 | 1 person / 33 m2 | 0 | 50 L/day/capita | 0.000 |
| Existing Retail area (m2) | 0 | 1 person / 100 m2 | 0 | 30 L/day/capita | 0.000 |
| Proposed Residential Units (unit) | 7 | 2.7 people / unit | 19 | 150 L/capita/day | 0.033 |
| Proposed Commercial area (m2) | 0 | 1 person / 25 m2 | 0 | 50 L/day/capita | 0.000 |
| Proposed Light Industrial area (m2) | 0 | 1 person / 33 m2 | 0 | 50 L/day/capita | 0.000 |
| Proposed Creche (m2) | 0 | 1 person / 20 m2 | 0 | 40 L/day/capita | 0.000 |
| Proposed Retail area (m2) | 0 | 1 person / 100 m2 | 0 | 30 L/day/capita | 0.000 |

**Coefficients for Subject Site**

| | | | |
|---|---|---|---|
| Infiltration rate for Existing properties (I) | = | 20 | % |
| Infiltration rate for New properties (I) | = | 10 | % |
| Commercial Peaking Factor (Pfdom,ind) | = | 4.50 | (up to 5.5Ha area) |
| Domestic Peaking Factor (Pfdom) | = | 6.00 | (0-750 Dwellings) |
| Trade Wastewater Flow Peaking Factor (Pftrade) | = | 3.00 | (No measured Data) |
| Gross Site Area | = | 1.88 | ha |
| C factor (Cv x Cr) | = | 0.80 | |
| Rainfall intensity (i) for sub-catchment greater than 400m2 for 2 years Return Period | = | 7.00 | mm/hr |
| Storm Design event peak rate runoff (Q = 2.78 x C x I x A - Modified Rational Method) | = | 29.27 | l/s |
| SW Allowance (1.5% of Gross Area) | = | 0.44 | |

**Foul Wastewater Discharge**

| | | | |
|---|---|---|---|
| Domestic Dry Weather Flow (P x G + I) | = | 0.04 | l/s |
| Design Foul Flow (Eqn1 + SW Allowance) | = | 0.66 | l/s |
| Commercial/Retail Dry Weather Flow (P x G + I) | = | 0.00 | l/s |
| Design Foul Flow (Eqn1) | = | 0.00 | l/s |
| Industrial Dry Weather Flow (P x G + I) | = | 0.00 | l/s |
| Design Foul Flow (Eqn1) | = | 0.00 | l/s |
| Total Discharge | | **0.66** | **l/s** |

**Water Demand**

| | | | |
|---|---|---|---|
| Domestic | = | 0.03 | l/s |
| Average Day/Peak Week Domestic Demand (1.25 times average) | = | 0.04 | l/s |
| Domestic and Industrial Demand | | 0.00 | |
| Normal Demand (Industrial/ Commercial Demand over 8 hours) | = | 0.00 | l/s |
| Total Peak Demand | | **0.04** | **l/s** |

## 7.11 APPENDIX M – IW CONFIRMATION OF FEASIBILITY

Noel Mahon

Unit 2C Nutgrove Office Park
Rathfarnham
Dublin 14
Dublin
D14CR20

**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**

29 April 2021

**Re: CDS21002476 pre-connection enquiry - Subject to contract | Contract denied**

**Connection for Housing Development of 7 unit(s) at St.Patricks Park, Rathangan, Kildare**

Dear Sir/Madam,

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

| **SERVICE** | **OUTCOME OF PRE-CONNECTION ENQUIRY**<br>**THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.** |
|---|---|
| Water Connection | Feasible without infrastructure upgrade by Irish Water |
| Wastewater Connection | Feasible without infrastructure upgrade by Irish Water |
| **SITE SPECIFIC COMMENTS** | |
| Water Connection | The proposed development indicates that an important Irish Water asset is present on the site. In advance of obtaining final planning permission the developer is requested to contact Irish Water to agree the required separation distances or proposed diversion associated with the infrastructure. |
| Wastewater Connection | The proposed development indicates that an important Irish Water asset is present on the site. In advance of obtaining final planning permission the developer is requested to contact Irish Water to agree the required separation distances or proposed diversion associated with the infrastructure. |

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

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


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

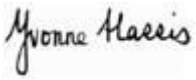
Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish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

**General Notes:**

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

If you have any further questions, please contact Lara Nagle from the design team on mkomso@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



**Yvonne Harris**

**Head of Customer Operations**

**THE END**