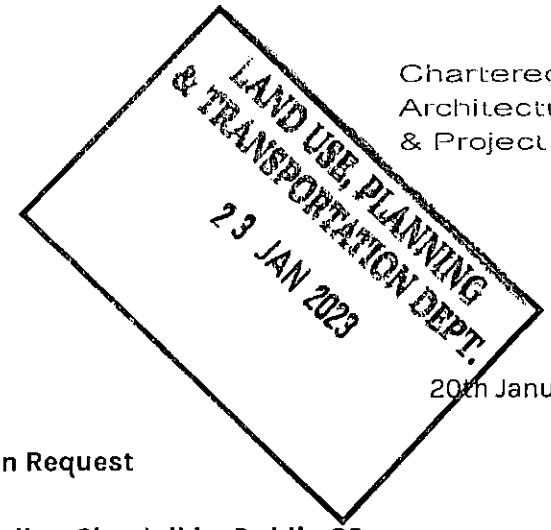
McArdle Doyle

Chartered Engineers
Architectural Services
& Project Managers



Planning Section,
South Dublin County Council,
County Hall Tallaght,
Dublin 24
D24A3XC

20th January 2023

RE: **Additional Information Request**
PLANNING REF: **SD22A/0363**
LOCATION: **Fonthill Road, Liffey Valley, Clondalkin, Dublin 22**
DEVELOPMENT: **New Unmanned Service Station Development**

Dear Sir/Madam,

1.0 INTRODUCTION

Please find enclosed **Additional Information Response** to South Dublin County Council **Register Reference No. SD22A/0363** in relation to the proposed development consisting of a new unmanned service station development at Fonthill Road, Liffey Valley, Clondalkin, Dublin 22.

This further information response is made by McArdle Doyle on behalf of our client, Certas Energy Ireland Limited.

The development description in this application consists of the following;

A new unmanned service station development consisting of construction of new petrol filling station forecourt with 4 dispensers, 2 underground fuel storage tanks with canopy structure (covering c. 235sq.m and 6.2m in height) with associated signage; Widen existing site entrance to the north-east of the site and creation of new egress location onto the Fonthill Road along the northern boundary to allow one-way internal road network incorporating new pedestrian crossing over existing footpath at site egress location; Automatic brush car wash and adjoining jet car wash with water recycling system; Single storey services building structure comprising of a car wash plant room and comms room area (gross floor area 16.3sq.m.) ; 4 electric charging bays, each comprising of a parking space and electric vehicle charging unit and associated signage; 3-room ESB substation to cater for EV charging infrastructure (gross floor area 38.3sq.m.); Air/Water services area with 2 car parking spaces; 2 internally illuminated double-sided totem signs, 1 at site entrance (4m high x 1.91m wide) with advertising area 15.3sq.m and 1 adjacent the new site egress location (5.8m high x 1.91m wide) with advertising area 22.16sq.m;
All other associated underground and overground infrastructure, drainage, lighting, CCTV unmanned systems, landscaping and site development works.

Location: Fonthill Road, Liffey Valley, Clondalkin, Dublin 22

It is noted that there are **4 no.** items referenced in the subject further information request, Register Reference No. SD22A/0363 and responses to all items are outlined in Section 02 of this report.

1.1 Content of Further Information Response

This report comprises of this cover letter outlining the individual further information responses to all requested items and rationale for same in conjunction with the following listed Appendix items A-E.

- **Appendix A**- South Dublin County Council Additional Information Request Ref no. SD22A/0363

- **Appendix B**- McArdle Doyle Further Information SUDS Report

- **Appendix C**- Charles McCorkell Arboricultural Report
  - Arboricultural Impact Assessment
  - Arboricultural Method Statement
  - Arboricultural Tree Survey

- **Appendix D** -Jane McCorkell Landscape Architect Further Information Response Item 03 & 04
  - Jane McCorkell Cover Letter- SD22A/0363 Further Information Response Item 03 & 04
  - PP397-01-01 Existing site survey
  - PP397-01-02 Existing site green factor analysis
  - PP397-02-01 Proposed landscape masterplan
  - PP397-02-02 Proposed green factor objectives
  - PP397-02-03 Green factor surface types
  - PP397-03-01 Tree and service plan with associated section details
  - PP348 -04-01 Landscape specifications
  - Appendix 1-Green infrastructure calculations of existing site
  - Appendix 2-Green infrastructure calculations of proposed site

- **Appendix E**-McArdle Doyle Updated Drawings, Register & Calculations
  - Updated Civil Drawing Register 20.01.23
  - P1956.C03_Rev A Proposed Site Layout
  - P1956.C04_Rev A Proposed Drainage & Watermain Layout
  - P1956.C11_Rev A Proposed Pavement Layout
  - McArdle Doyle Stormwater and Storage Control Calculations

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CONTENTS

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2.0 FURTHER INFORMATION REQUEST 01-04 (REF NO: SD22A/0363) & RESPONSE

A break down response of each planning condition no. 01-04 from Register Reference No. SD22A/0363 is set out below sections 2.1-2.4.

2.1 Further Information Request Item 01 (i)

Further Information Request 01 (i) SD22A/0363 states the following;
' 1. The Applicant is requested to provide the following to facilitate a complete assessment of the proposed development:
(i) The attenuation provided on site (60m3) is undersized by approximately 60%. The applicant is required to propose additional attenuation features.'

Further Information Response Item 01 (i):
Further to the above request, please find responses as follows:

The attenuation tank has been increased to provide 98m3 of storage. Please find enclosed revised drawing P1956.C04 Proposed Drainage Layout_REV A indicating the layout and location of the increased tank. This is also indicated in the attenuation/stormwater calculations attached as part of **Appendix E.**

As per attached McArdle Doyle calculation sheet 81m3 is required for a 1 in 100 year return period, however 98m3 is provided to cater for a 60% increase from the originally submitted planning documentation as per SDCC request in Item 1 (i).

As part of the revised package of McArdle Doyle Further Information drawings, P1956.C11 Proposed Paving Layout_REV A is updated to indicate the provision of permeable paving. Permeable paving will be provided at car parking spaces to cater for the interception storage for the development. Interception storage is to be provided in addition to the attenuation storage. Interception storage is calculated as the run off from 5mm of rainfall on the developed area. It is noted that 80% of the hardstanding areas are used for this calculation. The equivalent volume of interception storage should be provided to ensure the initial 5mm depth of rainfall is not discharged from site. The interception storage for the site will be provided within the permeable paving areas.

Overall impermeable area: 2,680 x 0.8 = 2,144 sq.m.

Total volume for 5mm rainfall: 2144 x 5 / 1000 = 10.72 cu.m.

The storage capacity of the permeable paving areas will be provided using 350mm depth of porous stone with a 30% void ratio, therefore storage capacity within permeable paving area:

Permeable Paving Area = 179 sq. m

Storage capacity: 179 x 0.35 x 0.30 = 18.80 cu.m

The storage capacity within the permeable paving areas is sufficient to prevent discharge from site during rainfall events of up to 5mm rainfall.

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The revised proposed drainage drawing P1956.C04 Proposed Drainage Layout_REV A also indicates the addition of 2 no. 650 litre water butts, 3 no. raingardens areas and a swale which runs along the southern and western site perimeter to enhance the SuDS elements of the proposed development. These proposals are further detailed in response to Item 01 (ii) on McArdle Doyle SUDS details drawing P1956.C31_REV- and in the McArdle Doyle SuDS Drainage Report.

2.2 Further Information Request Item 01 (ii):

Further Information Request Item 01 (ii) SD22A/0363 states the following;

'1. The Applicant is requested to provide the following to facilitate a complete assessment of the proposed development

(ii) The applicant shall submit a drawing and report showing the implementation of additional Sustainable Urban Drainage Systems (SuDS) features. SuDS features could include but are not limited to:
o Swale
o Tree pits
o Water butts
o Other such SuDS'

Further Information Response Item 01 (ii):

Further to the attenuation storage information updates outlined in **Item 01 (i)** the additional SuDS features that are proposed in the revised site design and all proposed features are outlined in detail in McArdle Doyle SUDS FI report attached as part of **Appendix B** of this report as well on McArdle Doyle Proposed SUDS details drawing P1956.C31_REV-.

2.3 Further Information Request Item 02:

Further Information Request Item 02 SD22A/0363 states the following;

'2.The Applicant is requested to submit detailed Tree Survey Report for the trees within and within falling distance of the proposed development area. This shall comprise a detailed Tree Survey, Arboricultural Impact Assessment and Tree Protection Plan all in accordance with, BS 5837: 2012 Trees in relation to design, demolition and construction - recommendations. The report shall be carried out by an independent, qualified Arborist'

Further Information Response Item 02:

It is noted that Response to Item 02 is detailed with an Arborist package prepared by Charles McCorkell Arborist Consultancy consisting of Arboricultural Impact Assessment, Arboricultural Method Statement and Arboricultural Tree Survey attached as part of **Appendix C** of this Further Information Response.

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2.4 Further Information Request Item 03

Further Information Request Item 03 SD22A/0363 states the following;

'The Applicant is requested to submit a plan that shows an overall approach to the delivery of landscape, green infrastructure and SuDS having regard to the following.

i. *In the case of small-scale developments this may consist of a simple landscape plan which includes objectives to protect or restore existing on site GI assets, provides for connection to local or primary GI corridors or includes elements which allow the site to act as a local stepping stone;*
ii. *Where the development site is located within or close to a Core or Corridor the development should, at a minimum, protect any existing GI assets and enhance same (for example, not breaking a GI Corridor but enhancing same with a connecting piece of planting, retaining hedgerows or woodlands);*
iii. *The characteristics and assets of the proximate GI Core, Corridor or Stepping Stone should be reflected within proposed development, for example continuation of hedgerows, tree planting, waterways;*
iv. *Development should seek to enhance or restore features that act as ecological corridors, particularly water features, hedgerows, tree lines, areas of un-cultivated land. These, or some element of them, should be incorporated into the proposed development to create pathways for wildlife and / or increase amenity value;*
v. *Development sites which are not located proximate to designated GI Cores or Corridors should identify the nearest designated GI Core, Corridor or Stepping Stone and make provision for GI interventions on the site which could eventually provide a link to local Stepping Stones, Cores or Corridors;*
vi. *Developers should be aware that ecological corridors can also act to quickly spread non-native invasive species. Therefore, identification and control of invasive species site should be included in planning applications and the GI Plan*
vii. *The Green Infrastructure Plans shall include:*

- *Site location plan showing the development site in the context of the wider GI as shown on the Council's GI Plan for the County;*
- *Site survey and analysis, identifying existing GI Infrastructure and key assets within the site;*
- *Indicate how the development proposals link to and enhance the wider GI Network of the County;*
- *Proposed GI protection, enhancement and restoration proposals as part of the landscape plan, where appropriate, for the site.'*

Further Information Response Item 03:

It is noted that Response to Item 03 is detailed in full with the Landscape and Green Infrastructure package issued by Jane McCorkell Landscape Architects attached as part of **Appendix D** of this Further Information Response.

2.5 Further Information Request Item 04

Further Information Request Item 04 SD22A/0363 states the following;

'4. There are concerns with the lack of information submitted in relation to the landscape scheme for the proposed development. The landscape proposals to be prepared by a suitably qualified landscape architect who shall liaise with the Drainage and Water Services Department and Parks and Public Realm Department to deliver multifunctional SuDS, i.e. amenity, biodiversity, water treatment and attenuation.

a) A Landscape Masterplan to scale of not less than 1:200 showing:

- *i. The species, variety, number, size and locations of all proposed planting*
- *ii. Details of Hard landscape works, specifying surface material and furniture*
- *iii. Details of additional natural SuDs features such as green roofs, bioretention rain gardens, swales, SuDS bioretention tree pits/linear trenches; showing how they work as part of an overall treatment train.*
- *iv. Tree planting along the northern boundary. Trees to be a minimum 18-20cm girth, native and/or pollinator friendly species.*
- *v. Levels, Detailed Cross Sections and Elevations*

b) Planting material where possible should be Irish Grown Nursey Stock and the importation of foreign planting material should be avoided within the proposed planting scheme.'

Further Information Response Item 04:

It is noted that Response to Item 04 is detailed in full with Landscape and green infrastructure package issued by Jane McCorkell Landscape Architects attached as part of **Appendix D** of this Further Information Response.

It is further noted that correspondence has taken place as requested in above item 04 with SDCC Water and Drainage Senior Executive Engineer Brian Harkin on 17.01.23 who communicated that the Landscape and SuDS aspects raised in Item 04 where a matter concerning the SDCC Parks Department.

Based on this, Oisin Egan from SDCC Parks Department has been in contact with McArdle Doyle and Jane McCorkell Landscape Design providing clarification on the Landscape and Green Infrastructure aspects that relate to both FI request items 03 & 04.

The details of this correspondence are highlighted in Jane McCorkells Green Infrastructure & Landscaping package cover letter responding to FI Request Items 03 & 04.

3.0 CONCLUSION

We trust the above and enclosed documentation is in order and the above sections satisfy the further information request to be clarified to South Dublin County Council.

If you require any further clarification of any of the items contained this Further Information Response Report, please do not hesitate to contact us. We would appreciate an acknowledgement of our response at your convenience.

Yours sincerely,

Ronnie McArdle, B Eng, C Eng, MIEI, APEA,
Managing Director.

APPENDIX A- SDCC Additional Information Request ref no. SD22A/0363

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Telephone: 01 4149000 Fax: 01 4149104 Email: planningdept@sdublincoco.ie

Comhairle Contae
Átha Cliath Theas
South Dublin County Council

McArdle Doyle
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Co. Louth

PLANNING & DEVELOPMENT ACT, 2000 (as amended) AND PLANNING REGULATIONS THEREUNDER

Decision Order Number: 1437	**Date of Decision:** 14-Nov-2022
Register Reference: SD22A/0363	**Registration Date:** 20-Sep-2022

Applicant: Certas Energy Ireland Limited

Development: A new unmanned service station development consisting of construction of new petrol filling station forecourt with 4 dispensers, 2 underground fuel storage tanks with canopy structure (covering c. 235sq.m and 6.2m in height) with associated signage; Widen existing site entrance to the north-east of the site and creation of new egress location onto the Fonthill Road along the northern boundary to allow one-way internal road network incorporating new pedestrian crossing over existing footpath at site egress location; Automatic brush car wash and adjoining jet car wash with water recycling system; Single storey services building structure comprising of a car wash plant room and comms room area (gross floor area 16.3sq.m.) ; 4 electric charging bays, each comprising of a parking space and electric vehicle charging unit and associated signage; 3-room ESB substation to cater for EV charging infrastructure (gross floor area 38.3sq.m.); Air/Water services area with 2 car parking spaces; 2 internally illuminated double-sided totem signs, 1 at site entrance (4m high x

1.91m wide) with advertising area 15.3sq.m and 1 adjacent the new site egress location (5.8m high x 1.91m wide) with advertising area 22.16sq.m; All other associated underground and overground infrastructure, drainage, lighting, CCTV unmanned systems, landscaping and site development works.

Location: Fonthill Road, Liffey Valley, Clondalkin, Dublin 22

Application Type: Permission

Dear Sir /Madam,

With reference to your planning application, received on 20-Sep-2022 in connection with the above, I wish to inform you that before the application can be considered under Section 33 of the Planning & Development Act 2000, six copies of the following ADDITIONAL INFORMATION must be submitted.

1. The Applicant is requested to provide the following to facilitate a complete assesment of the proposed development:
   (i) The attenuation provided on site (60m3) is undersized by approximately 60%. The applicant is required to propose additional attenuation features.
   (ii) The applicant shall submit a drawing and report showing the implementation of additional Sustainable Urban Drainage Systems (SuDS) features. SuDS features could include but are not limited to:
   o Swale
   o Tree pits
   o Water butts
   o Other such SuDS
2. The Applicant is requested to submit detailed Tree Survey Report for the trees within and within falling distance of the proposed development area. This shall comprise a detailed Tree Survey, Arboricultural Impact Assessment and Tree Protection Plan all in accordance with, BS 5837: 2012 Trees in relation to design, demolition and construction – recommendations. The report shall be carried out by an independent, qualified Arborist.
3. The Applicant is requested to submit a plan that shows an overall approach to the delivery of landscape, green infrastructure and SuDS having regard to the following.
   i) In the case of small-scale developments this may consist of a simple landscape plan which includes objectives to protect or restore existing on site GI assets, provides for connection to local or primary GI corridors or includes elements which allow the site to act as a local stepping stone;
   ii) Where the development site is located within or close to a Core or Corridor the development should, at a minimum, protect any existing GI assets and enhance same (for example, not breaking a GI Corridor but enhancing same with a connecting piece of planting, retaining hedgerows or woodlands);
   iii) The characteristics and assets of the proximate GI Core, Corridor or Stepping Stone should be reflected within proposed development, for example continuation of hedgerows, tree planting, waterways;
   iv) Development should seek to enhance or restore features that act as ecological corridors, particularly water features, hedgerows, tree lines, areas of un-cultivated land. These, or some element of them, should be incorporated into the proposed development to create pathways for wildlife and / or increase amenity value;
   v) Development sites which are not located proximate to designated GI Cores or Corridors should identify the nearest designated GI Core, Corridor or Stepping Stone and make provision for GI interventions on the site which could eventually provide a link to local Stepping Stones, Cores or Corridors;
   vi) Developers should be aware that ecological corridors can also act to quickly spread non-native invasive species. Therefore, identification and control of invasive species site should be included in planning applications and the GI Plan

vii) The Green Infrastructure Plans shall include:
- Site location plan showing the development site in the context of the wider GI as shown on the Council's GI Plan for the County;
- Site survey and analysis, identifying existing GI Infrastructure and key assets within the site;
- Indicate how the development proposals link to and enhance the wider GI Network of the County;
- Proposed GI protection, enhancement and restoration proposals as part of the landscape plan, where appropriate, for the site.

4. There are concerns with the lack of information submitted in relation to the landscape scheme for the proposed development. The landscape proposals to be prepared by a suitably qualified landscape architect who shall liaise with the Drainage and Water Services Department and Parks and Public Realm Department to deliver multifunctional SuDS, i.e. amenity, biodiversity, water treatment and attenuation.
a) A Landscape Masterplan to scale of not less than 1:200 showing:
i) The species, variety, number, size and locations of all proposed planting
ii) Details of Hard landscape works, specifying surface material and furniture
iii) Details of additional natural SuDs features such as green roofs, bioretention rain gardens, swales, SuDS bioretention tree pits/linear trenches; showing how they work as part of an overall treatment train.
iv) Tree planting along the northern boundary. Trees to be a minimum 18-20cm girth, native and/or pollinator friendly species.
v) Levels, Detailed Cross Sections and Elevations
b) Planting material where possible should be Irish Grown Nursey Stock and the importation of foreign planting material should be avoided within the proposed planting scheme.

NOTE: The applicant should note that any submission made in repsonse to the above will be examined and MAY be deemed to be SIGNIFICANT ADDITIONAL INFORMATION by the Planning Authority. In this event the applicant(s) will be subsequently notified and requested to publish a notice in an approved newspaper and erect or fix a site notice on the land or structure to which the further information relates and to submit copies of the both the newspaper and site notices to the Planning Authority in accordance with Article 35 (1) (a) and (b) of the Planning and Development Regulations 2001 (as amended).

Note: The applicant must submit the Further Information within **6 months** of the **date of decision**. If the information is not received within this period, the planning authority shall declare the application to be withdrawn.

Please ensure that your reply to this Request for Additional Information is accompanied by a *covering letter* marked "ADDITIONAL INFORMATION" and that the Planning Register Reference Number given above is quoted on the covering letter.

Signed on behalf of South Dublin County Council

Register Reference: SD22A/0363

Date: **17-Nov-2022**

Yours faithfully,

Pamela Hughes
for **Senior Planner**

APPENDIX B-McArdle Doyle Further Information SUDS Report

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McArdle Doyle

Chartered Engineers
Architectural Services
& Project Managers

Further Information SUDS Report

P1956
Proposed Unmanned Service Station Development, Liffey Valley, Fonthill Road, Clondalkin, Dublin 22.

Job No: - P1956
Document Revision: -
Date: 20.01.2023

McArdle Doyle Ltd
Second Floor, Exchange Build
The Long Walk, Dundalk, Co Louth

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LIST OF APPENDICES

McArdle Doyle Ltd
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1.0 Introduction

We, McArdle Doyle are instructed by the applicant are Certas Energy Ireland Ltd to complete the planning application for the proposed development of a new unmanned Service Station, Fonthill Road, Clondalkin Dublin 22, on lands south east of the existing Liffey Valley Shopping Centre.

The subject site extends to circa 2680 sq.m. (0.66 acres) and the application generally comprises the construction of a new service station with multi dispenser forecourt with associated canopy and underground fuel infrastructure, new car wash facilities with associated plant room as well as EV charging facilities with an associated substation building.

2.0 Scope of the Report

This report is written in response to South Dublin County Council Further Information Request SD22A/0363 dated 14.11.22 which requests the submission of a report describing the proposed drainage strategy in terms of additional sustainable urban drainage system (SUDS) features on the proposed site.

2.1 South Dublin County Council- Additional Information Item 01 (ii)

It is noted that South Dublin County Council additional Information Request register reference SD22A/0363 **Item 01 (ii)** states the following;

'1(ii) The applicant shall submit a drawing and report showing the implementation of additional Sustainable Urban Drainage Systems (SuDS) features. SuDS features could include but are not limited to:
o Swale
o Tree pits
o Water butts
o Other such SuDS'

The following report with accompanying updated McArdle Doyle drawings attached as part of this further information package aims to satisfy the queries raised in Additional Information **item 01 (ii)** with solutions that are consistent with recommended SUDS components outlined in the 2022 South Dublin County Council 'Sustainable Drainage Explanatory, Design and Evaluation Guide', the CIRIA 'SUDS Manual C753' and the 'Greater Dublin Strategic Drainage Study'.

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3.0 Proposed SUDS Features

It was noted that several SUDS proposals were reviewed for compatibility with the subject site to identify the most effective and beneficial SUDS strategy.
As noted above potential SuDS solutions were sought with reference to the 2022 South Dublin County Council 'Sustainable Drainage Explanatory, Design and Evaluation Guide', the CIRIA 'SUDS Manual C753' and the following were identified as the most suitable solutions based on existing site conditions and proposed site layout.

3.1 Attenuation Storage Structure

An underground surface water attenuation tank has been designed with the capacity increased to **98m³** as noted in Further information response to **Item 1 (i)** as part of the main additional information response document, It caters for the critical 100-year storm event and the tank has been sized based on the most up-to-date rainfall intensities derived from Met Eireann with 20% climate change implemented in the attenuation capacity design, as per GDSDS and SDCC 'Sustainable Drainage Explanatory, Design and Evaluation Guide' requirements.

It is proposed to construct a modular-type attenuation system, fully sealed, wrapped in impermeable membrane, to manufacturer's specifications. The proposed tank will be fully water-tight, to protect it from ground water ingress.

The post-development runoff rates will be restricted to the calculated equivalent greenfield pre-development intensities, by use of vortex-type flow control unit (Hydrobrake, or similar), located in the proposed flow control manhole chamber and the limited surface water runoff from the site will be discharged to the existing surface water network located on the Fonthill Road.

3.2 Permeable Paving

It is proposed to install permeable paving blocks Roadstone Aquaflow system or similar approved as a pavement surface for the car parking areas within designated spaces for EV parking and Air Water services parking.

This system is an infiltration system constructed on a roadbase material with a typical void ratio of 30-40%. This allows a temporary storage of surface water before it is infiltrated into the ground. It is noted that excess surface water that cannot be accommodated by this permeable paving system is directed to the mainline drainage system.

3.3 Swale

A proposed swale detail is incorporated at the perimeter of the site as highlighted in updated McArdle Doyle Drainage Drawing P1956.C05_RevA which can collect treat and convey run off from the sites hardstanding areas.

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This is also included in the landscape architects' details drawing PP397-03-01. Note the bio-retention soil mix specified by the landscape architect is to be used in this regard for the optimum treatment solution.

3.4 Raingardens

Raingardens are proposed at three locations on the north the boundary of the site adjacent the EV parking spaces and substation building. The raingarden design includes gentle sided sloping basin for water collection at the surface minimum 400mm deep. A bio retention soil mix with up to 20% coarse compost min 450mm deep is required in this area. The design includes an overflow in the case of heavy rain or impeded drainage as per SDCC 'sustainable Drainage Explanatory Design & Evaluation Guide 2022'. This overflow pipe is noted on revised McArdle Doyle Drainage Drawing P1956.C04Proposed Drainage and Watermain Layout_REV_A.

3.5 Water Butts

There are two separate 650 litre volume water butts proposed to be provided at each of two proposed structures on the site i.e the services plant room building and ESB substation building.
The water butts are to be employed as a simple rain water harvesting measure storing water which caters for irrigation of the proposed landscaping of the facility or for emergency fire suppression. The water butt specification attached in **Appendix 01** is for both domestic and industrial use and is manufactured by Garanta and is supplied nationwide.

3.6 Green Roof

A Green Roof is an ecologically sensible solution where vegetation is grown and habitats for wildlife can be established.
In terms of acting as a SUDS infrastructure component, It will retain rainwater up to 50% and will reduce rainwater run-off reducing the demands on the drainage infrastructure.
A proposed green roof specification from Landtech Soils is provided in **Appendix 2** of the report for the use on the services building and substation building on the proposed site.

4.0 Management of SUDS Features & Landscaping

A SUDS management plan is to be included in the operation and maintance manual for the proposed facility. The plan will provide a brief explanation of SUDS, how the suds infrastructure on site operates and the benefits of the retaining functionaility of SUDS.
A critical part of SUDS management is the maintenance aspect and the frequency of maintance for various types of infrastructure which should be carried out as per below table from 'SDCC Sustainable Drainage Explanatory, Design and Evaluation guide section 11.3.'

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Type	Activity	Normal site care (Site) or SuDS-specific maintenance (SuDS)	Suggested frequency
Regular Maintenance			
Litter	Pick up all litter in SUDS Landscape areas along with remainder of the site – remove from site	Site	1 visit monthly
Grass	Mow all grass verges, paths and amenity grass at 35-50mm with 75mm max. Leaving cuttings in situ	Site	As required or 1 visit monthly
Grass	Mow all dry swales, dry SUDS basins and margins to low flow channels and other SUDS features at 100mm with 150mm max. Cut wet swales or basins annually as wildflower areas – 1st and last cuts to be collected	Site	4-8 visits per year or as required
Grass	Wildflower areas strimmed to 100mm in Sept or at end of school holidays – all cuttings removed Or Wildflower areas strimmed to 100mm on 3 year rotation – 30% each year – all cuttings removed	Site	1 visit annually 1 visit annually
Inlets & outlets	Inspect monthly, remove silt from slab aprons and debris. Strim 1m round for access	SuDS	1 visit monthly
Permeable paving	Sweep all paving regularly to keep surface tidy	Site	1 visit annually or as required

Figure 01- SDCC SUDS Explanatory Design & Evaluation Guide Table 11.3 (Regular Maintenance)

Occasional Tasks			
Permeable paving	Sweep and suction brush permeable paving when ponding occurs	SuDS	As required - estimate 10-15 year intervals
Flow controls	Annual inspection of control chambers - remove silt and check free flow	SuDS	1 visit annually
Wetland & pond	Wetland vegetation to be cut at 100mm on 3 - 5 year rotation or 30% each year. All cuttings to be removed to wildlife piles or from site.	Site	As required
Silt management	Inspect swales, ponds, wetlands annually for silt accumulation	Site & SuDS	1 visit annually
Silt	Excavate silt, stack and dry within 10m of the SUDS feature, but outside the design profile where water flows. Spread, rake and overseed.	Site & SuDS	As required
Native planting	Remove lower branches where necessary to ensure good ground cover to protect soil profile from erosion.	SuDS	1 visit annually
Remedial Work			
General SuDS	Inspect SuDS system to check for damage or failure when carrying out other tasks. Undertake remedial work as required.	SuDS	Monthly As required

Figure 02- SDCC SUDS Explanatory Design Evaluation Guide Table 11.3 (Occasional Maintenance)

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5.0 Conclusion

We trust the above and enclosed documentation is in order and the above sections outline clearly the proposed SUDS strategy for the proposed development.
It is noted that information in this report should be read in conjunction with revised McArdle Doyle drainage drawings and master response document issued in response to this further information request REF NO SD22A/0363.
It is further noted that this SUDS strategy is an integration of McArdle Doyle drainage drawings and specification and the Landscape and Green Infrastructure package issued by appointed registered landscape architect Jane McCorkell.

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APPENDIX 1

Water Butt Specification

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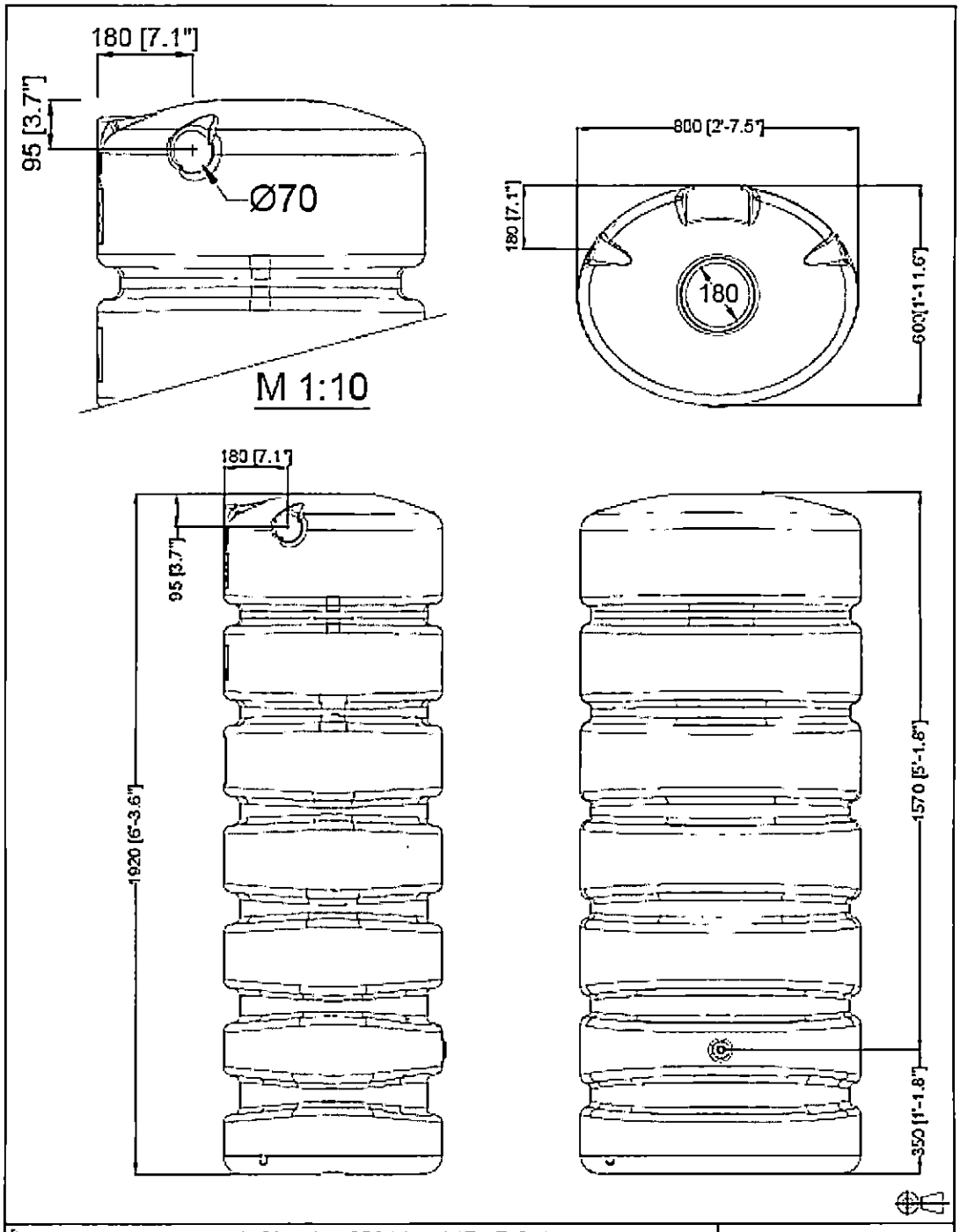

D	Gartentank Classico 650 Liter / 171,7 Gallonen Farbe: dunkelgrün			Artikel-Nr. product no. artículo no. artículo no. 326030
GB	Wall tank Classico 650 Liter / 171,1 gal. dark green	ES	Depósito de jardín Classico 650 Liter / 171,7 gal. verde oscuro	FR	Cuve murale Classico 650 Liter / 171,7 gal. vert foncé	revision
gezeichnet drawn	ISC	Gewicht weight	28 kg			
Datum date	2018.12.13	Toleranz tolerance	+/- 3%			
Maßstab scale	M 1:15	alle Maßangaben in mm [inch] all dimension in mm [inch]				

www.garantia.eu
info@garantia.eu

GARANTIA

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APPENDIX 2

Green Roof Specification

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LANDTECH SOILS

Extensive Sedum Green Roof – Typical Installation Specification

For an extensive Sedum green roof installation for a project - the use of our traditional option of the 'standard' in situ green roof build-up is the best option, which is summarised as follows: - see the attached Drawing.

'LSL 'Standard' Green Roof Specification' - build-up, is summarised as follows:

- Protection Fleece Layer - 300G
- Drainage Mat – 20mm Drainage /Reservoir Board
- Light Weight Extensive green roof substrate - installed to 75 -80mm depth
- Sedum Blanket - sown with 6-8 sedum varieties
- Separation Edge Strip - between Substrate & Gravel edge. As per specification.
- Gravel Edge Strip - 300mm wide (Variable) – at the roof perimeter and openings.
- Drainage / inspection covers – where and as required.

Weight - Roof Loading: A sedum green roof using the LSL Standard on-site build-up will add an extra weight loading of approximately 75 kgs / sq metre, as installed, with a potential saturated weight in the region of 95 kgs per sq metre. It is important that the structure of the building and the roof are designed to accommodate this additional weight loading.

Upstand: There should be an upstand (parapet) with a minimum height of approximately 80mm - 100mm or higher, on all open sides of the roof, to suit the overall aesthetics of the project. In an exposed location, a slightly higher upstand may be installed which will give some shelter for the sedum on the roof.

The main benefits of the Green Roof are:

- A Green Roof is an ecologically sensible solution that pays off.
- It will retain rainwater - up to 50% - a lot of which is returned to the atmosphere via evapotranspiration.
- A green roof will reduce rainwater run-off - reducing the demands on the infrastructure which will ultimately reduce costs.
- It will extend the life of the weatherproofing membrane on the roof and provides optimum UV protection.
- A sedum roof is quick and easy to install - with extremely low maintenance requirements.

For the Building and its occupants:

- It provides more green space, less air-borne particulate matter, less CO2.
- Provides soundproofing and thermal insulation.
- Improves the micro-climate.

A copy of our technical leaflet – outlining details of the product can be viewed on our website – via the following link LSL - Green Roofs

Further Information – Contact – info@landtechsoils.ie

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LANDTECH SOILS

Water Retention Capacity of a Green Roof. (SuDS) – A summary

A Green roof should be considered to be part of the Compensatory Systems when considering urban drainage, where the objective is not to drain water as soon as possible downstream, but to reduce the flow velocity and cause infiltration of the water, in order to offset the effects of urbanization on the urban hydrological processes. The green roofs fit perfectly in the Compensatory Systems. The capability to retain water of a green roof cover crop is linked mainly to the thickness and composition of the substrate, and will vary according to the type of vegetation, the drainage layer, the roof slope, the local climate and the number of days without rain.

The green roof assists with urban rainwater management due to its capacity to store water. The reduction consists on:

(1) Delaying the initial flow time due to the absorption of water in the green roof system.
(2) Reducing the overall flow retaining part of the precipitation.
(3) The distribution of the flow over a longer period, by releasing excess of water stored temporarily in the pores of the substrate.
(4) Seasonality – during suitable times of the year evapotranspiration will allow for substantial volumes of rainwater to be returned to the atmosphere. For example assuming a daily rainfall of about 15 mm in one day, the green roof cover can be expected to retain a large part of the total (typically - less than 5 mm will flow off), while the conventional roof will retain only about 2 mm.

Green Roof – LSL Substrate Properties – Typical Water Storage Capacity

Ext Green Roof Substrate (@70-80mm depth): Water Storage Capacity: > 35% by Volume
Int Green Roof Substrate (@ 100-150mm depth): Water Storage Capacity: > 45% by Volume

Example: A Standard LSL Green Roof Installation:
Roof Area: 100 m² (Sedum - Extensive Green Roof)
With LSL Green Roof Substrate @ 80mm Depth. This green roof, at a substrate depth of 80mm will require approximately 8 m³ (8,000 lts) of LSL Green Roof Substrate. At a water storage capacity of 35% - Thus this green roof area will retain approximately 35% (by Volume) of Rainwater = 2,800 lts of water.

This equates to a retained rainwater volume of 28 Litres / m².

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Registered in Ireland No. 230049

Fig. 1: Extensive - Sedum Blanket - Green Roof Build

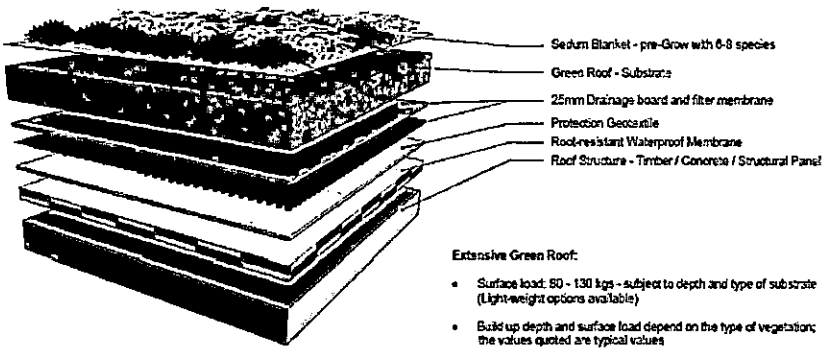
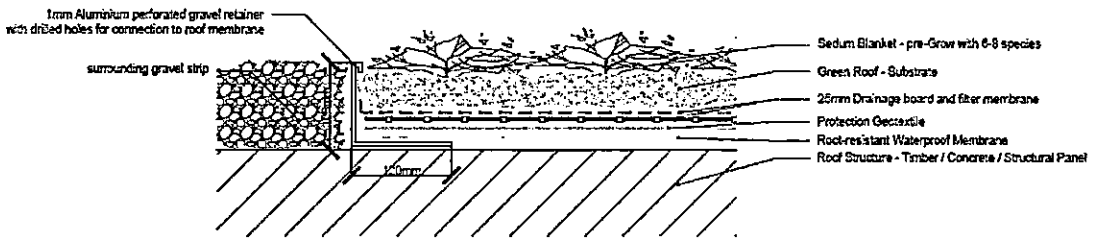


Fig. 2: Cross section of Aluminium edge / Green Roof Build



Green Roof Build	Scale: not to scale	Drawing No.: 2710-409	© Landtech Soils Ltd 2016
	Checked: KG / JOH	Rev.:	Contractor must verify all dimensions and levels on site before setting out and commencing work. Contractor to agree layout and design and all discrepancies / samples with the Client beforehand.
Drawn by: KG	Date: 18/01/2017		

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APPENDIX 3

Permeable Paving Specification

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PRODUCT NAME:

AQUAFLOW ML

PRODUCT DESCRIPTION: Specially designed, Hexagonal faced paving incorporating a slot and chamfer which allows water to permeate through the finished surface at a high rate. Designed for heavy duty use, which can be laid by hand or machine. Allowing rates of over 600m2 per day to be achieved with a three-man crew. Can be specified for all sites designed under BS7533-Pt13. Specialist top and bottom edge blocks within the range. Full ancillary kerb system to complement the range is also available.

PRODUCTION STANDARD: I.S. EN 1338 Concrete paving blocks — Requirements and test methods

USE: Concrete block paving for use in Sustainable Urban Paving Systems (SuDS) the Aquaflow ML can be specified for all sites designed under BS7533-Pt13 and BBA certificate: 97/3373

TYPE: Permeable Concrete Block paving

FINISH/COLOUR: Smooth finish hexagonal faced block paving with chamfered edges

AVAILABLE IN 2 COLOURS:
1. Natural
2. Charcoal Grey

AVAILABLE IN SIZES:

THICKNESS
1. 80mm for use in heavy duty pavements

WORKING SIZE
Block consists of three regular shaped 100mm Hexagons joined together to form a tri hexagon Working size 200mm x 200mm x80mm (refer to brochure)

SPECIAL SHAPES: Edge blocks MLE & MLTB to be used to start and complete the pattern. Kerbs & Channels available to match

INSTALLATION & MAINTENANCE: Laid to BS 7533 Pt. 13 and BBA certificate: 97/3373 and technical advice given in Roadstone Brochure Technical Section. Design service available

BUILD-UP/STONE SPECIFICATION:
Lower sub-base layer 10-63mm clean crushed stone
Upper sub-base layer 5-20mm clean crushed
Laying course 2-6mm clean crushed stone
Surface Dressing 2-4mm clean crushed stone

ANCILLARY COMPONENTS Exclusive to Roadstone / Formpave Aquaflow system
Inbitex Geotextile non-woven geotextile is used for separation, filtration and pollution control.
SC Intergrid sub-base stabilisation grid improves structural strength, increases design life and reduces construction costs.
SC Membrane This impermeable membrane allows the storage of collecting storm water. Used for the Aquaflow attenuation system it can be welded or taped dependent on the application. A higher grade SC Membrane GT can be specified when contamination is present.
SC Findrain This drainage component allows efficient and high flow removal of storm water from the Roadstone Aquaflow system. Wrapped in Inbitex Geotextile which provides further filtration and cleansing.
Aquaflow Distribution Tanks Voided crates that are extremely strong structurally and are wrapped in Inbitex Geotextile, which provides filtration and cleansing. Allows the collection of impermeable surface water catchment, such as roofs to the Aquaflow system.
Also available from Roadstone Top Hats, Tape and Fittings

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APPENDIX C- Charles McCorkell Arboricultural Report

- Arboricultural Impact Assessment
- Arboricultural Method Statement
- Arboricultural Tree Survey

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Louth Village, Dundalk, Co. Louth | Registered in Ireland

Company No. 406302
VAT No. IE 6426302 S

APPENDIX D- Jane McCorkell FI Response Item 03 & 04

- Jane McCorkell Cover Letter- SD22A/0363 Further Information Response Item 03 & 04
- PP397-01-01 Existing site survey
- PP397-01-02 Existing site green factor analysis
- PP397-02-01 Proposed landscape masterplan
- PP397-02-02 Proposed green factor objectives
- PP397-02-03 Green factor surface types
- PP397-03-01 Tree and service plan with associated section details
- PP348 -04-01 Landscape specifications
- Appendix 1-Green infrastructure calculations of existing site
- Appendix 2-Green infrastructure calculations of proposed site

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APPENDIX E- McArdle Doyle Updated Drawings, Register & Calculations

- Updated Civil Drawing Register 20.01.23
- P1956.C03_Rev A Proposed Site Layout
- P1956.C04_Rev A Proposed Drainage & Watermain Layout
- P1956.C11_Rev A Proposed Pavement Layout
- McArdle Doyle Stormwater and Storage Control Calculations

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Stormwater Storage and Control Calculations

INPUT — Institute of Hydrology Report No. 124 for Sites Up To 24 ha
OUTPUT — Greater Dublin Strategic Drainage Study

SITE DETAILS:

Location: Certas, Liffey Valley

Site Area	0.66 Acre	0.27 Ha	2,680.00 m^2
Impervious Area Draining To Piped Network	67%	1,796	m^2
Impervious Area Draining to Infiltration	0%	0	m^2
Pervious Area	33%	884	m^2
Allowance for Impervious Green Area	0%	0	m^3

RIVER REGIME PROTECTION:

Allowable Discharge From Site: $QBAR = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

Q_{BAR}: Mean Annual Peak Flow From Site — m^3/s
AREA: Area of Site — km^2
SAAR: Standard Annual Average Rainfall — 800 mm
SOIL: Soil Index SPR *(as per Flood Studies Report Procedure)* — SOIL TYPE: 4 — SPR INDEX: 0.470

1	0.1	Very Low	Sandy, well drained
2	0.3	Low	Intermediate Soil (silty)
3	0.37	Moderate	Intermediate Soil (sandy)
4	0.47	High	Clayey, poorly drained
5	0.53	Very High	Steep, rocky area

Rainfall Intensities
Climate Change Factor 20%

If site is <50ha, calculate Q-Bar for 50ha and linearly interpolate for Site Area

QT estimated from old data where not specified by GDSDS

QBAR 50 ha - STANDARD				Return Period	QT Factor	$Q_{ALL.}$	$Q_{ALL.}$	$Q_{PERM.}$	V
AREA	ha/km	50	0.5	Yrs	-	l/s	l/s/ha	l/s	m^3
Q_{BAR}	=	0.2822	m^3/s	1	0.85	1.29	4.80	1.29	18
Q_{BAR}	=	282.21	l/s	2	1	**1.51**	5.64	1.51	**21**
Q_{BAR}	=	5.64	l/s/ha	5	1.3	1.97	7.34	1.97	32
QBAR Development - RESTRICTED				10	1.7	2.57	9.60	2.57	36
AREA	ha/km^2	0.268	0.00268	20	1.9	2.87	10.72	2.87	49
Q_{BAR}	=	0.0015	m^3/s	30	2.1	**3.18**	11.85	3.18	**56**
Q_{BAR}	=	1.51	l/s	50	2.31	3.49	13.04	3.49	62
Q_{BAR}	=	5.64	l/s/ha	100	2.6	**3.93**	14.67	3.93	**81**

Interceptor Designed YES — Flow Control Designed at Outlet Manhole with overflow YES

LEVEL OF SERVICE

if **NO**, refer to details within report

No External Flooding - 100-year high intensity rainfall event fully contained within site	YES
No Internal Flooding - Finished Floor Levels above 100-year high rainfall event level	YES
No Internal Flooding - Finished Floor Levels above Highest Recorded/Known Stream Flood Level	YES

Calculation of Rainfall intensity i, using the Flood Studies Report methodology

INPUT
OUTPUT
STANDARD

Make a written request to Met Eireanns Inquiry Section quoting the following criteria ...

a) . . .	**Location of Site:**	Certas, Liffey Valley
b) . . .	**Durations:**	1 min, 2min, 5 min, 10 min . . . 48 hrs
c) . . .	**Return Periods:**	1, 2, 5, 10, 20, 30, 50, 100 Years

Address :	Met Eireann, Irish Meteorological Service, Glasnevin Hill, Dublin 9,
Tel.	01-806 4200
Fax:	01-806 4247
E-mail:	met.eireann@met.ie
Website:	www.met.ie

Site Area (acre) =	0.66224	Imp. Area (%) =	67%	Permeable Green Area (%) =	33%
Site Area (ha) =	0.27	Imp. Green Area (%) =	0%	Permeable Green Area (Ha) =	0.09

Imp. Area (ha) =	0.18	Imp. Green Area (ha) =	0.00	Imp Site Area (ha) =	0.18
				Total Site Area (ha) =	0.27

	1	2	5	10	20	30	50	100
$Q_{ALL.}$ - l/s/Ha	4.80	5.64	7.34	9.60	10.72	11.85	13.04	14.67
$Q_{ALL.}$ - l/s	1.29	1.51	1.97	2.57	2.87	3.18	3.49	3.93

Met Eireann:								
Duration	Return Period yrs							
	1	2	5	10	20	30	50	100
minutes	rainfall-mm							
15 min	5.7	6.7	10.2	13.0	16.3	18.5	21.7	26.8
30 min	7.4	8.7	13.0	16.5	20.5	23.2	27.0	33.2
60 min	9.7	11.3	16.6	20.9	25.8	29.0	33.6	41.0
2 hours	12.6	14.6	21.3	26.5	32.4	36.4	41.9	50.7
4 hours	16.5	19.0	27.2	33.6	40.8	45.5	52.2	62.7
6 hours	19.2	22.1	31.4	38.6	46.6	51.9	59.3	70.9
12 hours	25.1	28.6	40.1	48.9	58.7	65.0	73.9	87.7
24 hours	32.7	37.1	51.3	62.0	73.8	81.4	92.0	108.4
48 hours	39.7	44.6	60.1	71.6	84.0	92.0	103.0	119.8

Rainfall Intensities:								
Duration	Rainfall Intensities							
(minutes)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)
	1	2	5	10	20	30	50	100
15	27.36	32.16	48.96	62.40	78.24	88.80	104.16	128.64
30	17.76	20.88	31.20	39.60	49.20	55.68	64.80	79.68
60	11.64	13.56	19.92	25.08	30.96	34.80	40.32	49.20
120	7.56	8.76	12.78	15.90	19.44	21.84	25.14	30.42
240	4.95	5.70	8.16	10.08	12.24	13.65	15.66	18.81
360	3.84	4.42	6.28	7.72	9.32	10.38	11.86	14.18
720	2.51	2.86	4.01	4.89	5.87	6.50	7.39	8.77
1440	1.64	1.86	2.57	3.10	3.69	4.07	4.60	5.42
2880	0.99	1.12	1.50	1.79	2.10	2.30	2.58	3.00

1 **Find the Storage Capacity for a Storm with a** 1 **Year Design Return Period**

Insert the given information into the following table to find Rainfall Intensities using Q=2.78Ai

Duration	Rainfall		Site Area		Runoff from		Runoff / Storage		
	Depth	Intensity	Imp.	Green	Imp.	Green	Gross	Permissible	Nett
		i	A1	A2	Q	Q	Q	Q	Q
mins	mm	mm/hr	Ha	Ha	l/s	l/s	m3	m3	m3
15	5.70	27.36	0.18	0.00	14	0	12	1.16	11.1
30	7.40	17.76	0.18	0.00	9	0	16	2.31	13.6
60	9.70	11.64	0.18	0.00	6	0	21	4.63	16.3
120	12.60	7.56	0.18	0.00	4	0	27	9.26	17.9
240	16.50	4.95	0.18	0.00	2	0	36	18.51	17.1
360	19.20	3.84	0.18	0.00	2	0	41	27.77	13.6
720	25.10	2.51	0.18	0.00	1	0	54	55.54	-1.4
1440	32.70	1.64	0.18	0.00	1	0	71	111.09	-40.6
2880	39.70	0.99	0.18	0.00	0	0	86	222.18	-136.6

Therefore, Storage required is the maximum nett outflow = 18 m^3

2 **Find the Storage Capacity for a Storm with a** 2 **Year Design Return Period**

Insert the given information into the following table to find Rainfall Intensities using Q=2.78Ai

Duration	Rainfall		Site Area		Runoff from		Runoff / Storage		
	Depth	Intensity	Imp.	Green	Imp.	Green	Gross	Permissible	Nett
		i	A1	A2	Q	Q	Q	Q	Q
mins	mm	mm/hr	Ha	Ha	l/s	l/s	m3	m3	m3
15	6.70	32.16	0.18	0.00	16	0	14	1.36	13.1
30	8.70	20.88	0.18	0.00	10	0	19	2.72	16.0
60	11.30	13.56	0.18	0.00	7	0	24	5.45	18.9
120	14.60	8.76	0.18	0.00	4	0	31	10.89	20.6
240	19.00	5.70	0.18	0.00	3	0	41	21.78	19.2
360	22.10	4.42	0.18	0.00	2	0	48	32.67	15.0
720	28.60	2.86	0.18	0.00	1	0	62	65.35	-3.7
1440	37.10	1.86	0.18	0.00	1	0	80	130.69	-50.7
2880	44.60	1.12	0.18	0.00	1	0	96	261.39	-165.2

Therefore, Storage required is the maximum nett outflow = 21 m^3

3 **Find the Storage Capacity for a Storm with a** 5 **Year Design Return Period**

Insert the given information into the following table to find Rainfall Intensities using Q=2.78Ai

Duration	Rainfall		Site Area		Runoff from		Runoff / Storage		
	Depth	Intensity	Imp.	Green	Imp.	Green	Gross	Permissible	Nett
		i	A1	A2	Q	Q	Q	Q	Q
mins	mm	mm/hr	Ha	Ha	l/s	l/s	m3	m3	m3
15	10.20	48.96	0.18	0.00	24	0	22	1.77	20.2
30	13.00	31.20	0.18	0.00	16	0	28	3.54	24.5
60	16.60	19.92	0.18	0.00	10	0	36	7.08	28.7
120	21.30	12.78	0.18	0.00	6	0	46	14.16	31.8
240	27.20	8.16	0.18	0.00	4	0	59	28.32	30.3
360	31.40	6.28	0.18	0.00	3	0	68	42.48	25.2
720	40.10	4.01	0.18	0.00	2	0	86	84.95	1.5
1440	51.30	2.57	0.18	0.00	1	0	111	169.90	-59.3
2880	60.10	1.50	0.18	0.00	1	0	130	339.80	-210.2

Therefore, Storage required is the maximum nett outflow = 32 m^3

4 **Find the Storage Capacity for a Storm with a** 10 **Year Design Return Period**

Insert the given information into the following table to find Rainfall Intensities using Q=2.78Ai

Duration	Rainfall		Site Area		Runoff from		Runoff / Storage		
	Depth	Intensity	Imp.	Green	Imp.	Green	Gross	Permissible	Nett
		i	A1	A2	Q	Q	Q	Q	Q
mins	mm	mm/hr	Ha	Ha	l/s	l/s	m3	m3	m3
15	13.00	62.40	0.18	0.00	31	0	28	2.59	25.4
30	16.50	39.60	0.18	0.00	20	0	36	5.17	30.4
60	20.90	25.08	0.18	0.00	13	0	45	10.35	34.7
120	26.50	15.90	0.18	0.00	8	0	57	20.69	36.5
240	33.60	10.08	0.18	0.00	5	0	72	41.39	31.1
360	38.60	7.72	0.18	0.00	4	0	83	62.08	21.2
720	48.90	4.89	0.18	0.00	2	0	105	124.16	-18.7
1440	62.00	3.10	0.18	0.00	2	0	134	248.32	-114.6
2880	71.60	1.79	0.18	0.00	1	0	154	496.63	-342.2

Therefore, Storage required is the maximum nett outflow = 36 m^3

5 **Find the Storage Capacity for a Storm with a** **20** **Year Design Return Period**

Insert the given information into the following table to find Rainfall Intensities using Q=2.78Ai

Duration	Rainfall		Site Area		Runoff from		Runoff / Storage		
	Depth	Intensity	Imp.	Green	Imp.	Green	Gross	Permissible	Nett
		i	A1	A2	Q	Q	Q	Q	Q
mins	mm	mm/hr	Ha	Ha	l/s	l/s	m3	m3	m3
15	16.30	78.24	0.18	0.00	39	0	35	2.59	32.6
30	20.50	49.20	0.18	0.00	25	0	44	5.17	39.0
60	25.80	30.96	0.18	0.00	15	0	56	10.35	45.3
120	32.40	19.44	0.18	0.00	10	0	70	20.69	49.2
240	40.80	12.24	0.18	0.00	6	0	88	41.39	46.6
360	46.60	9.32	0.18	0.00	5	0	100	62.08	38.4
720	58.70	5.87	0.18	0.00	3	0	127	124.16	2.4
1440	73.80	3.69	0.18	0.00	2	0	159	248.32	-89.2
2880	84.00	2.10	0.18	0.00	1	0	181	496.63	-315.5

Therefore, Storage required is the maximum nett outflow = **49 m³**

6 **Find the Storage Capacity for a Storm with a** **30** **Year Design Return Period**

Insert the given information into the following table to find Rainfall Intensities using Q=2.78Ai

Duration	Rainfall		Site Area		Runoff from		Runoff / Storage		
	Depth	Intensity	Imp.	Green	Imp.	Green	Gross	Permissible	Nett
		i	A1	A2	Q	Q	Q	Q	Q
mins	mm	mm/hr	Ha	Ha	l/s	l/s	m3	m3	m3
15	18.50	88.80	0.18	0.00	44	0	40	2.86	37.0
30	23.20	55.68	0.18	0.00	28	0	50	5.72	44.3
60	29.00	34.80	0.18	0.00	17	0	63	11.44	51.1
120	36.40	21.84	0.18	0.00	11	0	78	22.87	55.6
240	45.50	13.65	0.18	0.00	7	0	98	45.74	52.4
360	51.90	10.38	0.18	0.00	5	0	112	68.61	43.3
720	65.00	6.50	0.18	0.00	3	0	140	137.23	2.9
1440	81.40	4.07	0.18	0.00	2	0	176	274.46	-98.9
2880	92.00	2.30	0.18	0.00	1	0	198	548.91	-350.5

Therefore, Storage required is the maximum nett outflow = **56 m³**

7 **Find the Storage Capacity for a Storm with a** **50** **Year Design Return Period**

Insert the given information into the following table to find Rainfall Intensities using Q=2.78Ai

Duration	Rainfall		Site Area		Runoff from		Runoff / Storage		
	Depth	Intensity	Imp.	Green	Imp.	Green	Gross	Permissible	Nett
		i	A1	A2	Q	Q	Q	Q	Q
mins	mm	mm/hr	Ha	Ha	l/s	l/s	m3	m3	m3
15	21.70	104.16	0.18	0.00	52	0	47	3.54	43.3
30	27.00	64.80	0.18	0.00	32	0	58	7.08	51.1
60	33.60	40.32	0.18	0.00	20	0	72	14.16	58.3
120	41.90	25.14	0.18	0.00	13	0	90	28.32	62.0
240	52.20	15.66	0.18	0.00	8	0	113	56.63	55.9
360	59.30	11.86	0.18	0.00	6	0	128	84.95	42.9
720	73.90	7.39	0.18	0.00	4	0	159	169.90	-10.5
1440	92.00	4.60	0.18	0.00	2	0	198	339.80	-141.4
2880	103.00	2.58	0.18	0.00	1	0	222	679.61	-457.5

Therefore, Storage required is the maximum nett outflow = **62 m³**

8 **Find the Storage Capacity for a Storm with a** **100** **Year Design Return Period**

Insert the given information into the following table to find Rainfall Intensities using Q=2.78Ai

Duration	Rainfall		Site Area		Runoff from		Runoff / Storage		
	Depth	Intensity	Imp.	Green	Imp.	Green	Gross	Permissible	Nett
		i	A1	A2	Q	Q	Q	Q	Q
mins	mm	mm/hr	Ha	Ha	l/s	l/s	m3	m3	m3
15	26.80	128.64	0.18	0.00	64	0	58	3.54	54.3
30	33.20	79.68	0.18	0.00	40	0	72	7.08	64.5
60	41.00	49.20	0.18	0.00	25	0	88	14.16	74.3
120	50.70	30.42	0.18	0.00	15	0	109	28.32	81.0
240	62.70	18.81	0.18	0.00	9	0	135	56.63	78.6
360	70.90	14.18	0.18	0.00	7	0	153	84.95	67.9
720	87.70	8.77	0.18	0.00	4	0	189	169.90	19.2
1440	108.40	5.42	0.18	0.00	3	0	234	339.80	-106.0
2880	119.80	3.00	0.18	0.00	1	0	258	679.61	-421.3

Therefore, Storage required is the maximum nett outflow = **81 m³**

DATA TABLE

INPUT
OUTPUT
STANDARD

Address	Met Eireann, Irish Meteorological Service, Glasnevin Hill, Dublin 9, Ireland
Tel.	01-806 4200
Fax:	01-806 4247
E-mail:	met.eireann@met.ie
Website:	www.met.ie

Extreme Rainfall Return Periods

Location **Certas, Liffey Valley**
Average Annual Rainfall 800 mm

Maximum rainfall (mm) of indicated duration expected in the return period.

	Return Period (years)								
Duration	1/2	1	2	5	10	20	30	50	100
15 min	3.9	5.7	6.7	10.2	13.0	16.3	18.5	21.7	26.8
30 min	5.1	7.4	8.7	13.0	16.5	20.5	23.2	27.0	33.2
60 min	6.7	9.7	11.3	16.6	20.9	25.8	29.0	33.6	41.0
2 hour	8.9	12.6	14.6	21.3	26.5	32.4	36.4	41.9	50.7
4 hour	11.8	16.5	19.0	27.2	33.6	40.8	45.5	52.2	62.7
6 hour	13.9	19.2	22.1	31.4	38.6	46.6	51.9	59.3	70.9
12 hour	18.3	25.1	28.6	40.1	48.9	58.7	65.0	73.9	87.7
24 hour	24.2	32.7	37.1	51.3	62.0	73.8	81.4	92.0	108.4
48 hour	30.1	39.7	44.6	60.1	71.6	84.0	92.0	103.0	119.8

Notes:
Larger margins of error for 1, 2, 5 and 10 minute values and for 100 year return periods

M560: 16.6 M52d: 60.1 M560/M52d: 0.28