

PROPOSED ARLESTON SOLAR & BESS ON LAND AT MANOR FARM, ARLESTON LANE, DERBY, DE73 7HN

FLOOD RISK ASSESSMENT AND SURFACE WATER DRAINAGE STRATEGY

11/03/2025

J-15585



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APPENDICES

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Appendix B Conceptual SuDS Design & Calculations (Attenuation Option)

1.0 INTRODUCTION

Arleston Solar Limited are proposing to install a new Solar PV Scheme and Battery Energy Storage Scheme (BESS) on Land at Manor Farm, Arleston Lane, Arleston, Derby, DE73 7HN.

As the site is over 1 hectare (ha) in size, it is necessary to produce a Flood Risk Assessment for the site that focuses on the surface water runoff from the site to ensure that flood risk is not increased downstream due to the proposed development.

The National Planning Policy Framework (NPPF) and associated planning practice guidance (PPG) requires applicants to demonstrate that developments are safe for their lifetime and do not increase flood risk elsewhere. They also set out that major developments should include Sustainable Drainage Systems (SuDS) unless clearly inappropriate.

In order to address this requirement, Nijhuis Industries UK and Ireland Ltd. have been commissioned to develop a Sustainable Drainage System (SuDS) for the proposed development.

Additionally, this assessment will also ensure that the development of the site does not increase flood risk to properties downstream of the site. This is achieved by providing a suitable drainage scheme that manages surface water runoff created by the development.

This report comprises the FRA for the proposed development, in line with the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG) and Derbyshire County Council.

2.0 SITE LOCATION AND DESCRIPTION

The approximate OSGR for the site is SK 33640 29726.

The proposal is to install a Solar PV scheme and BESS on Land at Manor Farm, Arleston Lane, Arleston Lane, Derby DH73 7HN.

A site location plan, showing the proposed site boundary, is shown in **Figure 2.1** below.

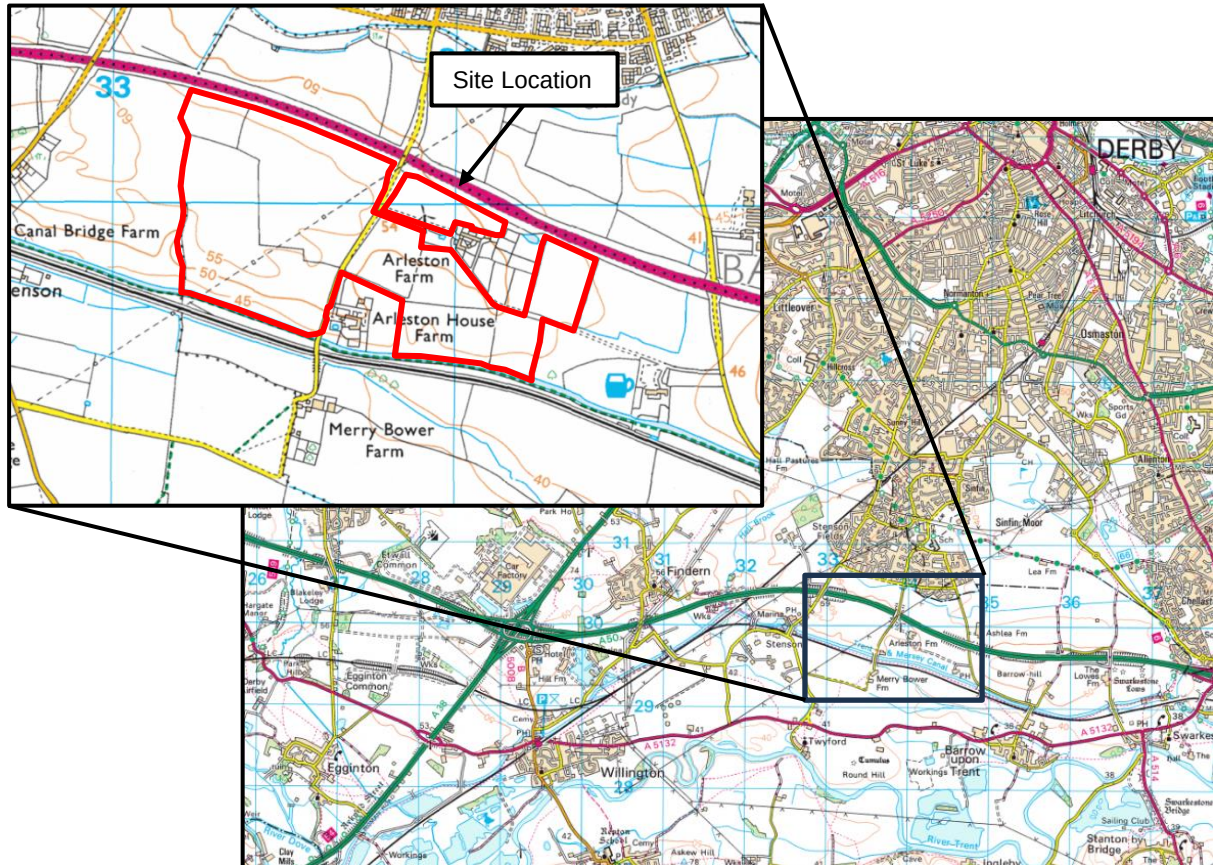


Figure 2.1. Site Location Plan

3.0 FLOOD RISK

3.1 Fluvial and Tidal Flooding

The nearest main watercourse is the Trent and Mersey Canal which is situated along the southern border of the site. The site is located approximately 100km from the coast.

The Environment Agency's Flood Map for Planning, shown below in **Figure 3.1**, indicates that the site is located within Flood Zone 1 (low risk), as such the site is not considered to be at risk from either fluvial or tidal flooding. Therefore, flooding from these sources will not be considered further within this report.

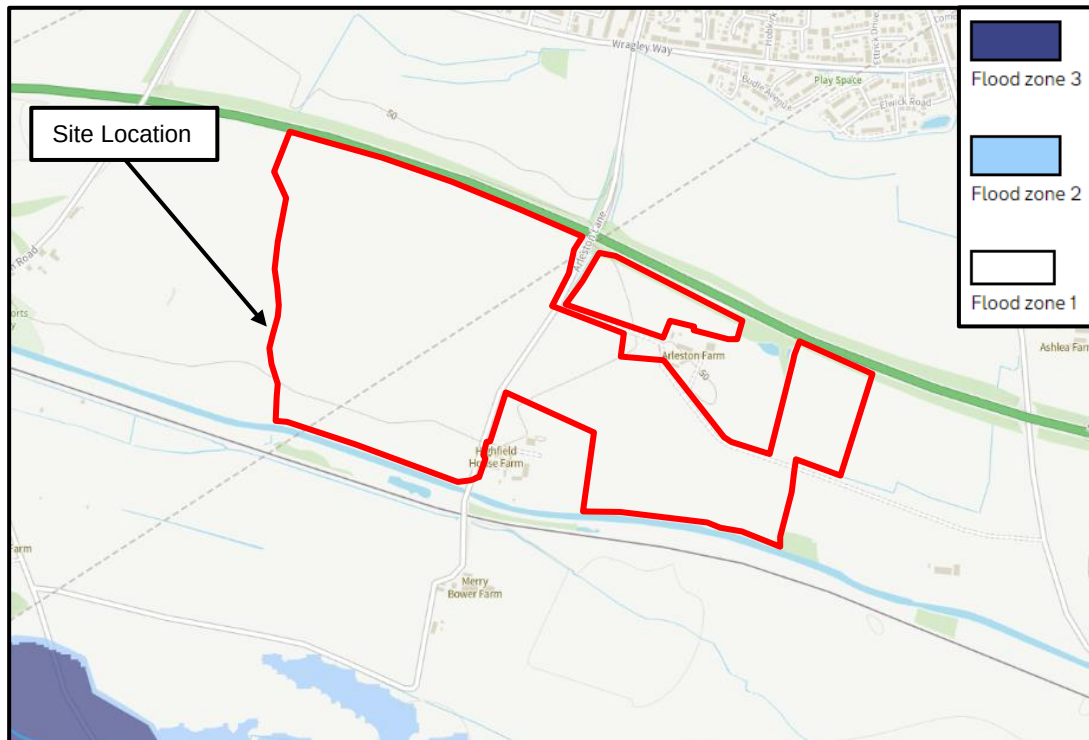


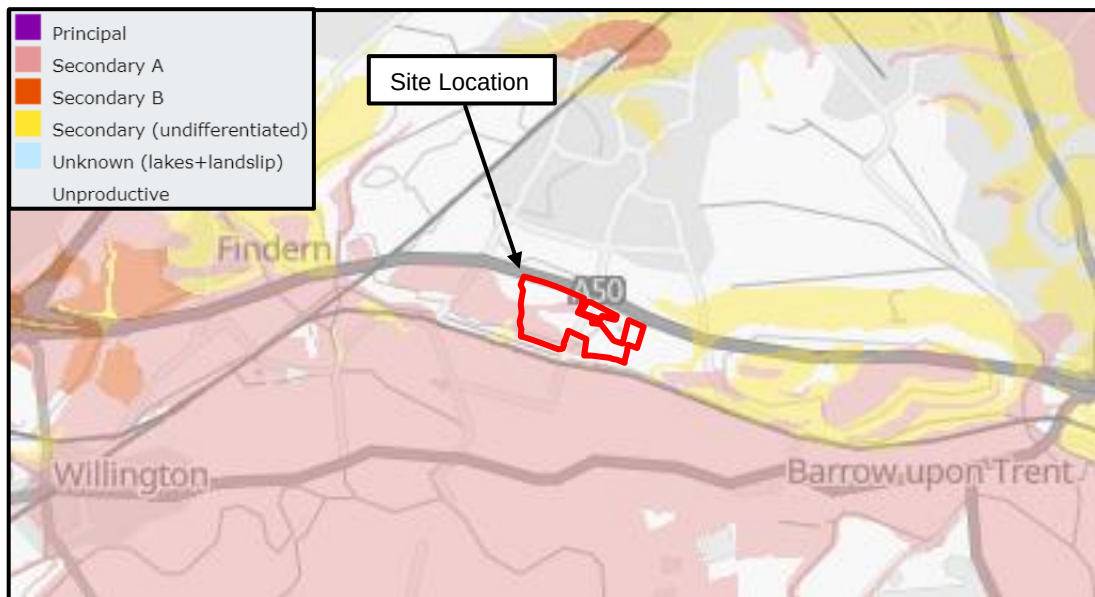
Figure 3.1. EA Indicative Flood Map

3.2 Groundwater Flooding

Groundwater flooding is linked to the ability of the ground to hold water. According to the gov.uk website, it is considered that flooding of groundwater is unlikely in this area.

Natural England manages and run the multi-organisation partnership known as MAGIC. This organisation has produced a web-based mapping resource which provides a range of information for the UK including soil types and structure as well as aquifer categorisation.

Figure 3.2 below shows that the site is situated within 'Secondary A', 'Secondary (undifferentiated)' aquifers and 'unproductive strata' aquifers. 'Secondary A' aquifers are defined as aquifers which 'comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers'. 'Secondary (undifferentiated)' aquifers are defined as 'aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value'. 'Unproductive strata are largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them.'



Overall, whilst groundwater may be found at the site, given the nature of the development, with vulnerable infrastructure raised above the ground level, it is considered that groundwater flooding does not pose a significant risk to most of the development site. Therefore, groundwater flooding will not be considered further within this report.

3.3 Overland/Surface Water Flooding

The Environment Agency maps shown below in **Figure 3.3.1** and **Figure 3.3.2** show the risk of flooding from surface water for the site for the current scenario and predictions for between 2040 to 2060. For both scenarios the maps indicate that the majority of the site is at very low risk. Whilst there are some small areas which are at high risk of flooding, given the nature of the development having raised and waterproof infrastructure, this is unlikely to present an issue. As such, this flooding mechanism will not be considered further within the report.

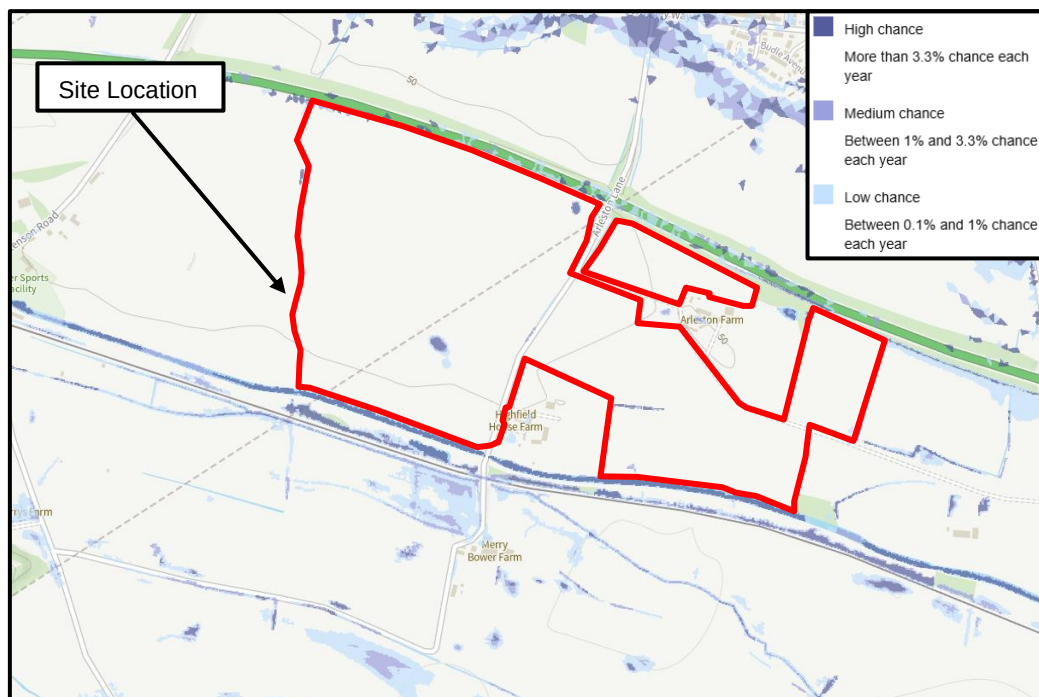


Figure 3.3.1. EA Surface Water Flooding Map.

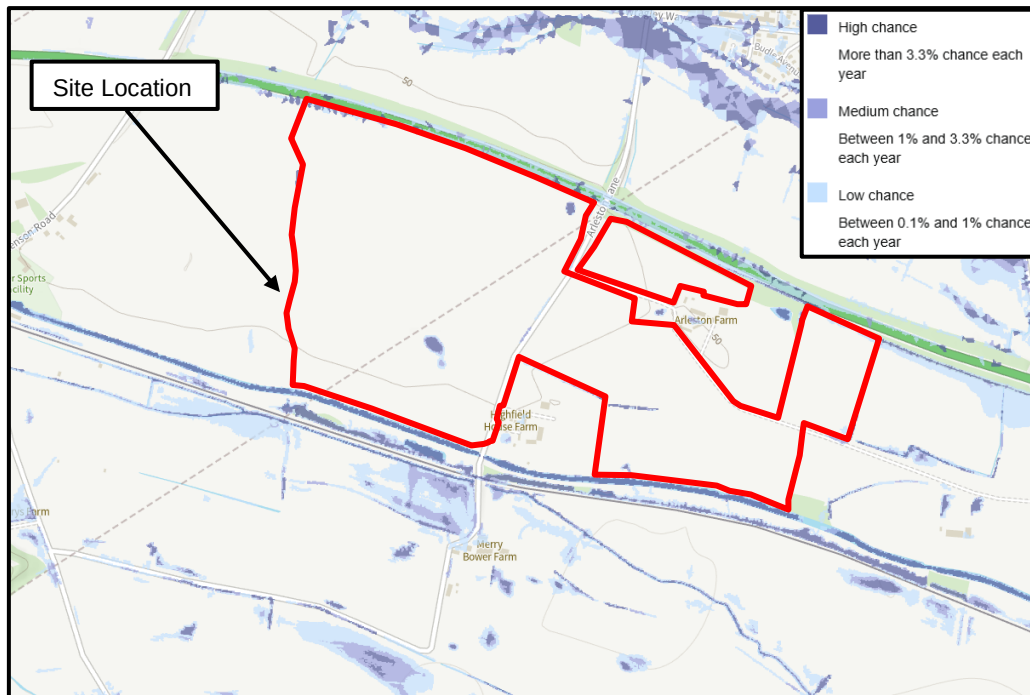


Figure 3.3.2. EA Surface Water Flooding Map Prediction Between 2040 and 2060.

4.0 SUSTAINABLE DRAINAGE SCHEME (SUDS)

4.1 Overview

SuDS is a concept that incorporates long-term environmental and social factors in order to design surface water drainage systems, in accordance with the ideals of sustainable development. SuDS takes into account the quantity and quality of surface water runoff and the value of surface water to the urban and rural environments. Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment, so it is the aim of the SuDS to avoid this in the future.

Most proposed urbanisation creates impermeable surfaces which will need drainage solutions to remove surface water runoff. Traditionally, it is only quantity of flow that has been accounted for in drainage solutions, preventing floods locally by conveying the water away from the site swiftly in underground pipes. These traditional methods frequently alter natural flow patterns which can lead to problems elsewhere in the catchment area. More recently, water quality issues must be accounted for, in order to avoid pollutants from urban areas being transported into rivers or groundwater.

Other aspects, such as water resources, community facilities, landscaping and provision of wildlife habitats have been largely ignored; a well-designed and well-managed SuDS can offer the following benefits:

- management of runoff flow rates, reducing the environmental impact of urbanisation
- maintenance or enhancement of water quality
- consideration to the requirements of the local community
- enhancement of biodiversity in urban watercourses
- maintain the natural groundwater level

4.2 Design Standards

Design of the site drainage infrastructure and Sustainable Drainage System (SuDS) is to be carried out in line with best practices and to industry standard design procedures. A number of publications, including design guidance and best practice guidance will be applied to different components of the final infrastructure. The sections below provide an overview of the design standards to be used on this project for various aspects of the infrastructure design.

4.3 The CIRIA SuDS Manual

This document is a comprehensive publication covering the design, construction, operation and maintenance of SuDS. The advice and best practice outlined in this document has been utilised in the design of the site SuDS features, which have been detailed in this report.

4.4 Building Regulations Part H

Building Regulations Part H 'Drainage and Waste Disposal' covers the design and installation of surface water and foul water systems. All private drainage including pipes, manholes, down pipes, and other drainage infrastructure on the site should be designed and installed in accordance with this document.

4.5 The Wallingford Procedure

Developed by HR Wallingford, this publication covers the design of urban drainage systems. In addition, the document includes regional rainfall data for use in design for varying return period events. Basic sizing calculations for the swales and the estimation of the runoff volumes have been made using this method.

4.6 National Planning Policy Framework

The National Planning Policy Framework (NPPF) contains the policy relating to the appropriate assessment of flood risk within the UK. The associated technical guidance provides further details on the definitions, classifications and constraints used to apply national policy to new developments.

It contains details on flood zone definition, site-specific FRA's, vulnerability classifications, appropriate development, climate change allowances, residual risk management, flood resilience, the sequential test and the exception test.

4.7 Percolation Testing

At this stage percolation testing has not been undertaken. It is likely that this will be undertaken at a later stage. As such, this report outlines two options for the SuDS to demonstrate that a suitable system can be implemented on the site regardless of ground conditions. Both options illustrate full compliance with the SuDS best practice and principles.

4.8 Environmental Considerations

The nature of the development means that runoff could originate from the solar panel arrays, solar panel pile systems and inverters. The runoff from the panels poses a low environmental risk. It has been assumed that any additional foul/industrial waste from the maintenance and operation of the facility will be disposed of elsewhere.

The use of heavy plant on-site during construction may cause the topsoil to be disrupted which in turn can pose a pollution risk to local watercourses. It is advised that silt fences are installed during the construction phase of the project to intercept silt laden runoff if construction traffic is likely to cause damage to the topsoil. It is noted that any soil handling would be undertaken during dry and suitable weather conditions to avoid any damage to the soil profile.

5.0 SUDS DESIGN

5.1 Drainage Design – Option 1 – Infiltration System

The preferable drainage solution for the proposed solar and BESS area would be to drain all surface water runoff from the additional impermeable areas to ground infiltration systems designed to a 100 year return period storm with an allowance for climate change.

In order to provide a detailed design for such an infiltration system, site investigation would be required to ascertain the percolation rates of the site's sub-soil. As the site investigation has not yet been carried out, an estimated infiltration rate of **0.15m/hr** has been used to produce an outline design for the infiltration system.

We have performed infiltration design calculations based on the assumed percolation rate outlined above. The proposed impermeable area for each of the elements has been measured. This approach will consider the access road as permeable therefore is not included in this calculation.

Solar PV Site

Since the solar panels are located on a sloped frame between approximately 0.8m on the lowest edge and 2.0m on the higher edge above ground level, it is anticipated that rain falling on each solar panel table will run off the panels and flow/infiltrate in the sheltered rain shadow area underneath the down-slope modules. A minimum of 10mm gap surrounding the panels will allow water to drain off each module.

The SuDS design will not consider the runoff from the access and maintenance roads as these are likely to be constructed of grass tracks/unbound crushed stones/gravel or similar permeable materials, which will allow infiltration of water in these areas. The access roads will, therefore, not increase surface water runoff rates from the site.

The proposed solar PV modules are anticipated to be supported by steel racking systems, which are to be set on driven piles. The proposed number of support posts approximately equates to an increase in the impermeable area of 281.5m².

The eleven inverter stations and other infrastructure total 268.6m². Therefore, in total the impermeable including the proposed support posts area is 550.1m².

Using Microdrainage Software the required length and dimensions of swale has been calculated for the 1 in 100 year rainfall event with a 50% allowance for climate change. Based on the impermeable area outlined above the required swale has a base width of 0.3m, a depth of 0.3m, side slopes of 1 in 4 and a length of 60m.

When considering the site layout and topography a series of swales have been proposed for the site. This is to ensure that all runoff from the site can be effectively captured and that surface water runoff remains within the site boundary. The total length of swales proposed is 1,345m, which is in excess of the total length required. The layout of the swales are shown on the Drawing within **Appendix A**.

Provided the swales outlined above are installed prior to other on-site construction works, it is anticipated that the runoff from the construction phase would be suitably managed. The swales will also serve to improve the water quality of runoff discharged from the site.

Calculations are included within **Appendix A** of this report.

BESS

The Battery Energy Storage System imposes a concentrated area of impermeable area. The impermeable area of the BESS has been calculated to be 1,349.6m².

Using this, an infiltration basin has been sized with dimensions of a base area of 80m² x 0.8m (depth) for the 1 in 100 year rainfall event with a 50% allowance for climate change. The infiltration basin utilises a 1 in 4 side slope and therefore has a surface area of 213.6m² at ground level. A 300mm freeboard is also included in the depth of the infiltration basin. An infiltration basin has been specified due to the available space and is a preferred option for ecological and biodiversity benefits.

Surface water runoff in the BESS area shall travel in predominantly south-westerly directions where its shall be captured and conveyed by conveyance trenches which outfall to the infiltration basin.

An indicative layout showing the infiltration system and calculations as discussed above are included in **Appendix A**.

5.2 Drainage Design – Option 2 – Attenuation System

If infiltration rates are found to be poor or groundwater ingress is observed in the trial pits, then surface water runoff from the development will need to be attenuated on site and discharged to a suitable receptor at an appropriate rate. In line with best practice, the runoff rate from the development should not exceed pre-development greenfield runoff rates and should allow for climate change.

Due to the topography of the site, the attenuation based system has been split into eight areas, Area 1, Area 2, Area 3, Area 4, Area 5, Area 6, Area 7 and BESS, based on overland flows. For the attenuation-based system the access track is included within the calculations as this option assumes infiltration is not viable and therefore the access track will require adequate drainage.

Area 1

Area 1 incorporates the most northerly portion of the solar PV site. The impermeable area of Area 1 has been calculated to be 563.8m². Using the impermeable area the greenfield runoff rate was calculated for the 1 in 100 year storm event using the ICP-SuDS method to be 0.5l/s.

Using this, an attenuation trench for Area 1 has been sized with dimensions of a depth of 1.0m, width of 0.5m and a length of 300m, for the 1 in 100 year rainfall event with a 50% allowance for climate change with the outfall set to 0.7l/s. The outfall has been set to 0.7l/s due to the minimum flow specifications of the Optimum Hydrobrake flow control device, which is to be used. The attenuation trench is to be installed with a slope of 1 in 1000 which is entirely viable given the topography of the proposed trench location. An attenuation trench has been specified due to the available space in Area 1.

The full calculations and associated drainage are included in **Appendix B**.

The runoff from Area 1 will flow in predominantly northerly directions. The runoff from Area 1's infrastructure, the support posts and inverters, are to be captured directly by the attenuation trench which is situated along the downstream perimeter of the Area 1. The runoff from the access roads in Area 1 shall be captured by a series of gullies. These will outfall into the attenuation trench. The outfall from the attenuation trench will be controlled to the rates outlined above. This ensures that the runoff from the site is controlled to pre-development rates.

There is a watercourse situated to the north of Area 1 which could offer a suitable connection point for the outfall of the attenuation trench.

Area 2

Area 2 incorporates the singular field to the north of the site. The impermeable area of Area 2 has been calculated to be 297.5m². Using the impermeable area the greenfield runoff rate was calculated for the 1 in 100 year storm event using the ICP-SuDS method to be 0.3l/s.

Using this, an attenuation trench for Area 2 has been sized with dimensions of a depth of 0.6m, width of 1.0m and a length of 70m, for the 1 in 100 year rainfall event with a 50% allowance for climate change with the outfall set to 0.7l/s. The outfall has been set to 0.7l/s due to the minimum flow specifications of the Optimum Hydrobrake flow control device, which is to be used. The attenuation trench is to be installed with a slope of 1 in 1000 which is entirely viable given the topography of the proposed trench location. An attenuation trench has been specified due to the available space in Area 2.

The full calculations and associated drainage are included in **Appendix B**.

The runoff from Area 2 will flow in predominantly westerly directions. The runoff from Area 2's infrastructure, the support posts and inverters, are to be captured directly by the attenuation trench which is situated along the downstream perimeter of the Area 2. The runoff from the access roads in Area 2 shall be captured by a series of gullies. These will outfall into the

attenuation trench. The outfall from the attenuation trench will be controlled to the rates outlined above. This ensures that the runoff from the site is controlled to pre-development rates.

There is a watercourse situated to the east of the site which could offer a suitable connection point for the outfall of the attenuation trench.

Area 3

Area 3 incorporates the north easterly portion of the solar PV site. The impermeable area of Area 3 has been calculated to be 430.2m². Using the impermeable area the greenfield runoff rate was calculated for the 1 in 100 year storm event using the ICP-SuDS method to be 0.4l/s.

Using this, an attenuation trench for Area 3 has been sized with dimensions of a depth of 1.0m, width of 1.0m and a length of 100m, for the 1 in 100 year rainfall event with a 50% allowance for climate change with the outfall set to 0.7l/s. The outfall has been set to 0.7l/s due to the minimum flow specifications of the Optimum Hydrobrake flow control device, which is to be used. The attenuation trench is to be installed with a slope of 1 in 1000 which is entirely viable given the topography of the proposed trench location. An attenuation trench has been specified due to the available space in Area 3.

The full calculations and associated drainage are included in **Appendix B**.

The runoff from Area 3 will flow in predominantly westerly directions. The runoff from Area 3's infrastructure, the support posts and inverters, are to be captured directly by the attenuation trench which is situated along the downstream perimeter of the Area 3. The runoff from the access roads in Area 3 shall be captured by a series of gullies. These will outfall into the attenuation trench. The outfall from the attenuation trench will be controlled to the rates outlined above. This ensures that the runoff from the site is controlled to pre-development rates.

There is a watercourse situated to the east of the Area 3 which could offer a suitable connection point for the outfall of the attenuation trench.

Area 4

Area 4 incorporates the southeasterly portion of the solar PV site. The impermeable area of Area 4 has been calculated to be 3,157.0m². Using the impermeable area the greenfield runoff rate was calculated for the 1 in 100 year storm event using the ICP-SuDS method to be 2.8l/s.

Using this, an attenuation trench for Area 4 has been sized with dimensions of a depth of 1.5m, width of 1.5m and a length of 380m, for the 1 in 100 year rainfall event with a 50% allowance for climate change with the outfall set to 2.8l/s. The attenuation trench is to be installed with a slope of 1 in 1000 which is entirely viable given the topography of the proposed trench location. An attenuation trench has been specified due to the available space in Area 4.

The full calculations and associated drainage are included in **Appendix B**.

The runoff from Area 4 will flow in predominantly southerly directions. The runoff from Area 4's infrastructure, the support posts and inverters, are to be captured directly by the attenuation trench which is situated along the downstream perimeter of the Area 4. The runoff from the access roads in Area 4 shall be captured by a series of gullies. These will outfall into the attenuation trench. The outfall from the attenuation trench will be controlled to the rates outlined above. This ensures that the runoff from the site is controlled to pre-development rates.

There is a watercourse situated to the south of Area 4 which could offer a suitable connection point for the outfall of the attenuation trench.

Area 5

Area 5 incorporates the area of the solar PV site situated to the east of the BESS area. The impermeable area of Area 5 has been calculated to be 3,365.1m². Using the impermeable area

the greenfield runoff rate was calculated for the 1 in 100 year storm event using the ICP-SuDS method to be 2.9l/s.

Using this, an attenuation basin for Area 5 has been sized with dimensions of a base area of 75m² x 1.5m (depth) for the 1 in 100 year rainfall event with a 50% allowance for climate change with the outfall set to 2.9l/s. The attenuation basin utilises a 1 in 4 side slope and therefore has a surface area of 472.3m² at ground level. A 300mm freeboard is also included in the depth of the attenuation basin. An attenuation basin has been specified due to the available space in Area 5 and is a preferred option for ecological and biodiversity benefits.

The full calculations and associated drainage are included in **Appendix B**.

The runoff from Area 5 will flow in predominantly south-easterly directions. The runoff from Area 5's infrastructure, the support posts, inverters and access roads in Area 5 shall be captured by a series of gullies. These will outfall into the attenuation basin. The outfall from the attenuation basin will be controlled to the rates outlined above. This ensures that the runoff from the site is controlled to pre-development rates.

There is a watercourse situated to the south of Area 5 which could offer a suitable connection point for the outfall of the attenuation basin.

Area 6

Area 6 incorporates the south-westerly portion of the solar PV site. The impermeable area of Area 6 has been calculated to be 1,503.7m². Using the impermeable area the greenfield runoff rate was calculated for the 1 in 100 year storm event using the ICP-SuDS method to be 1.3l/s.

Using this, an attenuation trench for Area 6 has been sized with dimensions of a depth of 1.0m, width of 1.0m and a length of 380m, for the 1 in 100 year rainfall event with a 50% allowance for climate change with the outfall set to 1.3l/s. The attenuation trench is to be installed with a slope of 1 in 1000 which is entirely viable given the topography of the proposed trench location. An attenuation trench has been specified due to the available space in Area 6.

The full calculations and associated drainage are included in **Appendix B**.

The runoff from Area 6 will flow in predominantly southerly directions. The runoff from Area 6's infrastructure, the support posts and inverters, are to be captured directly by the attenuation trench which is situated along the downstream perimeter of the Area 6. The runoff from the access roads in Area 6 shall be captured by a series of gullies. These will outfall into the attenuation trench. The outfall from the attenuation trench will be controlled to the rates outlined above. This ensures that the runoff from the site is controlled to pre-development rates.

There is a watercourse situated to the south of Area 6 which could offer a suitable connection point for the outfall of the attenuation trench.

Area 7

Area 7 incorporates the area of the solar PV site situated to the north of the site. The impermeable area of Area 7 has been calculated to be 1,956.5m². Using the impermeable area the greenfield runoff rate was calculated for the 1 in 100 year storm event using the ICP-SuDS method to be 1.7l/s.

Using this, an attenuation basin for Area 7 has been sized with dimensions of a base area of 110m² x 1.0m (depth) for the 1 in 100 year rainfall event with a 50% allowance for climate change with the outfall set to 1.7l/s. The attenuation basin utilises a 1 in 4 side slope and therefore has a surface area of 309.0m² at ground level. A 300mm freeboard is also included in

the depth of the attenuation basin. An attenuation basin has been specified due to the available space in Area 7 and is a preferred option for ecological and biodiversity benefits.

The full calculations and associated drainage are included in **Appendix B**.

The runoff from Area 7 will flow in predominantly north-easterly directions. The runoff from Area 7's infrastructure, the support posts, inverters and access roads in Area 7 shall be captured by a series of gullies. These will outfall into the attenuation basin. The outfall from the attenuation basin will be controlled to the rates outlined above. This ensures that the runoff from the site is controlled to pre-development rates.

There is a watercourse situated northeast of Area 7 which could offer a suitable connection point for the outfall of the attenuation basin.

BESS

The BESS area imposes a concentrated impermeable area which has been calculated to be 4,129.8m². Using the impermeable area the greenfield runoff rate was calculated for the 1 in 100 year storm event using the ICP-SuDS method to be 3.6l/s.

Using this, an attenuation basin for the BESS area has been sized with dimensions of a base area of 100m² x 1.5m (depth) for the 1 in 100 year rainfall event with a 50% allowance for climate change with the outfall set to 3.6l/s. The attenuation basin utilises a 1 in 4 side slope and therefore has a surface area of 425.8m² at ground level. A 300mm freeboard is also included in the depth of the attenuation basin. An attenuation basin has been specified due to the available space in the BESS area and is a preferred option for ecological and biodiversity benefits.

The full calculations and associated drainage are included in **Appendix B**.

The runoff from the BESS will flow in predominantly southeasterly directions. The runoff from the BESS infrastructure and access roads shall be captured by a series of gullies. These will outfall into the attenuation basin. The outfall from the attenuation basin will be controlled to the rates outlined above. This ensures that the runoff from the site is controlled to pre-development rates.

There is a watercourse situated to the north of the BESS which could offer a suitable connection point for the outfall of the attenuation basin.

5.3 Maintenance Requirements

The management and maintenance of the surface water drainage scheme will ensure that the infiltration systems will operate as intended for their lifetime. The CIRIA SuDS Manual 2015 outlines the minimum maintenance requirements which are shown below. The system should also be maintained in line with the relevant manufacturers recommendations.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseed	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Figure 5.3.1 Operation and Maintenance Requirements for Swales – The CIRIA SuDS Manual

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Figure 5.3.2 Operation and Maintenance Requirements for Infiltration Trenches – The CIRIA SuDS Manual

TABLE 22.1 Operation and maintenance requirements for detention basins		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Figure 5.3.3. Operation and Maintenance Requirements for Infiltration and Attenuation Basins – The CIRIA SuDS Manual

The drainage system will remain in private ownership; the site operator would, therefore, be responsible for the maintenance of the drainage features within the site. The developer of the site should make this responsibility clear to the site operator by providing a maintenance plan for the development.

5.4 Summary

Percolation testing has not been conducted at the proposed development site, as such a two option scheme for the development has been outlined to demonstrate that a suitable scheme can be implemented regardless of ground conditions.

The conceptual design of a surface water drainage scheme has been carried out based on the current proposed development layout. This has demonstrated that the surface water runoff from the development can be managed entirely on site so as not to unduly affect the flood risk to neighbouring areas.

6.0 EFFECT ON ADJACENT SITES

In the absence of percolation testing, an infiltration and attenuation option have been investigated. Both of which are outlined in **Section 5.0**. As such, there will be no impact on neighbouring sites as a result of the proposed development.

The impermeable areas created by the site have been designed to be managed by a robust drainage system regardless of ground conditions. This will ensure that there is no flood risk from the surface water from the proposed development.

7.0 RESIDUAL RISKS AFTER DEVELOPMENT

The capacity of the drainage scheme design in **Section 5.0** for the drainage system for solar PV site and BESS has been designed for the 1 in 100 year event with an allowance for climate change, therefore there will be minimal risk post development. Therefore, any unauthorised future connections into the site drainage network will potentially overload the system. Any future development on the site, beyond the current proposal, should be suitably planned and considered, especially if new impermeable areas are to be introduced to the site.

As long as these factors are considered in the design of the development there is the capacity to manage any associated residual risks.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The study has investigated the mechanisms for flooding at the proposed Arleston Solar and BESS on land at Manor Farm, Arleston Lane, Derby, DE73 7HN. It has been identified that the development site is largely not at direct risk of flooding. The development area is in Flood Zone 1 (low risk) and as such this report has focused on reducing the risks associated with surface water runoff.

Developments over 1ha in size in Flood Zone 1, require a Flood Risk Assessment to ensure flood risk is not increased to areas downstream of the development site. This study has investigated the impact that the development proposal will have on surface water runoff rates from the site.

Two options were shown for the site depending on the results of percolation testing. If successful, a series of infiltration swales will capture the runoff from the solar site with an infiltration basin capturing runoff from the BESS. If unsuccessful the flows will be captured and attenuated to a mixture of attenuation trenches and attenuation basins for the solar and BESS site and connected to surrounding watercourses.

If the recommendations made in this report are followed during the development of the site, there will be a reduction in the surface water discharge rate from the site and therefore flood risk will be minimised.

On the basis of this report and by reference to EA flood maps, it is concluded that the developed site area is located within Flood Zone 1 and, therefore, is not at any direct risk of flooding. The National Planning Policy Framework and associated Planning Practice Guidance states 'All uses of land are appropriate in this zone' from a flooding perspective. Consequently, with regard to flood risk, the proposed development is entirely appropriate in this area.

Provided the recommendations outlined in this report are adopted in the development proposal then there is the capacity to manage the surface water runoff from the development onsite without causing a detrimental risk to the groundwater beneath.

**APPENDIX A CONCEPTUAL SUDS DESIGN &
CALCULATIONS (INFILTRATION
OPTION)**

1. THIS DRAWING AND ANY ANCHILLARY DRAWINGS OR DATA ARE COPYRIGHT OF NIJUH5 H2OK L1D AND MAY NOT BE USED, COPIED OR AMENDED FOR ANY PURPOSE WHATSOEVER WITHOUT WRITTEN APPROVAL.
2. THIS DRAWING IS ONLY TO BE USED FOR THE PURPOSES DESCRIBED IN THE STATUS BOX BELOW. WORK TO FIGURED DIMENSIONS ONLY, DO NOT SCALE.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS, DETAILS AND SPECIFICATIONS PERTAINING TO THE WORK DESCRIBED.
4. MATERIALS AND WORKMANSHIP SHALL COMPLY TO THE APPROPRIATE BRITISH STANDARDS AND CODES OF PRACTICE UNLESS OTHERWISE STATED.
5. THE ACTIVITIES REQUIRED TO CONSTRUCT THE WORK, SHOWN ON DRAWINGS CLEARLY MARKED FOR CONSTRUCTION, MAY BE SUBJECT TO THE PROVISIONS OF THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2015 THE CONTRACTOR AND CLIENT MUST ENSURE THAT THEY ARE ADEQUATELY CONVERSANT WITH THESE REGULATIONS AND THAT THE APPROPRIATE PROCEDURES REQUIRED UNDER THE REGULATIONS ARE OBSERVED AT ALL TIMES.

 PROPOSED SITE BOUNDARY
 PROPOSED SURFACE WATER DRAINAGE (INFILTRATION OPTION)
 OVERLAND FLOW ARROW
 PROPOSED SWALE
 PROPOSED CONVEYANCE TRENCH
 PROPOSED INFILTRATION BASIN

HG	09.06.25	AMENDED RED LINE BOUNDARY				P04
Name	Date	Remarks				Revision

INFORMATION



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#missionwater

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NSI Office	WEST	Drawn by	LC	Date	09-06-25	Status	S2
Title CONCEPTUAL SURFACE WATER DRAINAGE - INFILTRATION							Revision P04 Checked by HG
Project ARLESTON SOLAR & BESS							Release Date 09-06-25
Project № J-15585			Quotation №				Size A1
Document № J15585-NUK-XX-XX-DR-D-3001-S2-P4							Sheet 1/2
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Summary of Results for 100 year Return Period (+50%) Half Drain Time : 74 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>99.926</td><td>0.226</td><td>2.4</td><td>12.9</td><td>Flood Risk</td></tr><tr><td>30 min Summer</td><td>99.956</td><td>0.256</td><td>2.7</td><td>16.4</td><td>Flood Risk</td></tr><tr><td>60 min Summer</td><td>99.973</td><td>0.273</td><td>2.9</td><td>18.7</td><td>Flood Risk</td></tr><tr><td>120 min Summer</td><td>99.977</td><td>0.277</td><td>2.9</td><td>19.2</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>99.973</td><td>0.273</td><td>2.9</td><td>18.6</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>99.966</td><td>0.266</td><td>2.8</td><td>17.7</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>99.952</td><td>0.252</td><td>2.7</td><td>15.9</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>99.939</td><td>0.239</td><td>2.5</td><td>14.4</td><td>Flood Risk</td></tr><tr><td>600 min Summer</td><td>99.928</td><td>0.228</td><td>2.4</td><td>13.0</td><td>Flood Risk</td></tr><tr><td>720 min Summer</td><td>99.917</td><td>0.217</td><td>2.3</td><td>11.8</td><td>Flood Risk</td></tr><tr><td>960 min Summer</td><td>99.898</td><td>0.198</td><td>2.1</td><td>9.9</td><td>Flood Risk</td></tr><tr><td>1440 min Summer</td><td>99.868</td><td>0.168</td><td>1.8</td><td>7.2</td><td>Flood Risk</td></tr><tr><td>2160 min Summer</td><td>99.837</td><td>0.137</td><td>1.5</td><td>4.8</td><td>Flood Risk</td></tr><tr><td>2880 min Summer</td><td>99.816</td><td>0.116</td><td>1.3</td><td>3.4</td><td>Flood Risk</td></tr><tr><td>4320 min Summer</td><td>99.788</td><td>0.088</td><td>1.0</td><td>1.9</td><td>Flood Risk</td></tr><tr><td>5760 min Summer</td><td>99.771</td><td>0.071</td><td>0.8</td><td>1.2</td><td>Flood Risk</td></tr><tr><td>7200 min Summer</td><td>99.760</td><td>0.060</td><td>0.7</td><td>0.8</td><td>Flood Risk</td></tr><tr><td>8640 min Summer</td><td>99.754</td><td>0.054</td><td>0.6</td><td>0.6</td><td>Flood Risk</td></tr><tr><td>10080 min Summer</td><td>99.750</td><td>0.050</td><td>0.5</td><td>0.5</td><td>Flood Risk</td></tr><tr><td>15 min Winter</td><td>99.941</td><td>0.241</td><td>2.6</td><td>14.5</td><td>Flood Risk</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>148.033</td><td>0.0</td><td>26</td></tr><tr><td>30 min Summer</td><td>98.183</td><td>0.0</td><td>37</td></tr><tr><td>60 min Summer</td><td>62.011</td><td>0.0</td><td>60</td></tr><tr><td>120 min Summer</td><td>37.763</td><td>0.0</td><td>92</td></tr><tr><td>180 min Summer</td><td>27.826</td><td>0.0</td><td>126</td></tr><tr><td>240 min Summer</td><td>22.264</td><td>0.0</td><td>160</td></tr><tr><td>360 min Summer</td><td>16.283</td><td>0.0</td><td>228</td></tr><tr><td>480 min Summer</td><td>13.021</td><td>0.0</td><td>294</td></tr><tr><td>600 min Summer</td><td>10.939</td><td>0.0</td><td>358</td></tr><tr><td>720 min Summer</td><td>9.483</td><td>0.0</td><td>420</td></tr><tr><td>960 min Summer</td><td>7.563</td><td>0.0</td><td>544</td></tr><tr><td>1440 min Summer</td><td>5.488</td><td>0.0</td><td>786</td></tr><tr><td>2160 min Summer</td><td>3.975</td><td>0.0</td><td>1144</td></tr><tr><td>2880 min Summer</td><td>3.159</td><td>0.0</td><td>1504</td></tr><tr><td>4320 min Summer</td><td>2.280</td><td>0.0</td><td>2212</td></tr><tr><td>5760 min Summer</td><td>1.808</td><td>0.0</td><td>2944</td></tr><tr><td>7200 min Summer</td><td>1.509</td><td>0.0</td><td>3664</td></tr><tr><td>8640 min Summer</td><td>1.302</td><td>0.0</td><td>4400</td></tr><tr><td>10080 min Summer</td><td>1.150</td><td>0.0</td><td>5112</td></tr><tr><td>15 min 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Nanjerrick Court Allet Truro, TR4 9DJ					
Date 28/02/2025 15:42 File SWALE .SRCX		Designed by QD9548 Checked by			
Innovyze		Source Control 2020.1			
Summary of Results for 100 year Return Period (+50%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.972	0.272	2.9	18.5	Flood Risk
60 min Winter	99.992	0.292	3.1	21.3	Flood Risk
120 min Winter	99.995	0.295	3.1	21.7	Flood Risk
180 min Winter	99.988	0.288	3.1	20.7	Flood Risk
240 min Winter	99.978	0.278	2.9	19.3	Flood Risk
360 min Winter	99.959	0.259	2.7	16.8	Flood Risk
480 min Winter	99.940	0.240	2.6	14.5	Flood Risk
600 min Winter	99.924	0.224	2.4	12.6	Flood Risk
720 min Winter	99.909	0.209	2.2	11.0	Flood Risk
960 min Winter	99.884	0.184	2.0	8.6	Flood Risk
1440 min Winter	99.848	0.148	1.6	5.5	Flood Risk
2160 min Winter	99.813	0.113	1.2	3.2	Flood Risk
2880 min Winter	99.791	0.091	1.0	2.0	Flood Risk
4320 min Winter	99.765	0.065	0.7	1.0	Flood Risk
5760 min Winter	99.754	0.054	0.6	0.6	Flood Risk
7200 min Winter	99.748	0.048	0.5	0.5	Flood Risk
8640 min Winter	99.745	0.045	0.4	0.4	Flood Risk
10080 min Winter	99.742	0.042	0.4	0.4	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	98.183	0.0	38		
60 min Winter	62.011	0.0	60		
120 min Winter	37.763	0.0	98		
180 min Winter	27.826	0.0	136		
240 min Winter	22.264	0.0	172		
360 min Winter	16.283	0.0	242		
480 min Winter	13.021	0.0	310		
600 min Winter	10.939	0.0	376		
720 min Winter	9.483	0.0	440		
960 min Winter	7.563	0.0	564		
1440 min Winter	5.488	0.0	804		
2160 min Winter	3.975	0.0	1156		
2880 min Winter	3.159	0.0	1504		
4320 min Winter	2.280	0.0	2212		
5760 min Winter	1.808	0.0	2944		
7200 min Winter	1.509	0.0	3664		
8640 min Winter	1.302	0.0	4416		
10080 min Winter	1.150	0.0	5096		
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Innovyze	Source Control 2020.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.400	Shortest Storm (mins)	15
Ratio R	0.376	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+50

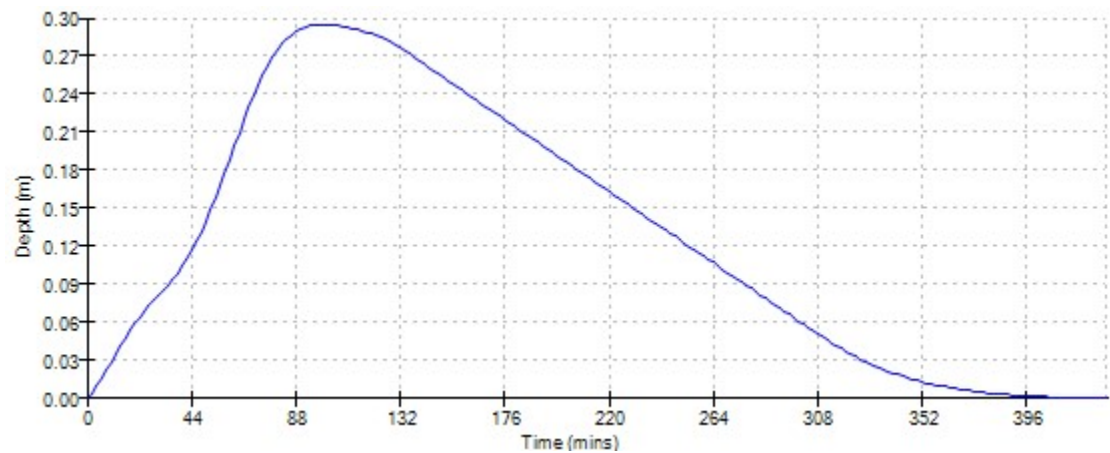
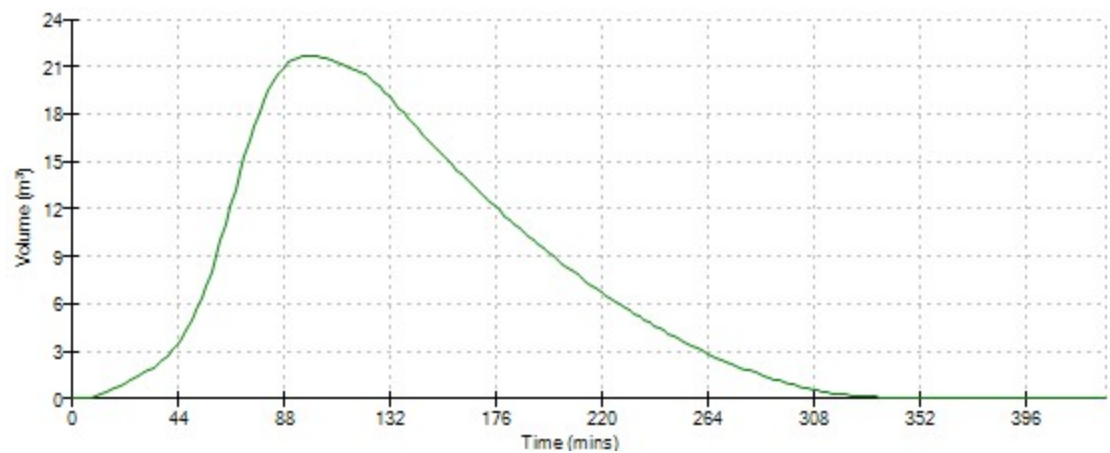
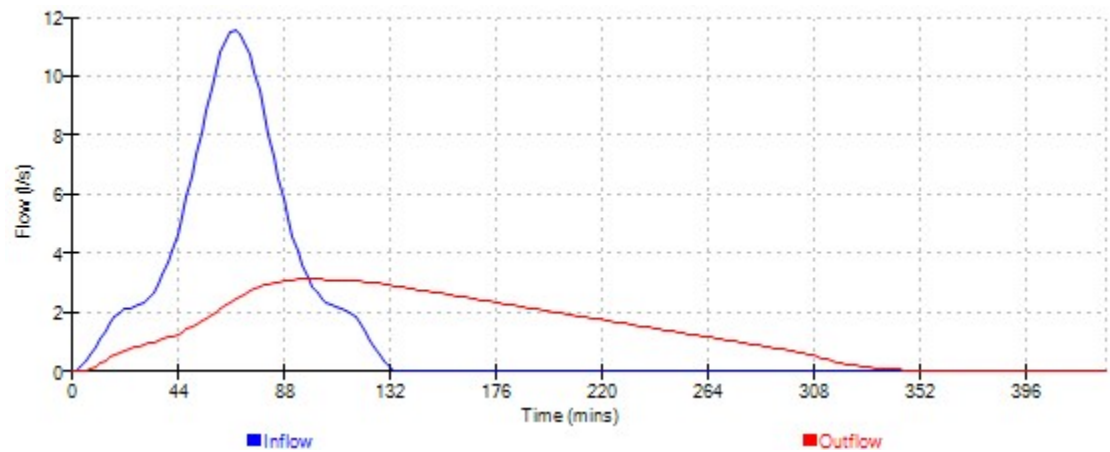
Time Area Diagram

Total Area (ha) 0.055

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)
0 4 0.014	4 8 0.014	8 12 0.014	12 16 0.013				

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Date 28/02/2025 15:42 File SWALE .SRCX	Designed by QD9548 Checked by																									
Innovyze	Source Control 2020.1																									
Model Details Storage is Online Cover Level (m) 100.000 Swale Structure <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.15000</td><td>Length (m)</td><td>60.0</td></tr><tr><td>Infiltration Coefficient Side (m/hr)</td><td>0.15000</td><td>Side Slope (1:X)</td><td>4.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Slope (1:X)</td><td>1000.0</td></tr><tr><td>Porosity</td><td>1.00</td><td>Cap Volume Depth (m)</td><td>0.000</td></tr><tr><td>Invert Level (m)</td><td>99.700</td><td>Cap Infiltration Depth (m)</td><td>0.000</td></tr><tr><td>Base Width (m)</td><td>0.3</td><td></td><td></td></tr></table>			Infiltration Coefficient Base (m/hr)	0.15000	Length (m)	60.0	Infiltration Coefficient Side (m/hr)	0.15000	Side Slope (1:X)	4.0	Safety Factor	2.0	Slope (1:X)	1000.0	Porosity	1.00	Cap Volume Depth (m)	0.000	Invert Level (m)	99.700	Cap Infiltration Depth (m)	0.000	Base Width (m)	0.3		
Infiltration Coefficient Base (m/hr)	0.15000	Length (m)	60.0																							
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Invert Level (m)	99.700	Cap Infiltration Depth (m)	0.000																							
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Event: 120 min Winter



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Nanjerrick Court Allet Truro, TR4 9DJ																																																																																																																																																																																																																								
Date 28/02/2025 15:51 File INFILTRATION BASIN BESS...		Designed by QD9548 Checked by																																																																																																																																																																																																																						
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Summary of Results for 100 year Return Period (+50%) Half Drain Time : 115 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>99.510</td><td>0.310</td><td>3.7</td><td>31.4</td><td>O K</td></tr><tr><td>30 min Summer</td><td>99.578</td><td>0.378</td><td>4.2</td><td>40.2</td><td>O K</td></tr><tr><td>60 min Summer</td><td>99.625</td><td>0.425</td><td>4.5</td><td>46.8</td><td>O K</td></tr><tr><td>120 min Summer</td><td>99.642</td><td>0.442</td><td>4.6</td><td>49.2</td><td>O K</td></tr><tr><td>180 min Summer</td><td>99.639</td><td>0.439</td><td>4.6</td><td>48.7</td><td>O K</td></tr><tr><td>240 min Summer</td><td>99.630</td><td>0.430</td><td>4.5</td><td>47.4</td><td>O K</td></tr><tr><td>360 min Summer</td><td>99.606</td><td>0.406</td><td>4.4</td><td>44.0</td><td>O K</td></tr><tr><td>480 min Summer</td><td>99.583</td><td>0.383</td><td>4.2</td><td>40.9</td><td>O K</td></tr><tr><td>600 min Summer</td><td>99.562</td><td>0.362</td><td>4.1</td><td>38.0</td><td>O K</td></tr><tr><td>720 min Summer</td><td>99.542</td><td>0.342</td><td>3.9</td><td>35.4</td><td>O K</td></tr><tr><td>960 min Summer</td><td>99.505</td><td>0.305</td><td>3.7</td><td>30.8</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>99.444</td><td>0.244</td><td>3.2</td><td>23.5</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>99.375</td><td>0.175</td><td>2.8</td><td>16.1</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>99.326</td><td>0.126</td><td>2.5</td><td>11.1</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>99.264</td><td>0.064</td><td>2.1</td><td>5.4</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>99.245</td><td>0.045</td><td>1.8</td><td>3.7</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>99.238</td><td>0.038</td><td>1.5</td><td>3.2</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>99.233</td><td>0.033</td><td>1.3</td><td>2.7</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>99.230</td><td>0.030</td><td>1.1</td><td>2.4</td><td>O K</td></tr><tr><td>15 min Winter</td><td>99.542</td><td>0.342</td><td>3.9</td><td>35.5</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>139.925</td><td>0.0</td><td>27</td></tr><tr><td>30 min Summer</td><td>91.956</td><td>0.0</td><td>39</td></tr><tr><td>60 min Summer</td><td>57.620</td><td>0.0</td><td>64</td></tr><tr><td>120 min Summer</td><td>34.923</td><td>0.0</td><td>104</td></tr><tr><td>180 min Summer</td><td>25.727</td><td>0.0</td><td>136</td></tr><tr><td>240 min Summer</td><td>20.597</td><td>0.0</td><td>170</td></tr><tr><td>360 min Summer</td><td>14.951</td><td>0.0</td><td>240</td></tr><tr><td>480 min Summer</td><td>11.919</td><td>0.0</td><td>308</td></tr><tr><td>600 min Summer</td><td>9.991</td><td>0.0</td><td>374</td></tr><tr><td>720 min Summer</td><td>8.645</td><td>0.0</td><td>440</td></tr><tr><td>960 min Summer</td><td>6.876</td><td>0.0</td><td>570</td></tr><tr><td>1440 min Summer</td><td>4.972</td><td>0.0</td><td>820</td></tr><tr><td>2160 min Summer</td><td>3.589</td><td>0.0</td><td>1180</td></tr><tr><td>2880 min Summer</td><td>2.845</td><td>0.0</td><td>1536</td></tr><tr><td>4320 min Summer</td><td>2.048</td><td>0.0</td><td>2220</td></tr><tr><td>5760 min Summer</td><td>1.621</td><td>0.0</td><td>2936</td></tr><tr><td>7200 min Summer</td><td>1.351</td><td>0.0</td><td>3672</td></tr><tr><td>8640 min Summer</td><td>1.163</td><td>0.0</td><td>4408</td></tr><tr><td>10080 min Summer</td><td>1.025</td><td>0.0</td><td>5136</td></tr><tr><td>15 min Winter</td><td>139.925</td><td>0.0</td><td>27</td></tr></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	99.510	0.310	3.7	31.4	O K	30 min Summer	99.578	0.378	4.2	40.2	O K	60 min Summer	99.625	0.425	4.5	46.8	O K	120 min Summer	99.642	0.442	4.6	49.2	O K	180 min Summer	99.639	0.439	4.6	48.7	O K	240 min Summer	99.630	0.430	4.5	47.4	O K	360 min Summer	99.606	0.406	4.4	44.0	O K	480 min Summer	99.583	0.383	4.2	40.9	O K	600 min Summer	99.562	0.362	4.1	38.0	O K	720 min Summer	99.542	0.342	3.9	35.4	O K	960 min Summer	99.505	0.305	3.7	30.8	O K	1440 min Summer	99.444	0.244	3.2	23.5	O K	2160 min Summer	99.375	0.175	2.8	16.1	O K	2880 min Summer	99.326	0.126	2.5	11.1	O K	4320 min Summer	99.264	0.064	2.1	5.4	O K	5760 min Summer	99.245	0.045	1.8	3.7	O K	7200 min Summer	99.238	0.038	1.5	3.2	O K	8640 min Summer	99.233	0.033	1.3	2.7	O K	10080 min Summer	99.230	0.030	1.1	2.4	O K	15 min Winter	99.542	0.342	3.9	35.5	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	139.925	0.0	27	30 min Summer	91.956	0.0	39	60 min Summer	57.620	0.0	64	120 min Summer	34.923	0.0	104	180 min Summer	25.727	0.0	136	240 min Summer	20.597	0.0	170	360 min Summer	14.951	0.0	240	480 min Summer	11.919	0.0	308	600 min Summer	9.991	0.0	374	720 min Summer	8.645	0.0	440	960 min Summer	6.876	0.0	570	1440 min Summer	4.972	0.0	820	2160 min Summer	3.589	0.0	1180	2880 min Summer	2.845	0.0	1536	4320 min Summer	2.048	0.0	2220	5760 min Summer	1.621	0.0	2936	7200 min Summer	1.351	0.0	3672	8640 min Summer	1.163	0.0	4408	10080 min Summer	1.025	0.0	5136	15 min Winter	139.925	0.0	27
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Nijhuis Industries UK & Ireland				Page 2	
Nanjerrick Court Allet Truro, TR4 9DJ					
Date 28/02/2025 15:51 File INFILTRATION BASIN BESS...		Designed by QD9548 Checked by			
Innovyze		Source Control 2020.1			
<u>Summary of Results for 100 year Return Period (+50%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.615	0.415	4.4	45.4	O K
60 min Winter	99.669	0.469	4.8	53.2	O K
120 min Winter	99.688	0.488	5.0	56.1	O K
180 min Winter	99.684	0.484	4.9	55.4	O K
240 min Winter	99.671	0.471	4.8	53.5	O K
360 min Winter	99.638	0.438	4.6	48.7	O K
480 min Winter	99.606	0.406	4.4	44.1	O K
600 min Winter	99.576	0.376	4.2	39.9	O K
720 min Winter	99.547	0.347	4.0	36.2	O K
960 min Winter	99.497	0.297	3.6	29.8	O K
1440 min Winter	99.416	0.216	3.1	20.4	O K
2160 min Winter	99.330	0.130	2.5	11.5	O K
2880 min Winter	99.273	0.073	2.1	6.2	O K
4320 min Winter	99.242	0.042	1.6	3.4	O K
5760 min Winter	99.234	0.034	1.3	2.8	O K
7200 min Winter	99.228	0.028	1.1	2.3	O K
8640 min Winter	99.225	0.025	0.9	2.0	O K
10080 min Winter	99.222	0.022	0.8	1.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	91.956	0.0	40		
60 min Winter	57.620	0.0	64		
120 min Winter	34.923	0.0	110		
180 min Winter	25.727	0.0	144		
240 min Winter	20.597	0.0	182		
360 min Winter	14.951	0.0	258		
480 min Winter	11.919	0.0	330		
600 min Winter	9.991	0.0	400		
720 min Winter	8.645	0.0	468		
960 min Winter	6.876	0.0	600		
1440 min Winter	4.972	0.0	854		
2160 min Winter	3.589	0.0	1216		
2880 min Winter	2.845	0.0	1560		
4320 min Winter	2.048	0.0	2204		
5760 min Winter	1.621	0.0	2920		
7200 min Winter	1.351	0.0	3672		
8640 min Winter	1.163	0.0	4368		
10080 min Winter	1.025	0.0	5120		
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Nanjerrick Court Allet Truro, TR4 9DJ		
Date 28/02/2025 15:51	Designed by QD9548	
File INFILTRATION BASIN BESS...	Checked by	
Innovyze	Source Control 2020.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+50

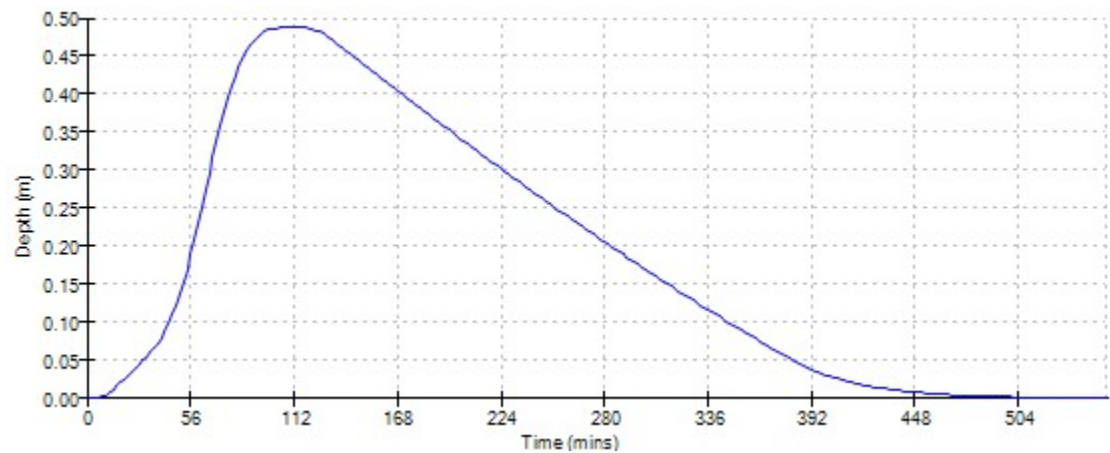
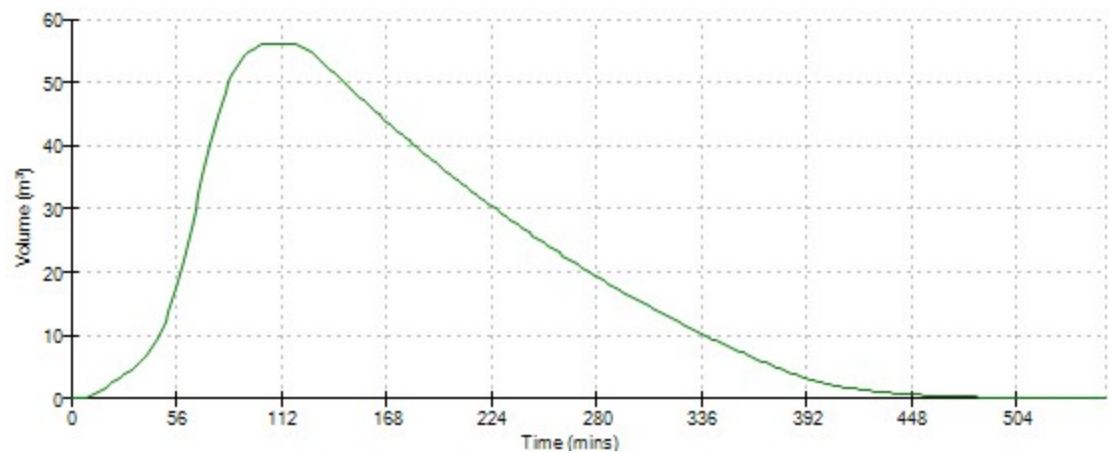
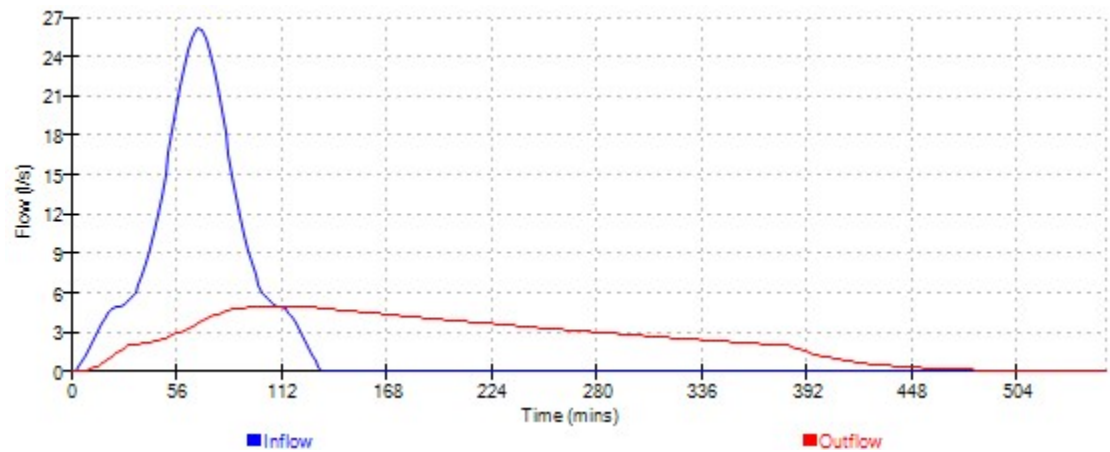
Time Area Diagram

Total Area (ha) 0.135

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)
0 4 0.034	4 8 0.034	8 12 0.034	12 16 0.033				

Nijhuis Industries UK & Ireland		Page 4								
Nanjerrick Court Allet Truro, TR4 9DJ										
Date 28/02/2025 15:51 File INFILTRATION BASIN BESS...	Designed by QD9548 Checked by									
Innovyze Source Control 2020.1										
Model Details Storage is Online Cover Level (m) 100.000 Infiltration Basin Structure Invert Level (m) 99.200 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.15000 Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.15000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>80.0</td><td>0.800</td><td>213.6</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	80.0	0.800	213.6
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	80.0	0.800	213.6							
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Event: 120 min Winter



APPENDIX B

CONCEPTUAL CALCULATIONS OPTION)

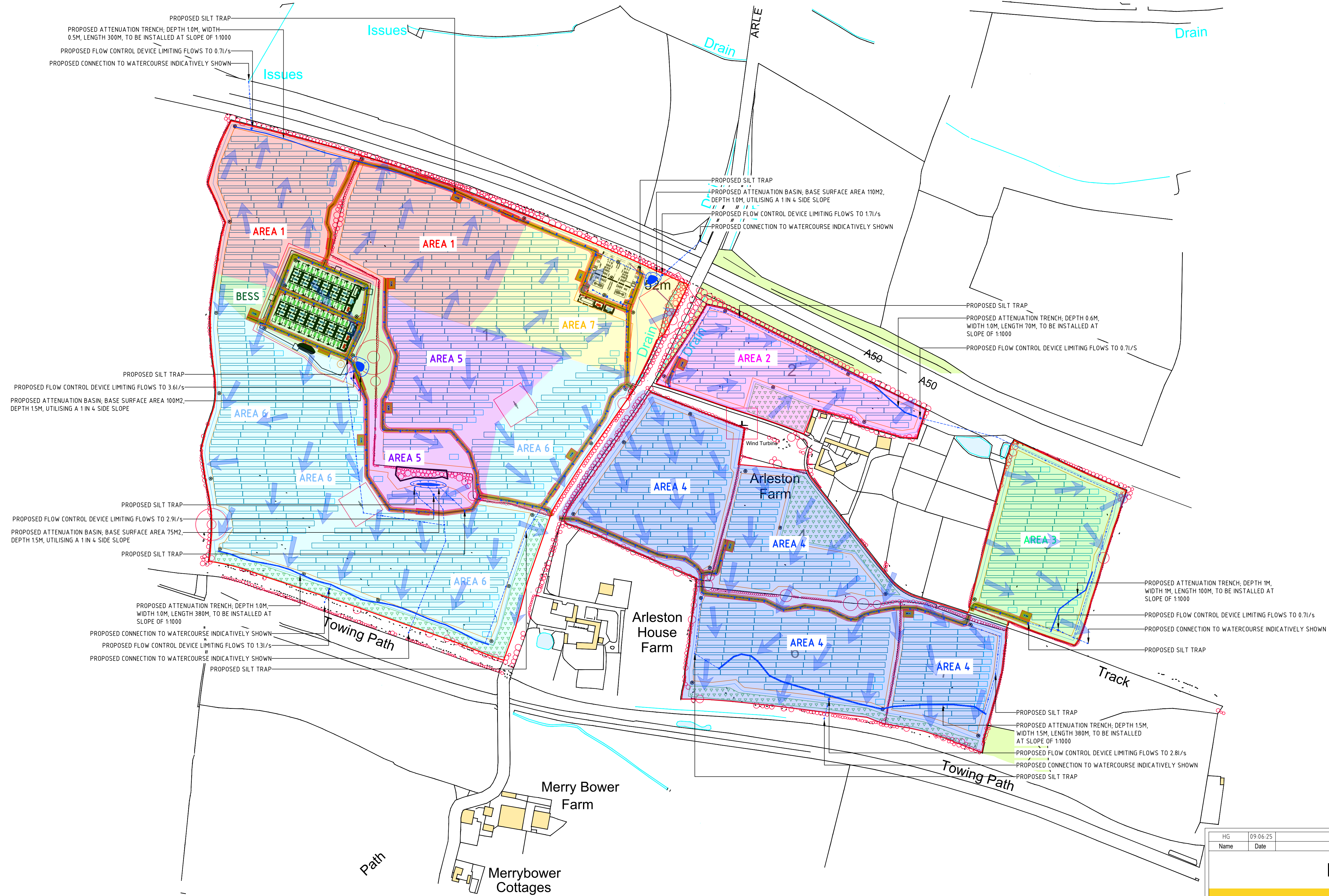
SUDS DESIGN & (ATTENUATION

NOTES

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2. THIS DRAWING IS ONLY TO BE USED FOR THE PURPOSES DESCRIBED IN THE STATUS BOX BELOW. WORK TO FIGURED DIMENSIONS ONLY, DO NOT SCALE.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS, DETAILS AND SPECIFICATIONS PERTAINING TO THE WORK DESCRIBED.
4. MATERIALS AND WORKMANSHIP SHALL COMPLY TO THE APPROPRIATE BRITISH STANDARDS AND CODES OF PRACTICE UNLESS OTHERWISE STATED.
5. THE ACTIVITIES REQUIRED TO CONSTRUCT THE WORK, SHOWN ON DRAWINGS CLEARLY MARKED FOR CONSTRUCTION, MAY BE SUBJECT TO THE PROVISIONS OF THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2015 THE CONTRACTOR AND CLIENT MUST ENSURE THAT THEY ARE ADEQUATELY CONVERSANT WITH THESE REGULATIONS AND THAT THE APPROPRIATE PROCEDURES REQUIRED UNDER THE REGULATIONS ARE OBSERVED AT ALL TIMES.

KEY

- PROPOSED SITE BOUNDARY
- PROPOSED SURFACE WATER (ATTENUATION OPTION)
- PROPOSED GULLY
- OVERLAND FLOW ARROW
- PROPOSED PRIVATE SURFACE WATER POLYPROPYLENE INSPECTION CHAMBER (P.P.I.C Ø450/475mm)
- PROPOSED FLOW CONTROL DEVICE
- PROPOSED ATTENUATION BASIN
- PROPOSED ATTENUATION TRENCH



HG	09.06.25	AMENDED RED LINE BOUNDARY	P04
Name	Date	Remarks	Revision

INFORMATION



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#missionwater

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NSI Office	WEST	Drawn by	HG	Date	09.06.25	Status	S2		
Title								CONCEPTUAL SURFACE WATER DRAINAGE - ATTENUATION	
Project								ARLESTON SOLAR & BESS	
Project No				J-15585	Quotation No				
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Nanjerrick Court Allet Truro, TR4 9DJ		
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ICP SUDS Mean Annual Flood Input Return Period (years) 100 Soil 0.400 Area (ha) 0.056 Urban 0.000 SAAR (mm) 700 Region Number Region 4 Results 1/s QBAR Rural 0.2 QBAR Urban 0.2 Q100 years 0.5 Q1 year 0.2 Q30 years 0.4 Q100 years 0.5		
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Summary of Results for 100 year Return Period (+50%)

Half Drain Time : 454 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	99.459	0.459	0.0	0.5	0.5	13.9	O K
30 min Summer	99.552	0.552	0.0	0.5	0.5	18.1	O K
60 min Summer	99.640	0.640	0.0	0.6	0.6	22.0	O K
120 min Summer	99.712	0.712	0.0	0.6	0.6	25.3	Flood Risk
180 min Summer	99.738	0.738	0.0	0.6	0.6	26.4	Flood Risk
240 min Summer	99.744	0.744	0.0	0.6	0.6	26.7	Flood Risk
360 min Summer	99.730	0.730	0.0	0.6	0.6	26.1	Flood Risk
480 min Summer	99.711	0.711	0.0	0.6	0.6	25.3	Flood Risk
600 min Summer	99.694	0.694	0.0	0.6	0.6	24.5	O K
720 min Summer	99.678	0.678	0.0	0.6	0.6	23.8	O K
960 min Summer	99.650	0.650	0.0	0.6	0.6	22.5	O K
1440 min Summer	99.599	0.599	0.0	0.6	0.6	20.2	O K
2160 min Summer	99.529	0.529	0.0	0.5	0.5	17.1	O K
2880 min Summer	99.465	0.465	0.0	0.5	0.5	14.2	O K
4320 min Summer	99.349	0.349	0.0	0.5	0.5	8.9	O K
5760 min Summer	99.237	0.237	0.0	0.5	0.5	4.2	O K
7200 min Summer	99.157	0.157	0.0	0.5	0.5	1.9	O K
8640 min Summer	99.104	0.104	0.0	0.5	0.5	0.8	O K
10080 min Summer	99.071	0.071	0.0	0.5	0.5	0.4	O K
15 min Winter	99.498	0.498	0.0	0.5	0.5	15.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.925	0.0	14.7	30
30 min Summer	91.956	0.0	19.3	44
60 min Summer	57.620	0.0	24.2	72
120 min Summer	34.923	0.0	29.3	128
180 min Summer	25.727	0.0	32.4	186
240 min Summer	20.597	0.0	34.6	244
360 min Summer	14.951	0.0	37.7	348
480 min Summer	11.919	0.0	40.0	402
600 min Summer	9.991	0.0	42.0	466
720 min Summer	8.645	0.0	43.6	530
960 min Summer	6.876	0.0	46.2	666
1440 min Summer	4.972	0.0	50.1	942
2160 min Summer	3.589	0.0	54.3	1352
2880 min Summer	2.845	0.0	57.4	1756
4320 min Summer	2.048	0.0	61.9	2552
5760 min Summer	1.621	0.0	65.3	3168
7200 min Summer	1.351	0.0	68.1	3760
8640 min Summer	1.163	0.0	70.4	4416
10080 min Summer	1.025	0.0	72.3	5136
15 min Winter	139.925	0.0	16.5	30

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Summary of Results for 100 year Return Period (+50%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	99.603	0.603	0.0	0.6	0.6	20.4	O K
60 min Winter	99.704	0.704	0.0	0.6	0.6	24.9	Flood Risk
120 min Winter	99.791	0.791	0.0	0.6	0.6	28.8	Flood Risk
180 min Winter	99.826	0.826	0.0	0.6	0.6	30.4	Flood Risk
240 min Winter	99.838	0.838	0.0	0.6	0.6	31.0	Flood Risk
360 min Winter	99.832	0.832	0.0	0.6	0.6	30.7	Flood Risk
480 min Winter	99.812	0.812	0.0	0.6	0.6	29.8	Flood Risk
600 min Winter	99.790	0.790	0.0	0.6	0.6	28.8	Flood Risk
720 min Winter	99.769	0.769	0.0	0.6	0.6	27.9	Flood Risk
960 min Winter	99.730	0.730	0.0	0.6	0.6	26.1	Flood Risk
1440 min Winter	99.656	0.656	0.0	0.6	0.6	22.8	O K
2160 min Winter	99.551	0.551	0.0	0.5	0.5	18.1	O K
2880 min Winter	99.457	0.457	0.0	0.5	0.5	13.8	O K
4320 min Winter	99.259	0.259	0.0	0.5	0.5	5.0	O K
5760 min Winter	99.116	0.116	0.0	0.5	0.5	1.0	O K
7200 min Winter	99.062	0.062	0.0	0.4	0.4	0.3	O K
8640 min Winter	99.051	0.051	0.0	0.4	0.4	0.2	O K
10080 min Winter	99.044	0.044	0.0	0.3	0.3	0.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	91.956	0.0	21.6	43			
60 min Winter	57.620	0.0	27.1	72			
120 min Winter	34.923	0.0	32.9	128			
180 min Winter	25.727	0.0	36.3	184			
240 min Winter	20.597	0.0	38.8	240			
360 min Winter	14.951	0.0	42.2	350			
480 min Winter	11.919	0.0	44.9	452			
600 min Winter	9.991	0.0	47.0	488			
720 min Winter	8.645	0.0	48.8	562			
960 min Winter	6.876	0.0	51.7	718			
1440 min Winter	4.972	0.0	56.1	1022			
2160 min Winter	3.589	0.0	60.8	1456			
2880 min Winter	2.845	0.0	64.2	1880			
4320 min Winter	2.048	0.0	69.4	2560			
5760 min Winter	1.621	0.0	73.2	3056			
7200 min Winter	1.351	0.0	76.2	3680			
8640 min Winter	1.163	0.0	78.8	4408			
10080 min Winter	1.025	0.0	81.0	4984			
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Nanjerrick Court Allet Truro, TR4 9DJ																																																											
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Rainfall Details <table><tr><td>Rainfall Model</td><td>FSR</td><td>Winter Storms</td><td>Yes</td></tr><tr><td>Return Period (years)</td><td>100</td><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>19.000</td><td>Shortest Storm (mins)</td><td>15</td></tr><tr><td>Ratio R</td><td>0.400</td><td>Longest Storm (mins)</td><td>10080</td></tr><tr><td>Summer Storms</td><td>Yes</td><td>Climate Change %</td><td>+50</td></tr></table> Time Area Diagram Total Area (ha) 0.056 <table><tr><th>Time (mins)</th><th>Area</th><th>Time (mins)</th><th>Area</th><th>Time (mins)</th><th>Area</th><th>Time (mins)</th><th>Area</th></tr><tr><th>From:</th><th>To:</th><th>From:</th><th>To:</th><th>From:</th><th>To:</th><th>From:</th><th>To:</th></tr><tr><th></th><th>(ha)</th><th></th><th>(ha)</th><th></th><th>(ha)</th><th></th><th>(ha)</th></tr><tr><td>0</td><td>4 0.014</td><td>4</td><td>8 0.014</td><td>8</td><td>12 0.014</td><td>12</td><td>16 0.014</td></tr></table>				Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.000	Shortest Storm (mins)	15	Ratio R	0.400	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+50	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From:	To:	From:	To:	From:	To:	From:	To:		(ha)		(ha)		(ha)		(ha)	0	4 0.014	4	8 0.014	8	12 0.014	12	16 0.014
Rainfall Model	FSR	Winter Storms	Yes																																																								
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Model Details

Storage is Online Cover Level (m) 100.000

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	0.5
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	300.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	99.000	Cap Infiltration Depth (m)	0.000

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0039-7000-1000-7000
Design Head (m)	1.000
Design Flow (l/s)	0.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	39
Invert Level (m)	99.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.7
Flush-Flo™	0.172	0.5
Kick-Flo®	0.345	0.4
Mean Flow over Head Range	-	0.5

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	0.5	1.200	0.8	3.000	1.1	7.000	1.7
0.200	0.5	1.400	0.8	3.500	1.2	7.500	1.7
0.300	0.5	1.600	0.9	4.000	1.3	8.000	1.8
0.400	0.5	1.800	0.9	4.500	1.4	8.500	1.8
0.500	0.5	2.000	1.0	5.000	1.4	9.000	1.9
0.600	0.6	2.200	1.0	5.500	1.5	9.500	1.9
0.800	0.6	2.400	1.0	6.000	1.6		
1.000	0.7	2.600	1.1	6.500	1.6		

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ICP SUDS Mean Annual Flood Input Return Period (years) 100 Soil 0.400 Area (ha) 0.030 Urban 0.000 SAAR (mm) 700 Region Number Region 4 Results 1/s QBAR Rural 0.1 QBAR Urban 0.1 Q100 years 0.3 Q1 year 0.1 Q30 years 0.2 Q100 years 0.3		
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Micro
Drainage

Innovyze

Source Control 2020.1

Summary of Results for 100 year Return Period (+50%)

Half Drain Time : 185 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	99.669	0.369	0.0	0.6	0.6	7.0	O K
30 min Summer	99.768	0.468	0.0	0.6	0.6	9.1	Flood Risk
60 min Summer	99.847	0.547	0.0	0.6	0.6	10.8	Flood Risk
120 min Summer	99.886	0.586	0.0	0.6	0.6	11.6	Flood Risk
180 min Summer	99.878	0.578	0.0	0.6	0.6	11.4	Flood Risk
240 min Summer	99.862	0.562	0.0	0.6	0.6	11.1	Flood Risk
360 min Summer	99.827	0.527	0.0	0.6	0.6	10.3	Flood Risk
480 min Summer	99.797	0.497	0.0	0.6	0.6	9.7	Flood Risk
600 min Summer	99.767	0.467	0.0	0.6	0.6	9.1	Flood Risk
720 min Summer	99.737	0.437	0.0	0.6	0.6	8.4	Flood Risk
960 min Summer	99.676	0.376	0.0	0.6	0.6	7.2	O K
1440 min Summer	99.557	0.257	0.0	0.6	0.6	4.7	O K
2160 min Summer	99.450	0.150	0.0	0.6	0.6	2.4	O K
2880 min Summer	99.396	0.096	0.0	0.6	0.6	1.3	O K
4320 min Summer	99.359	0.059	0.0	0.5	0.5	0.5	O K
5760 min Summer	99.345	0.045	0.0	0.4	0.4	0.3	O K
7200 min Summer	99.338	0.038	0.0	0.3	0.3	0.2	O K
8640 min Summer	99.334	0.034	0.0	0.3	0.3	0.2	O K
10080 min Summer	99.331	0.031	0.0	0.3	0.3	0.1	O K
15 min Winter	99.714	0.414	0.0	0.6	0.6	8.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.925	0.0	7.9	28
30 min Summer	91.956	0.0	10.3	41
60 min Summer	57.620	0.0	13.0	68
120 min Summer	34.923	0.0	15.7	122
180 min Summer	25.727	0.0	17.4	162
240 min Summer	20.597	0.0	18.5	194
360 min Summer	14.951	0.0	20.2	260
480 min Summer	11.919	0.0	21.5	330
600 min Summer	9.991	0.0	22.5	398
720 min Summer	8.645	0.0	23.3	468
960 min Summer	6.876	0.0	24.8	606
1440 min Summer	4.972	0.0	26.8	840
2160 min Summer	3.589	0.0	29.1	1176
2880 min Summer	2.845	0.0	30.7	1508
4320 min Summer	2.048	0.0	33.2	2204
5760 min Summer	1.621	0.0	35.0	2936
7200 min Summer	1.351	0.0	36.5	3600
8640 min Summer	1.163	0.0	37.7	4336
10080 min Summer	1.025	0.0	38.8	5136
15 min Winter	139.925	0.0	8.8	28

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+50

Time Area Diagram

Total Area (ha) 0.030

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.008	4 8	0.008	8 12	0.008	12 16	0.006

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Model Details

Storage is Online Cover Level (m) 100.000

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	70.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	99.300	Cap Infiltration Depth (m)	0.000

Hydro-Brake® Optimum Outflow Control

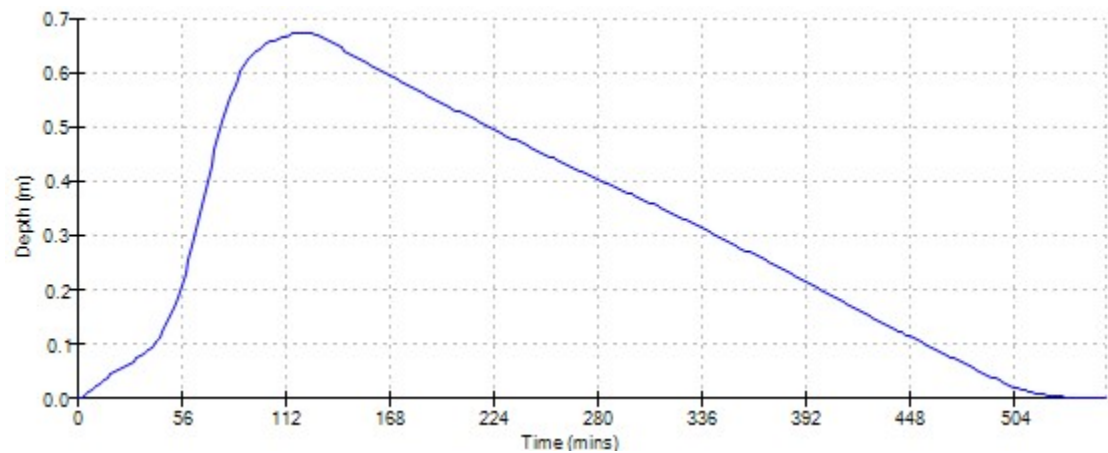
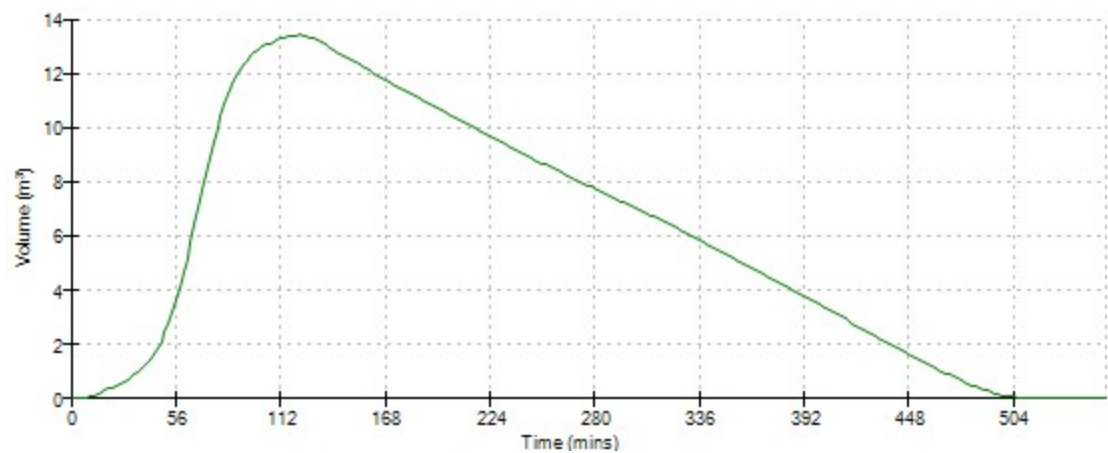
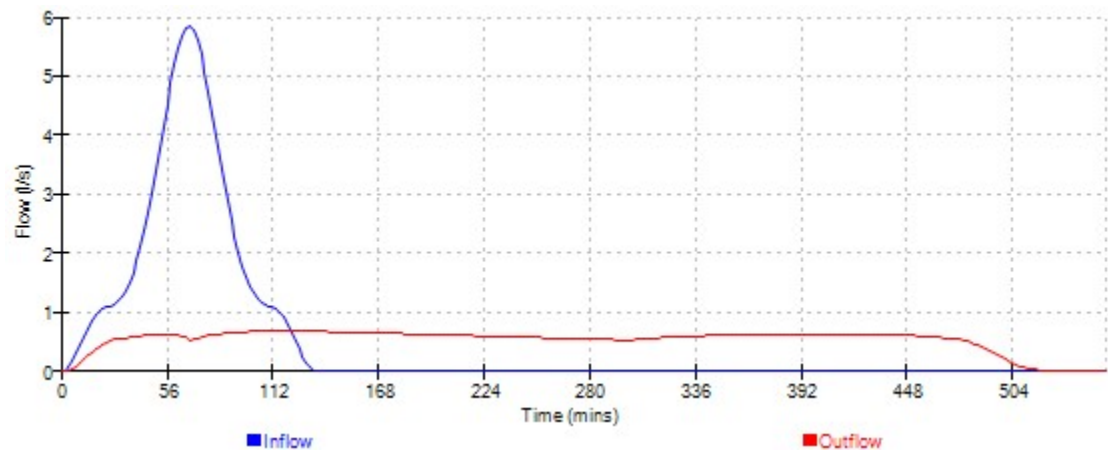
Unit Reference	MD-SHE-0042-7000-0700-7000
Design Head (m)	0.700
Design Flow (l/s)	0.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	99.300
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	0.7
Flush-Flo™	0.185	0.6
Kick-Flo®	0.373	0.5
Mean Flow over Head Range	-	0.6

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	0.6	1.200	0.9	3.000	1.3	7.000	2.0
0.200	0.6	1.400	0.9	3.500	1.4	7.500	2.0
0.300	0.6	1.600	1.0	4.000	1.5	8.000	2.1
0.400	0.5	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.2
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.7	2.400	1.2	6.000	1.8		
1.000	0.8	2.600	1.3	6.500	1.9		

Event: 120 min Winter



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ICP SUDS Mean Annual Flood Input Return Period (years) 100 Soil 0.400 Area (ha) 0.043 Urban 0.000 SAAR (mm) 700 Region Number Region 4 Results 1/s QBAR Rural 0.1 QBAR Urban 0.1 Q100 years 0.4 Q1 year 0.1 Q30 years 0.3 Q100 years 0.4		
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Date 28/02/2025 14:57 File ATTENUATION TRENCH A3.SRCX			Designed by QD9548 Checked by																																																																																																																																																																																																																																																																																					
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Summary of Results for 100 year Return Period (+50%) Half Drain Time : 336 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max Σ Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>99.401</td><td>0.401</td><td>0.0</td><td>0.5</td><td>0.5</td><td>10.5</td><td>O K</td></tr><tr><td>30 min Summer</td><td>99.506</td><td>0.506</td><td>0.0</td><td>0.5</td><td>0.5</td><td>13.7</td><td>O K</td></tr><tr><td>60 min Summer</td><td>99.602</td><td>0.602</td><td>0.0</td><td>0.6</td><td>0.6</td><td>16.6</td><td>O K</td></tr><tr><td>120 min Summer</td><td>99.673</td><td>0.673</td><td>0.0</td><td>0.6</td><td>0.6</td><td>18.7</td><td>O K</td></tr><tr><td>180 min Summer</td><td>99.692</td><td>0.692</td><td>0.0</td><td>0.6</td><td>0.6</td><td>19.3</td><td>O K</td></tr><tr><td>240 min Summer</td><td>99.689</td><td>0.689</td><td>0.0</td><td>0.6</td><td>0.6</td><td>19.2</td><td>O K</td></tr><tr><td>360 min Summer</td><td>99.663</td><td>0.663</td><td>0.0</td><td>0.6</td><td>0.6</td><td>18.4</td><td>O K</td></tr><tr><td>480 min Summer</td><td>99.640</td><td>0.640</td><td>0.0</td><td>0.6</td><td>0.6</td><td>17.7</td><td>O K</td></tr><tr><td>600 min Summer</td><td>99.619</td><td>0.619</td><td>0.0</td><td>0.6</td><td>0.6</td><td>17.1</td><td>O K</td></tr><tr><td>720 min Summer</td><td>99.599</td><td>0.599</td><td>0.0</td><td>0.6</td><td>0.6</td><td>16.5</td><td>O K</td></tr><tr><td>960 min Summer</td><td>99.562</td><td>0.562</td><td>0.0</td><td>0.5</td><td>0.5</td><td>15.4</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>99.493</td><td>0.493</td><td>0.0</td><td>0.5</td><td>0.5</td><td>13.3</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>99.397</td><td>0.397</td><td>0.0</td><td>0.5</td><td>0.5</td><td>10.4</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>99.291</td><td>0.291</td><td>0.0</td><td>0.5</td><td>0.5</td><td>7.2</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>99.159</td><td>0.159</td><td>0.0</td><td>0.5</td><td>0.5</td><td>3.3</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>99.098</td><td>0.098</td><td>0.0</td><td>0.5</td><td>0.5</td><td>1.4</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>99.068</td><td>0.068</td><td>0.0</td><td>0.5</td><td>0.5</td><td>0.7</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>99.055</td><td>0.055</td><td>0.0</td><td>0.4</td><td>0.4</td><td>0.5</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>99.047</td><td>0.047</td><td>0.0</td><td>0.4</td><td>0.4</td><td>0.3</td><td>O K</td></tr><tr><td>15 min Winter</td><td>99.446</td><td>0.446</td><td>0.0</td><td>0.5</td><td>0.5</td><td>11.9</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>139.925</td><td>0.0</td><td>11.3</td><td>29</td></tr><tr><td>30 min Summer</td><td>91.956</td><td>0.0</td><td>14.8</td><td>43</td></tr><tr><td>60 min Summer</td><td>57.620</td><td>0.0</td><td>18.6</td><td>70</td></tr><tr><td>120 min Summer</td><td>34.923</td><td>0.0</td><td>22.5</td><td>126</td></tr><tr><td>180 min Summer</td><td>25.727</td><td>0.0</td><td>24.9</td><td>184</td></tr><tr><td>240 min Summer</td><td>20.597</td><td>0.0</td><td>26.6</td><td>240</td></tr><tr><td>360 min Summer</td><td>14.951</td><td>0.0</td><td>28.9</td><td>302</td></tr><tr><td>480 min Summer</td><td>11.919</td><td>0.0</td><td>30.8</td><td>366</td></tr><tr><td>600 min Summer</td><td>9.991</td><td>0.0</td><td>32.2</td><td>432</td></tr><tr><td>720 min Summer</td><td>8.645</td><td>0.0</td><td>33.5</td><td>502</td></tr><tr><td>960 min Summer</td><td>6.876</td><td>0.0</td><td>35.5</td><td>640</td></tr><tr><td>1440 min Summer</td><td>4.972</td><td>0.0</td><td>38.5</td><td>916</td></tr><tr><td>2160 min Summer</td><td>3.589</td><td>0.0</td><td>41.7</td><td>1324</td></tr><tr><td>2880 min Summer</td><td>2.845</td><td>0.0</td><td>44.0</td><td>1680</td></tr><tr><td>4320 min Summer</td><td>2.048</td><td>0.0</td><td>47.6</td><td>2340</td></tr><tr><td>5760 min Summer</td><td>1.621</td><td>0.0</td><td>50.2</td><td>3000</td></tr><tr><td>7200 min Summer</td><td>1.351</td><td>0.0</td><td>52.3</td><td>3680</td></tr><tr><td>8640 min Summer</td><td>1.163</td><td>0.0</td><td>54.0</td><td>4408</td></tr><tr><td>10080 min Summer</td><td>1.025</td><td>0.0</td><td>55.6</td><td>5056</td></tr><tr><td>15 min Winter</td><td>139.925</td><td>0.0</td><td>12.6</td><td>29</td></tr></table>								Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	99.401	0.401	0.0	0.5	0.5	10.5	O K	30 min Summer	99.506	0.506	0.0	0.5	0.5	13.7	O K	60 min Summer	99.602	0.602	0.0	0.6	0.6	16.6	O K	120 min Summer	99.673	0.673	0.0	0.6	0.6	18.7	O K	180 min Summer	99.692	0.692	0.0	0.6	0.6	19.3	O K	240 min Summer	99.689	0.689	0.0	0.6	0.6	19.2	O K	360 min Summer	99.663	0.663	0.0	0.6	0.6	18.4	O K	480 min Summer	99.640	0.640	0.0	0.6	0.6	17.7	O K	600 min Summer	99.619	0.619	0.0	0.6	0.6	17.1	O K	720 min Summer	99.599	0.599	0.0	0.6	0.6	16.5	O K	960 min Summer	99.562	0.562	0.0	0.5	0.5	15.4	O K	1440 min Summer	99.493	0.493	0.0	0.5	0.5	13.3	O K	2160 min Summer	99.397	0.397	0.0	0.5	0.5	10.4	O K	2880 min Summer	99.291	0.291	0.0	0.5	0.5	7.2	O K	4320 min Summer	99.159	0.159	0.0	0.5	0.5	3.3	O K	5760 min Summer	99.098	0.098	0.0	0.5	0.5	1.4	O K	7200 min Summer	99.068	0.068	0.0	0.5	0.5	0.7	O K	8640 min Summer	99.055	0.055	0.0	0.4	0.4	0.5	O K	10080 min Summer	99.047	0.047	0.0	0.4	0.4	0.3	O K	15 min Winter	99.446	0.446	0.0	0.5	0.5	11.9	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	139.925	0.0	11.3	29	30 min Summer	91.956	0.0	14.8	43	60 min Summer	57.620	0.0	18.6	70	120 min Summer	34.923	0.0	22.5	126	180 min Summer	25.727	0.0	24.9	184	240 min Summer	20.597	0.0	26.6	240	360 min Summer	14.951	0.0	28.9	302	480 min Summer	11.919	0.0	30.8	366	600 min Summer	9.991	0.0	32.2	432	720 min Summer	8.645	0.0	33.5	502	960 min Summer	6.876	0.0	35.5	640	1440 min Summer	4.972	0.0	38.5	916	2160 min Summer	3.589	0.0	41.7	1324	2880 min Summer	2.845	0.0	44.0	1680	4320 min Summer	2.048	0.0	47.6	2340	5760 min Summer	1.621	0.0	50.2	3000	7200 min Summer	1.351	0.0	52.3	3680	8640 min Summer	1.163	0.0	54.0	4408	10080 min Summer	1.025	0.0	55.6	5056	15 min Winter	139.925	0.0	12.6	29
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																																																																																	
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Innovyze			Source Control 2020.1				
Summary of Results for 100 year Return Period (+50%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	99.565	0.565	0.0	0.5	0.5	15.4	O K
60 min Winter	99.676	0.676	0.0	0.6	0.6	18.8	O K
120 min Winter	99.763	0.763	0.0	0.6	0.6	21.4	Flood Risk
180 min Winter	99.792	0.792	0.0	0.6	0.6	22.2	Flood Risk
240 min Winter	99.795	0.795	0.0	0.6	0.6	22.3	Flood Risk
360 min Winter	99.769	0.769	0.0	0.6	0.6	21.6	Flood Risk
480 min Winter	99.740	0.740	0.0	0.6	0.6	20.7	Flood Risk
600 min Winter	99.712	0.712	0.0	0.6	0.6	19.9	Flood Risk
720 min Winter	99.684	0.684	0.0	0.6	0.6	19.0	O K
960 min Winter	99.630	0.630	0.0	0.6	0.6	17.4	O K
1440 min Winter	99.527	0.527	0.0	0.5	0.5	14.3	O K
2160 min Winter	99.380	0.380	0.0	0.5	0.5	9.9	O K
2880 min Winter	99.223	0.223	0.0	0.5	0.5	5.2	O K
4320 min Winter	99.089	0.089	0.0	0.5	0.5	1.2	O K
5760 min Winter	99.055	0.055	0.0	0.4	0.4	0.5	O K
7200 min Winter	99.045	0.045	0.0	0.3	0.3	0.3	O K
8640 min Winter	99.038	0.038	0.0	0.3	0.3	0.2	O K
10080 min Winter	99.034	0.034	0.0	0.3	0.3	0.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	91.956	0.0	16.6	43			
60 min Winter	57.620	0.0	20.8	70			
120 min Winter	34.923	0.0	25.2	126			
180 min Winter	25.727	0.0	27.9	182			
240 min Winter	20.597	0.0	29.8	236			
360 min Winter	14.951	0.0	32.4	340			
480 min Winter	11.919	0.0	34.4	384			
600 min Winter	9.991	0.0	36.1	462			
720 min Winter	8.645	0.0	37.5	540			
960 min Winter	6.876	0.0	39.7	692			
1440 min Winter	4.972	0.0	43.1	990			
2160 min Winter	3.589	0.0	46.7	1428			
2880 min Winter	2.845	0.0	49.3	1736			
4320 min Winter	2.048	0.0	53.3	2304			
5760 min Winter	1.621	0.0	56.2	2944			
7200 min Winter	1.351	0.0	58.5	3664			
8640 min Winter	1.163	0.0	60.5	4288			
10080 min Winter	1.025	0.0	62.2	5136			
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Innovyze		Source Control 2020.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+50

Time Area Diagram

Total Area (ha) 0.043

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.011	4 8	0.011	8 12	0.011	12 16	0.010

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Model Details

Storage is Online Cover Level (m) 100.000

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	100.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	99.000	Cap Infiltration Depth (m)	0.000

Hydro-Brake® Optimum Outflow Control

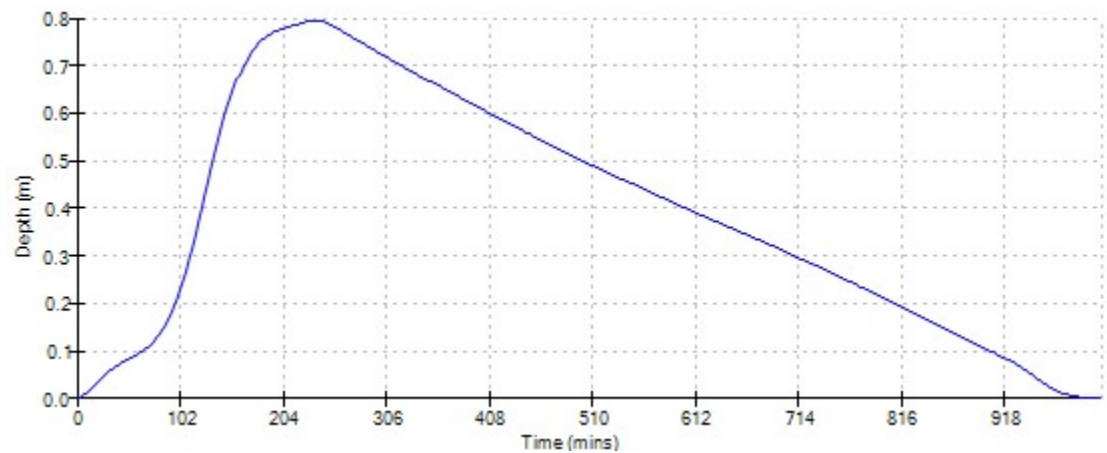
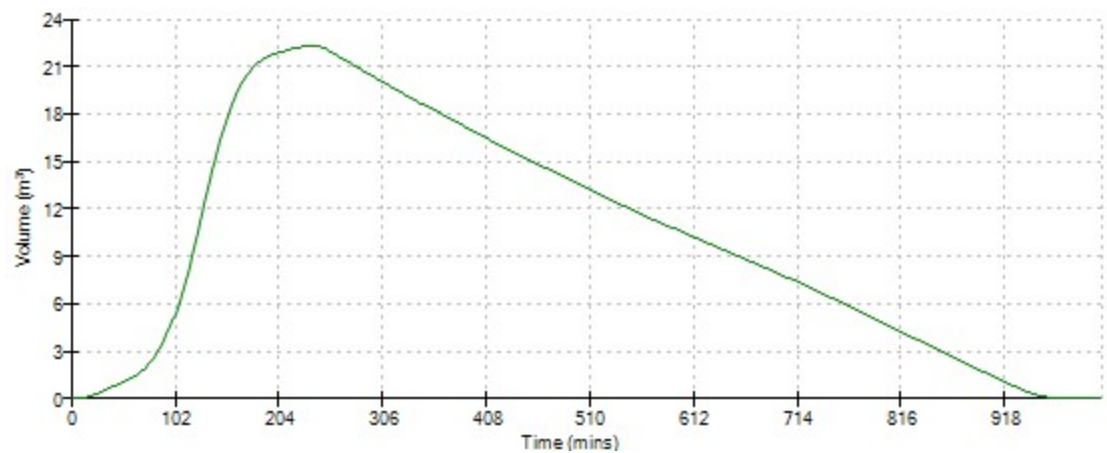
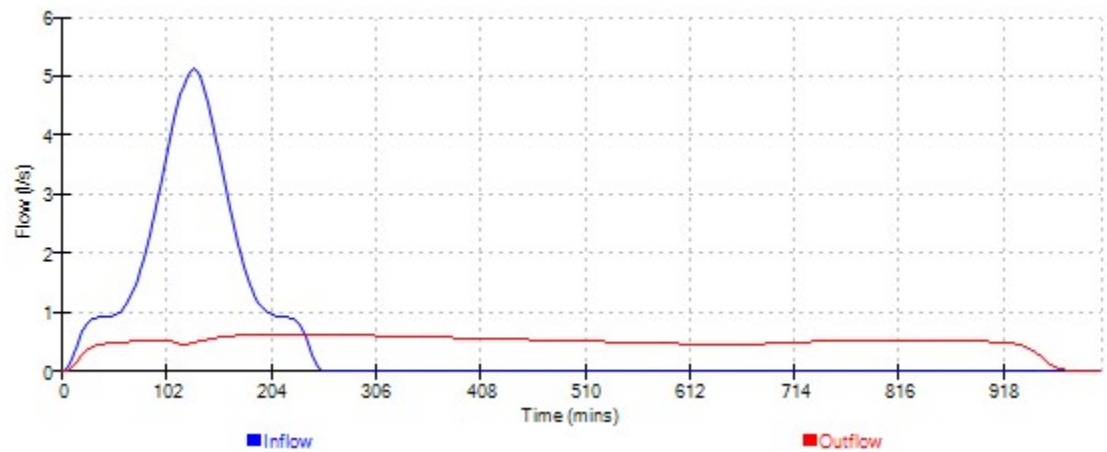
Unit Reference	MD-SHE-0039-7000-1000-7000
Design Head (m)	1.000
Design Flow (l/s)	0.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	39
Invert Level (m)	99.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.7
Flush-Flo™	0.172	0.5
Kick-Flo®	0.345	0.4
Mean Flow over Head Range	-	0.5

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	0.5	1.200	0.8	3.000	1.1	7.000	1.7
0.200	0.5	1.400	0.8	3.500	1.2	7.500	1.7
0.300	0.5	1.600	0.9	4.000	1.3	8.000	1.8
0.400	0.5	1.800	0.9	4.500	1.4	8.500	1.8
0.500	0.5	2.000	1.0	5.000	1.4	9.000	1.9
0.600	0.6	2.200	1.0	5.500	1.5	9.500	1.9
0.800	0.6	2.400	1.0	6.000	1.6		
1.000	0.7	2.600	1.1	6.500	1.6		

Event: 240 min Winter



Nijhuis Industries UK & Ireland		Page 1
Nanjerrick Court Allet Truro, TR4 9DJ		
Date 28/02/2025 14:37 File	Designed by QD9548 Checked by	
Innovyze		
Source Control 2020.1		
ICP SUDS Mean Annual Flood Input Return Period (years) 100 Soil 0.400 Area (ha) 0.316 Urban 0.000 SAAR (mm) 700 Region Number Region 4 Results 1/s QBAR Rural 1.1 QBAR Urban 1.1 Q100 years 2.8 Q1 year 0.9 Q30 years 2.1 Q100 years 2.8		
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Nijhuis Industries UK & Ireland							Page 1																																																																																																																																																																																																																																																																																	
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Innovyze			Source Control 2020.1																																																																																																																																																																																																																																																																																					
Summary of Results for 100 year Return Period (+50%) Half Drain Time : 688 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max Σ Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>99.155</td><td>0.655</td><td>0.0</td><td>2.4</td><td>2.4</td><td>79.4</td><td>O K</td></tr><tr><td>30 min Summer</td><td>99.297</td><td>0.797</td><td>0.0</td><td>2.4</td><td>2.4</td><td>103.8</td><td>O K</td></tr><tr><td>60 min Summer</td><td>99.436</td><td>0.936</td><td>0.0</td><td>2.4</td><td>2.4</td><td>127.5</td><td>O K</td></tr><tr><td>120 min Summer</td><td>99.559</td><td>1.059</td><td>0.0</td><td>2.4</td><td>2.4</td><td>148.5</td><td>O K</td></tr><tr><td>180 min Summer</td><td>99.613</td><td>1.113</td><td>0.0</td><td>2.4</td><td>2.4</td><td>157.8</td><td>O K</td></tr><tr><td>240 min Summer</td><td>99.638</td><td>1.138</td><td>0.0</td><td>2.5</td><td>2.5</td><td>162.1</td><td>O K</td></tr><tr><td>360 min Summer</td><td>99.646</td><td>1.146</td><td>0.0</td><td>2.5</td><td>2.5</td><td>163.5</td><td>O K</td></tr><tr><td>480 min Summer</td><td>99.633</td><td>1.133</td><td>0.0</td><td>2.5</td><td>2.5</td><td>161.2</td><td>O K</td></tr><tr><td>600 min Summer</td><td>99.610</td><td>1.110</td><td>0.0</td><td>2.4</td><td>2.4</td><td>157.3</td><td>O K</td></tr><tr><td>720 min Summer</td><td>99.588</td><td>1.088</td><td>0.0</td><td>2.4</td><td>2.4</td><td>153.5</td><td>O K</td></tr><tr><td>960 min Summer</td><td>99.548</td><td>1.048</td><td>0.0</td><td>2.4</td><td>2.4</td><td>146.8</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>99.483</td><td>0.983</td><td>0.0</td><td>2.4</td><td>2.4</td><td>135.6</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>99.395</td><td>0.895</td><td>0.0</td><td>2.4</td><td>2.4</td><td>120.5</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>99.312</td><td>0.812</td><td>0.0</td><td>2.4</td><td>2.4</td><td>106.4</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>99.145</td><td>0.645</td><td>0.0</td><td>2.4</td><td>2.4</td><td>77.8</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>98.980</td><td>0.480</td><td>0.0</td><td>2.4</td><td>2.4</td><td>49.6</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>98.871</td><td>0.371</td><td>0.0</td><td>2.4</td><td>2.4</td><td>31.0</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>98.787</td><td>0.287</td><td>0.0</td><td>2.4</td><td>2.4</td><td>18.6</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>98.720</td><td>0.220</td><td>0.0</td><td>2.3</td><td>2.3</td><td>10.9</td><td>O K</td></tr><tr><td>15 min Winter</td><td>99.213</td><td>0.713</td><td>0.0</td><td>2.4</td><td>2.4</td><td>89.4</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>139.925</td><td>0.0</td><td>82.9</td><td>30</td></tr><tr><td>30 min Summer</td><td>91.956</td><td>0.0</td><td>109.0</td><td>44</td></tr><tr><td>60 min Summer</td><td>57.620</td><td>0.0</td><td>136.6</td><td>74</td></tr><tr><td>120 min Summer</td><td>34.923</td><td>0.0</td><td>165.5</td><td>130</td></tr><tr><td>180 min Summer</td><td>25.727</td><td>0.0</td><td>182.9</td><td>190</td></tr><tr><td>240 min Summer</td><td>20.597</td><td>0.0</td><td>195.3</td><td>248</td></tr><tr><td>360 min Summer</td><td>14.951</td><td>0.0</td><td>212.6</td><td>364</td></tr><tr><td>480 min Summer</td><td>11.919</td><td>0.0</td><td>226.0</td><td>480</td></tr><tr><td>600 min Summer</td><td>9.991</td><td>0.0</td><td>236.8</td><td>548</td></tr><tr><td>720 min Summer</td><td>8.645</td><td>0.0</td><td>245.9</td><td>606</td></tr><tr><td>960 min Summer</td><td>6.876</td><td>0.0</td><td>260.7</td><td>732</td></tr><tr><td>1440 min Summer</td><td>4.972</td><td>0.0</td><td>282.8</td><td>1000</td></tr><tr><td>2160 min Summer</td><td>3.589</td><td>0.0</td><td>306.2</td><td>1416</td></tr><tr><td>2880 min Summer</td><td>2.845</td><td>0.0</td><td>323.7</td><td>1828</td></tr><tr><td>4320 min Summer</td><td>2.048</td><td>0.0</td><td>349.5</td><td>2644</td></tr><tr><td>5760 min Summer</td><td>1.621</td><td>0.0</td><td>368.7</td><td>3296</td></tr><tr><td>7200 min Summer</td><td>1.351</td><td>0.0</td><td>384.1</td><td>3968</td></tr><tr><td>8640 min Summer</td><td>1.163</td><td>0.0</td><td>397.1</td><td>4592</td></tr><tr><td>10080 min Summer</td><td>1.025</td><td>0.0</td><td>408.3</td><td>5248</td></tr><tr><td>15 min Winter</td><td>139.925</td><td>0.0</td><td>92.9</td><td>30</td></tr></table>								Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	99.155	0.655	0.0	2.4	2.4	79.4	O K	30 min Summer	99.297	0.797	0.0	2.4	2.4	103.8	O K	60 min Summer	99.436	0.936	0.0	2.4	2.4	127.5	O K	120 min Summer	99.559	1.059	0.0	2.4	2.4	148.5	O K	180 min Summer	99.613	1.113	0.0	2.4	2.4	157.8	O K	240 min Summer	99.638	1.138	0.0	2.5	2.5	162.1	O K	360 min Summer	99.646	1.146	0.0	2.5	2.5	163.5	O K	480 min Summer	99.633	1.133	0.0	2.5	2.5	161.2	O K	600 min Summer	99.610	1.110	0.0	2.4	2.4	157.3	O K	720 min Summer	99.588	1.088	0.0	2.4	2.4	153.5	O K	960 min Summer	99.548	1.048	0.0	2.4	2.4	146.8	O K	1440 min Summer	99.483	0.983	0.0	2.4	2.4	135.6	O K	2160 min Summer	99.395	0.895	0.0	2.4	2.4	120.5	O K	2880 min Summer	99.312	0.812	0.0	2.4	2.4	106.4	O K	4320 min Summer	99.145	0.645	0.0	2.4	2.4	77.8	O K	5760 min Summer	98.980	0.480	0.0	2.4	2.4	49.6	O K	7200 min Summer	98.871	0.371	0.0	2.4	2.4	31.0	O K	8640 min Summer	98.787	0.287	0.0	2.4	2.4	18.6	O K	10080 min Summer	98.720	0.220	0.0	2.3	2.3	10.9	O K	15 min Winter	99.213	0.713	0.0	2.4	2.4	89.4	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	139.925	0.0	82.9	30	30 min Summer	91.956	0.0	109.0	44	60 min Summer	57.620	0.0	136.6	74	120 min Summer	34.923	0.0	165.5	130	180 min Summer	25.727	0.0	182.9	190	240 min Summer	20.597	0.0	195.3	248	360 min Summer	14.951	0.0	212.6	364	480 min Summer	11.919	0.0	226.0	480	600 min Summer	9.991	0.0	236.8	548	720 min Summer	8.645	0.0	245.9	606	960 min Summer	6.876	0.0	260.7	732	1440 min Summer	4.972	0.0	282.8	1000	2160 min Summer	3.589	0.0	306.2	1416	2880 min Summer	2.845	0.0	323.7	1828	4320 min Summer	2.048	0.0	349.5	2644	5760 min Summer	1.621	0.0	368.7	3296	7200 min Summer	1.351	0.0	384.1	3968	8640 min Summer	1.163	0.0	397.1	4592	10080 min Summer	1.025	0.0	408.3	5248	15 min Winter	139.925	0.0	92.9	30
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																																																																																	
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1440 min Summer	99.483	0.983	0.0	2.4	2.4	135.6	O K																																																																																																																																																																																																																																																																																	
2160 min Summer	99.395	0.895	0.0	2.4	2.4	120.5	O K																																																																																																																																																																																																																																																																																	
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4320 min Summer	99.145	0.645	0.0	2.4	2.4	77.8	O K																																																																																																																																																																																																																																																																																	
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2880 min Summer	2.845	0.0	323.7	1828																																																																																																																																																																																																																																																																																				
4320 min Summer	2.048	0.0	349.5	2644																																																																																																																																																																																																																																																																																				
5760 min Summer	1.621	0.0	368.7	3296																																																																																																																																																																																																																																																																																				
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Nijhuis Industries UK & Ireland		Page 4
Nanjerrick Court Allet Truro, TR4 9DJ		
Date 28/02/2025 15:00	Designed by QD9548	
File ATTENUATION TRENCH A4.SRCX	Checked by	
Innovyze	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 100.000

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	1.5
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	380.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	98.500	Cap Infiltration Depth (m)	0.000

Hydro-Brake® Optimum Outflow Control

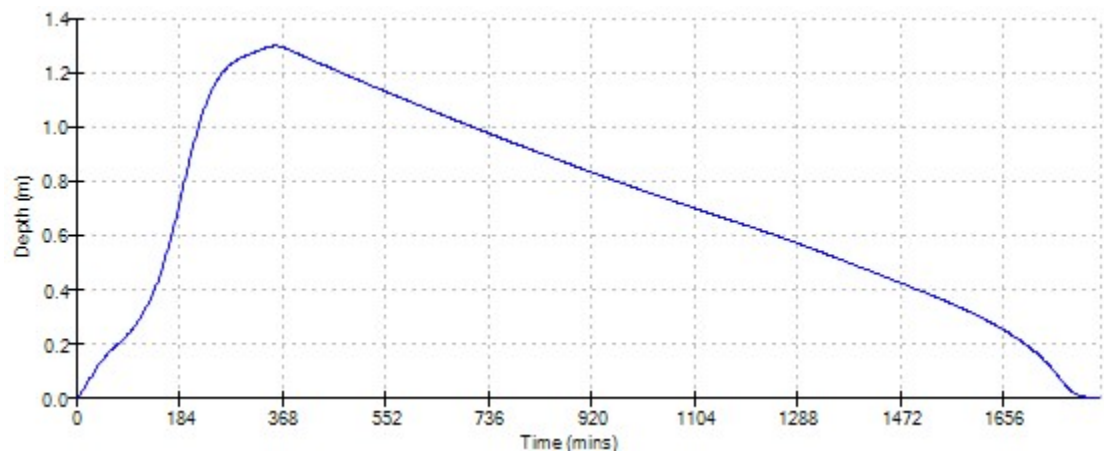
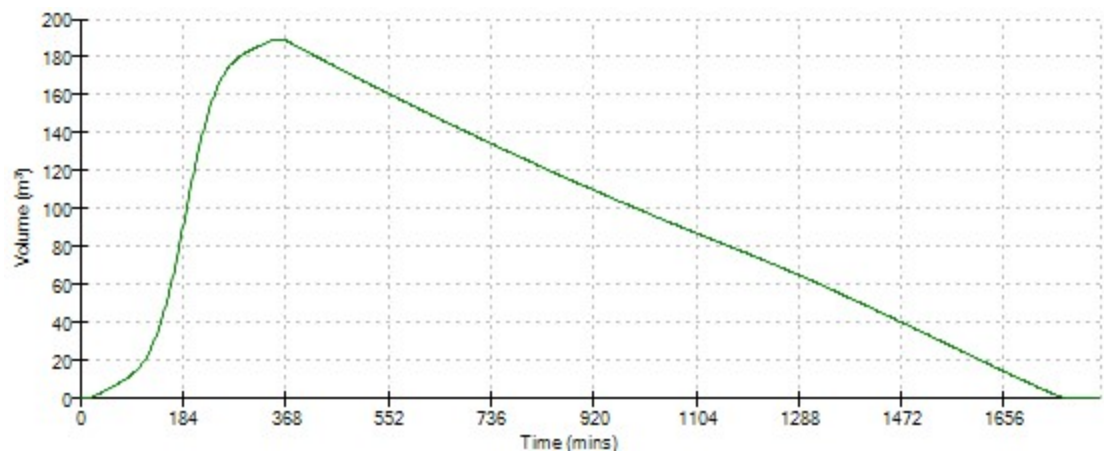
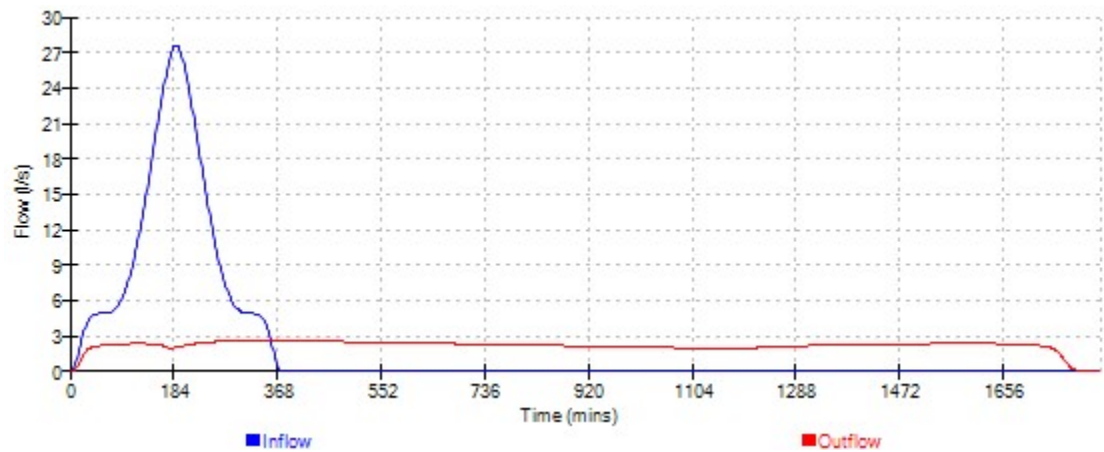
Unit Reference	MD-SHE-0073-2800-1500-2800
Design Head (m)	1.500
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	73
Invert Level (m)	98.500
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.8
Flush-Flo™	0.319	2.4
Kick-Flo®	0.647	1.9
Mean Flow over Head Range	-	2.2

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	1.9	1.200	2.5	3.000	3.9	7.000	5.7
0.200	2.3	1.400	2.7	3.500	4.1	7.500	5.9
0.300	2.4	1.600	2.9	4.000	4.4	8.000	6.1
0.400	2.3	1.800	3.0	4.500	4.7	8.500	6.3
0.500	2.3	2.000	3.2	5.000	4.9	9.000	6.5
0.600	2.1	2.200	3.3	5.500	5.1	9.500	6.6
0.800	2.1	2.400	3.5	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

Event: 360 min Winter



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Innovyze		
Source Control 2020.1		
ICP SUDS Mean Annual Flood Input Return Period (years) 100 Soil 0.400 Area (ha) 0.337 Urban 0.000 SAAR (mm) 700 Region Number Region 4 Results 1/s QBAR Rural 1.1 QBAR Urban 1.1 Q100 years 2.9 Q1 year 1.0 Q30 years 2.2 Q100 years 2.9		
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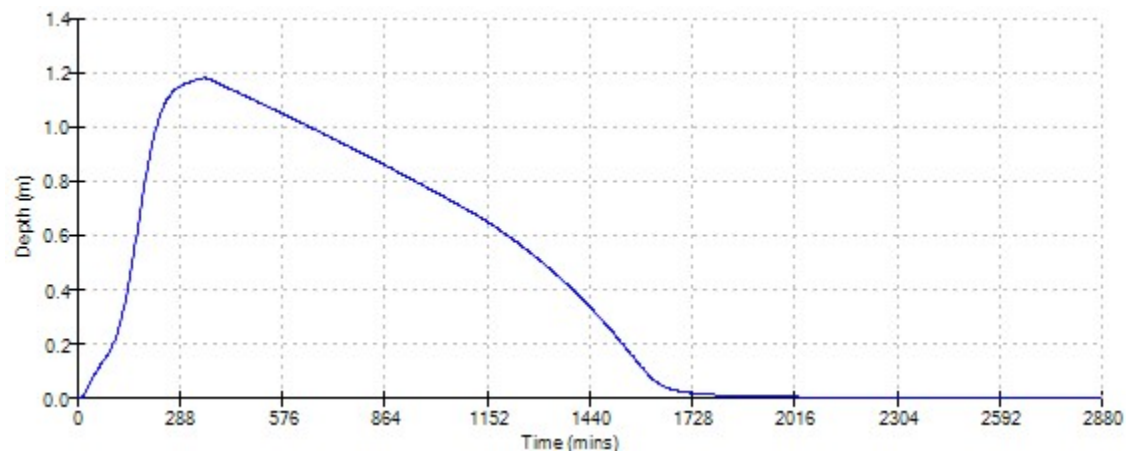
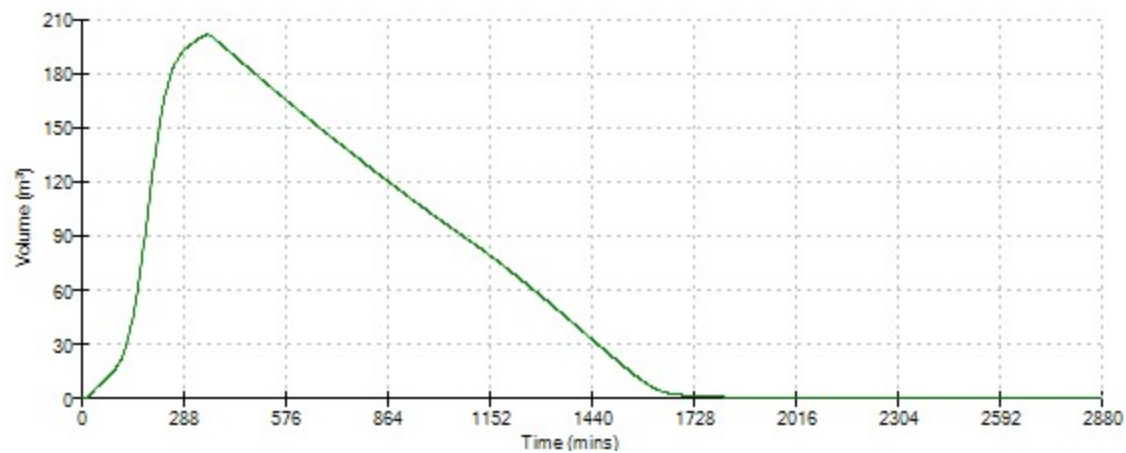
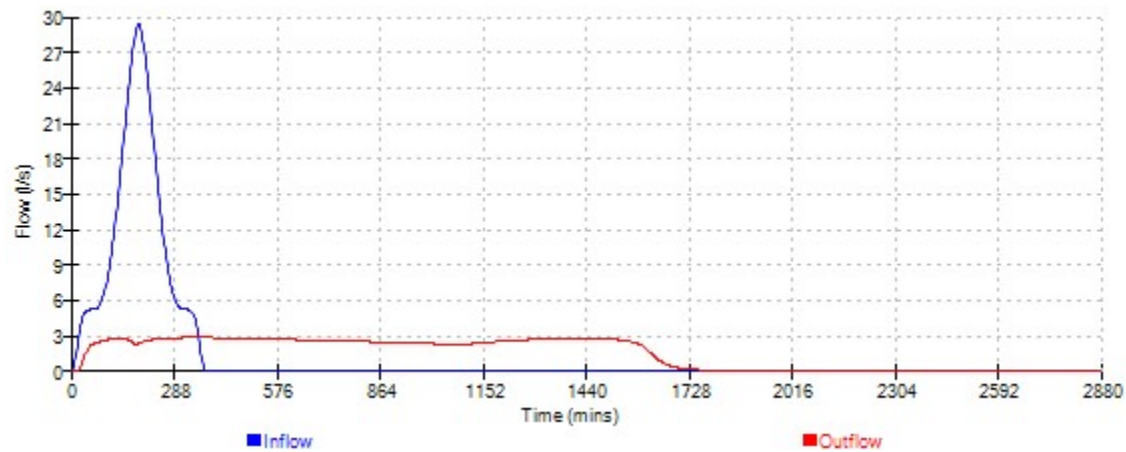
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Innovyze		Source Control 2020.1			
Summary of Results for 100 year Return Period (+50%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.181	0.681	2.8	84.8	O K
30 min Summer	99.315	0.815	2.8	110.9	O K
60 min Summer	99.429	0.929	2.8	136.2	O K
120 min Summer	99.521	1.021	2.8	158.5	O K
180 min Summer	99.559	1.059	2.8	168.3	O K
240 min Summer	99.576	1.076	2.8	172.7	O K
360 min Summer	99.581	1.081	2.8	173.9	O K
480 min Summer	99.571	1.071	2.8	171.2	O K
600 min Summer	99.556	1.056	2.8	167.3	O K
720 min Summer	99.541	1.041	2.8	163.5	O K
960 min Summer	99.512	1.012	2.8	156.2	O K
1440 min Summer	99.460	0.960	2.8	143.4	O K
2160 min Summer	99.384	0.884	2.8	125.8	O K
2880 min Summer	99.307	0.807	2.8	109.3	O K
4320 min Summer	99.119	0.619	2.8	73.9	O K
5760 min Summer	98.944	0.444	2.8	46.9	O K
7200 min Summer	98.813	0.313	2.8	30.0	O K
8640 min Summer	98.723	0.223	2.7	20.0	O K
10080 min Summer	98.665	0.165	2.6	14.1	O K
15 min Winter	99.237	0.737	2.8	95.4	O K
30 min Winter	99.379	0.879	2.8	124.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	139.925	0.0	88.2	30	
30 min Summer	91.956	0.0	115.9	44	
60 min Summer	57.620	0.0	145.5	72	
120 min Summer	34.923	0.0	176.4	130	
180 min Summer	25.727	0.0	195.0	188	
240 min Summer	20.597	0.0	208.1	246	
360 min Summer	14.951	0.0	226.6	364	
480 min Summer	11.919	0.0	240.9	480	
600 min Summer	9.991	0.0	252.4	528	
720 min Summer	8.645	0.0	262.0	590	
960 min Summer	6.876	0.0	277.9	716	
1440 min Summer	4.972	0.0	301.3	988	
2160 min Summer	3.589	0.0	326.5	1396	
2880 min Summer	2.845	0.0	345.1	1816	
4320 min Summer	2.048	0.0	372.6	2560	
5760 min Summer	1.621	0.0	393.2	3232	
7200 min Summer	1.351	0.0	409.6	3888	
8640 min Summer	1.163	0.0	423.4	4504	
10080 min Summer	1.025	0.0	435.3	5240	
15 min Winter	139.925	0.0	98.8	30	
30 min Winter	91.956	0.0	129.9	44	
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Innovyze		Source Control 2020.1			
Summary of Results for 100 year Return Period (+50%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.502	1.002	2.8	153.7	O K
120 min Winter	99.602	1.102	2.8	179.7	O K
180 min Winter	99.646	1.146	2.8	191.8	O K
240 min Winter	99.667	1.167	2.9	197.9	O K
360 min Winter	99.679	1.179	2.9	201.3	O K
480 min Winter	99.676	1.176	2.9	200.3	O K
600 min Winter	99.663	1.163	2.9	196.7	O K
720 min Winter	99.645	1.145	2.8	191.7	O K
960 min Winter	99.612	1.112	2.8	182.2	O K
1440 min Winter	99.545	1.045	2.8	164.5	O K
2160 min Winter	99.439	0.939	2.8	138.4	O K
2880 min Winter	99.326	0.826	2.8	113.3	O K
4320 min Winter	99.021	0.521	2.8	58.2	O K
5760 min Winter	98.785	0.285	2.8	26.8	O K
7200 min Winter	98.663	0.163	2.6	13.9	O K
8640 min Winter	98.607	0.107	2.3	8.8	O K
10080 min Winter	98.591	0.091	2.0	7.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	57.620	0.0	163.0	72	
120 min Winter	34.923	0.0	197.6	128	
180 min Winter	25.727	0.0	218.4	186	
240 min Winter	20.597	0.0	233.1	242	
360 min Winter	14.951	0.0	253.8	356	
480 min Winter	11.919	0.0	269.8	468	
600 min Winter	9.991	0.0	282.6	574	
720 min Winter	8.645	0.0	293.5	672	
960 min Winter	6.876	0.0	311.2	758	
1440 min Winter	4.972	0.0	337.4	1066	
2160 min Winter	3.589	0.0	365.7	1520	
2880 min Winter	2.845	0.0	386.5	1964	
4320 min Winter	2.048	0.0	417.3	2676	
5760 min Winter	1.621	0.0	440.4	3232	
7200 min Winter	1.351	0.0	458.8	3824	
8640 min Winter	1.163	0.0	474.2	4424	
10080 min Winter	1.025	0.0	487.5	5136	
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Nanjerrick Court Allet Truro, TR4 9DJ																																																		
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.400</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+50</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.337 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.085</td> <td>4 8</td> <td>0.085</td> <td>8 12</td> <td>0.085</td> <td>12 16</td> <td>0.082</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.000	Shortest Storm (mins)	15	Ratio R	0.400	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+50	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	0 4	0.085	4 8	0.085	8 12	0.085	12 16	0.082
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Model Details Storage is Online Cover Level (m) 100.000 Tank or Pond Structure Invert Level (m) 98.500 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>75.0</td><td>1.500</td><td>372.3</td></tr></tbody></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0078-2900-1200-2900 Design Head (m)1.200 Design Flow (l/s)2.9 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)78 Invert Level (m)98.500 Minimum Outlet Pipe Diameter (mm)100 Suggested Manhole Diameter (mm)1200 <table><thead><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>Design Point (Calculated)</td><td>1.200</td><td>2.9</td></tr><tr><td>Flush-Flo™</td><td>0.342</td><td>2.8</td></tr><tr><td>Kick-Flo®</td><td>0.696</td><td>2.3</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>2.5</td></tr></tbody></table> 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 <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>2.2</td><td>1.200</td><td>2.9</td><td>3.000</td><td>4.4</td><td>7.000</td><td>6.6</td></tr><tr><td>0.200</td><td>2.7</td><td>1.400</td><td>3.1</td><td>3.500</td><td>4.8</td><td>7.500</td><td>6.8</td></tr><tr><td>0.300</td><td>2.8</td><td>1.600</td><td>3.3</td><td>4.000</td><td>5.1</td><td>8.000</td><td>7.0</td></tr><tr><td>0.400</td><td>2.8</td><td>1.800</td><td>3.5</td><td>4.500</td><td>5.4</td><td>8.500</td><td>7.2</td></tr><tr><td>0.500</td><td>2.7</td><td>2.000</td><td>3.7</td><td>5.000</td><td>5.6</td><td>9.000</td><td>7.4</td></tr><tr><td>0.600</td><td>2.6</td><td>2.200</td><td>3.8</td><td>5.500</td><td>5.9</td><td>9.500</td><td>7.6</td></tr><tr><td>0.800</td><td>2.4</td><td>2.400</td><td>4.0</td><td>6.000</td><td>6.1</td><td></td><td></td></tr><tr><td>1.000</td><td>2.7</td><td>2.600</td><td>4.1</td><td>6.500</td><td>6.4</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	75.0	1.500	372.3	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.200	2.9	Flush-Flo™	0.342	2.8	Kick-Flo®	0.696	2.3	Mean Flow over Head Range	-	2.5	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	2.2	1.200	2.9	3.000	4.4	7.000	6.6	0.200	2.7	1.400	3.1	3.500	4.8	7.500	6.8	0.300	2.8	1.600	3.3	4.000	5.1	8.000	7.0	0.400	2.8	1.800	3.5	4.500	5.4	8.500	7.2	0.500	2.7	2.000	3.7	5.000	5.6	9.000	7.4	0.600	2.6	2.200	3.8	5.500	5.9	9.500	7.6	0.800	2.4	2.400	4.0	6.000	6.1			1.000	2.7	2.600	4.1	6.500	6.4		
Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																														
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Event: 360 min Winter



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ICP SUDS Mean Annual Flood Input Return Period (years) 100 Soil 0.400 Area (ha) 0.150 Urban 0.000 SAAR (mm) 700 Region Number Region 4 Results 1/s QBAR Rural 0.5 QBAR Urban 0.5 Q100 years 1.3 Q1 year 0.4 Q30 years 1.0 Q100 years 1.3		
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Summary of Results for 100 year Return Period (+50%)

Half Drain Time : 654 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	99.520	0.520	0.0	1.1	1.1	37.7	O K
30 min Summer	99.621	0.621	0.0	1.1	1.1	49.2	O K
60 min Summer	99.720	0.720	0.0	1.1	1.1	60.4	Flood Risk
120 min Summer	99.806	0.806	0.0	1.2	1.2	70.2	Flood Risk
180 min Summer	99.844	0.844	0.0	1.2	1.2	74.5	Flood Risk
240 min Summer	99.861	0.861	0.0	1.2	1.2	76.4	Flood Risk
360 min Summer	99.864	0.864	0.0	1.2	1.2	76.9	Flood Risk
480 min Summer	99.853	0.853	0.0	1.2	1.2	75.6	Flood Risk
600 min Summer	99.836	0.836	0.0	1.2	1.2	73.6	Flood Risk
720 min Summer	99.820	0.820	0.0	1.2	1.2	71.8	Flood Risk
960 min Summer	99.792	0.792	0.0	1.2	1.2	68.6	Flood Risk
1440 min Summer	99.745	0.745	0.0	1.1	1.1	63.3	Flood Risk
2160 min Summer	99.681	0.681	0.0	1.1	1.1	56.0	O K
2880 min Summer	99.622	0.622	0.0	1.1	1.1	49.2	O K
4320 min Summer	99.509	0.509	0.0	1.1	1.1	36.3	O K
5760 min Summer	99.389	0.389	0.0	1.1	1.1	22.7	O K
7200 min Summer	99.302	0.302	0.0	1.1	1.1	13.6	O K
8640 min Summer	99.227	0.227	0.0	1.1	1.1	7.8	O K
10080 min Summer	99.169	0.169	0.0	1.1	1.1	4.3	O K
15 min Winter	99.562	0.562	0.0	1.1	1.1	42.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.925	0.0	39.4	30
30 min Summer	91.956	0.0	51.7	44
60 min Summer	57.620	0.0	64.8	72
120 min Summer	34.923	0.0	78.6	130
180 min Summer	25.727	0.0	86.8	188
240 min Summer	20.597	0.0	92.7	246
360 min Summer	14.951	0.0	100.9	364
480 min Summer	11.919	0.0	107.3	480
600 min Summer	9.991	0.0	112.4	532
720 min Summer	8.645	0.0	116.7	596
960 min Summer	6.876	0.0	123.8	722
1440 min Summer	4.972	0.0	134.2	992
2160 min Summer	3.589	0.0	145.4	1408
2880 min Summer	2.845	0.0	153.6	1820
4320 min Summer	2.048	0.0	165.9	2636
5760 min Summer	1.621	0.0	175.0	3296
7200 min Summer	1.351	0.0	182.3	3968
8640 min Summer	1.163	0.0	188.5	4592
10080 min Summer	1.025	0.0	193.8	5248
15 min Winter	139.925	0.0	44.1	30

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Summary of Results for 100 year Return Period (+50%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	99.676	0.676	0.0	1.1	1.1	55.4	O K
60 min Winter	99.788	0.788	0.0	1.2	1.2	68.2	Flood Risk
120 min Winter	99.890	0.890	0.0	1.2	1.2	79.8	Flood Risk
180 min Winter	99.937	0.937	0.0	1.3	1.3	85.1	Flood Risk
240 min Winter	99.960	0.960	0.0	1.3	1.3	87.8	Flood Risk
360 min Winter	99.973	0.973	0.0	1.3	1.3	89.3	Flood Risk
480 min Winter	99.969	0.969	0.0	1.3	1.3	88.8	Flood Risk
600 min Winter	99.954	0.954	0.0	1.3	1.3	87.1	Flood Risk
720 min Winter	99.934	0.934	0.0	1.3	1.3	84.8	Flood Risk
960 min Winter	99.897	0.897	0.0	1.2	1.2	80.6	Flood Risk
1440 min Winter	99.832	0.832	0.0	1.2	1.2	73.2	Flood Risk
2160 min Winter	99.738	0.738	0.0	1.1	1.1	62.5	Flood Risk
2880 min Winter	99.649	0.649	0.0	1.1	1.1	52.3	O K
4320 min Winter	99.467	0.467	0.0	1.1	1.1	31.5	O K
5760 min Winter	99.295	0.295	0.0	1.1	1.1	13.1	O K
7200 min Winter	99.170	0.170	0.0	1.1	1.1	4.4	O K
8640 min Winter	99.102	0.102	0.0	1.0	1.0	1.5	O K
10080 min Winter	99.074	0.074	0.0	0.9	0.9	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	91.956	0.0	57.9	44
60 min Winter	57.620	0.0	72.6	72
120 min Winter	34.923	0.0	88.0	128
180 min Winter	25.727	0.0	97.2	186
240 min Winter	20.597	0.0	103.8	242
360 min Winter	14.951	0.0	113.0	356
480 min Winter	11.919	0.0	120.1	468
600 min Winter	9.991	0.0	125.9	574
720 min Winter	8.645	0.0	130.7	672
960 min Winter	6.876	0.0	138.6	760
1440 min Winter	4.972	0.0	150.3	1070
2160 min Winter	3.589	0.0	162.8	1524
2880 min Winter	2.845	0.0	172.1	1968
4320 min Winter	2.048	0.0	185.8	2816
5760 min Winter	1.621	0.0	196.0	3360
7200 min Winter	1.351	0.0	204.2	3896
8640 min Winter	1.163	0.0	211.1	4424
10080 min Winter	1.025	0.0	217.0	5104

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Nanjerrick Court Allet Truro, TR4 9DJ		
Date 28/02/2025 15:16	Designed by QD9548	
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Innovyze	Source Control 2020.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+50

Time Area Diagram

Total Area (ha) 0.150

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)
0 4 0.038	4 8 0.038	8 12 0.038	12 16 0.036				

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Nanjerrick Court Allet Truro, TR4 9DJ		
Date 28/02/2025 15:16	Designed by QD9548	
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Innovyze	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 100.000

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	380.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	99.000	Cap Infiltration Depth (m)	0.000

Hydro-Brake® Optimum Outflow Control

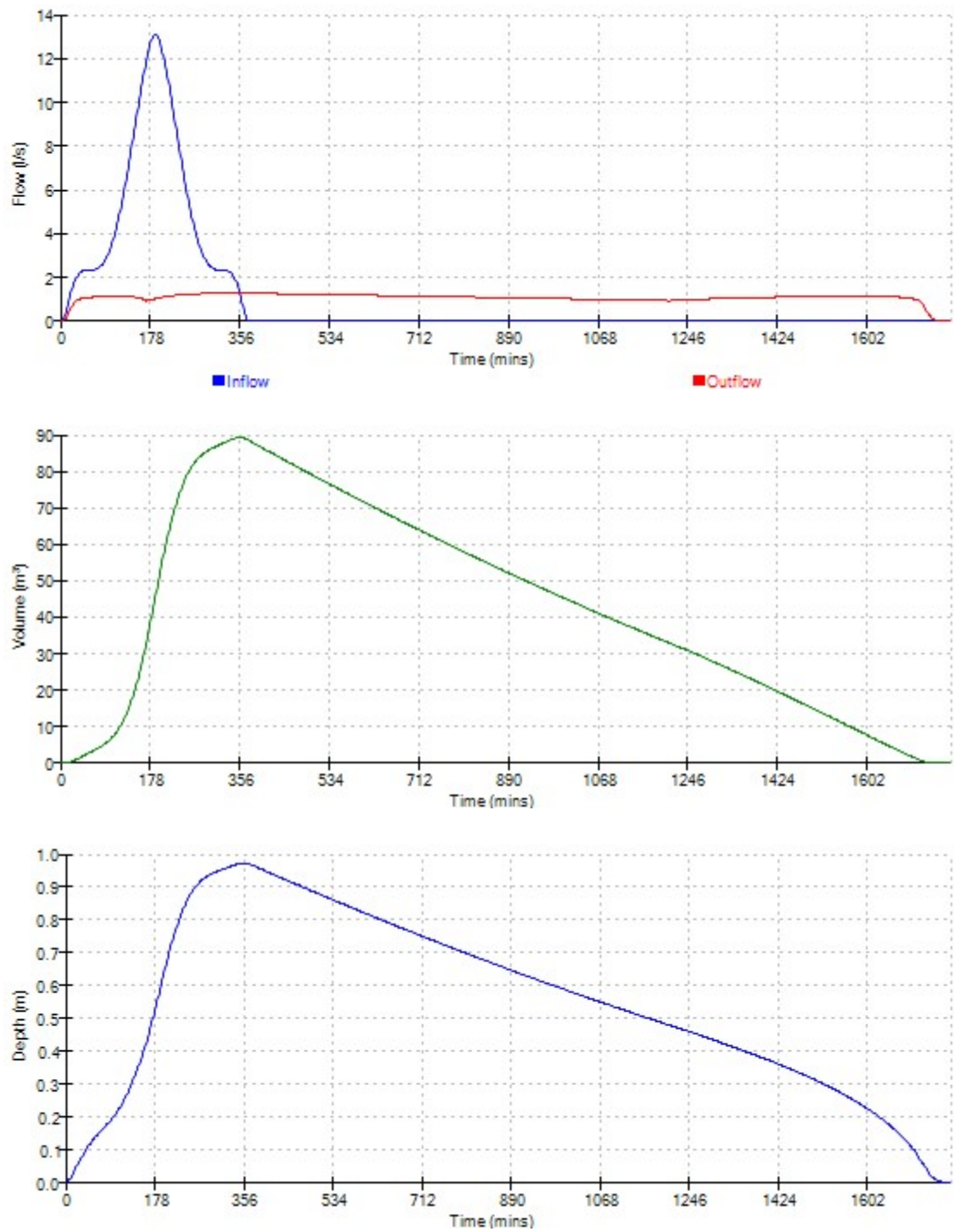
Unit Reference	MD-SHE-0053-1300-1000-1300
Design Head (m)	1.000
Design Flow (l/s)	1.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	53
Invert Level (m)	99.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.3
Flush-Flo™	0.236	1.1
Kick-Flo®	0.477	0.9
Mean Flow over Head Range	-	1.1

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	1.0	1.200	1.4	3.000	2.1	7.000	3.2
0.200	1.1	1.400	1.5	3.500	2.3	7.500	3.3
0.300	1.1	1.600	1.6	4.000	2.4	8.000	3.4
0.400	1.1	1.800	1.7	4.500	2.6	8.500	3.5
0.500	1.0	2.000	1.8	5.000	2.7	9.000	3.6
0.600	1.0	2.200	1.9	5.500	2.8	9.500	3.6
0.800	1.2	2.400	1.9	6.000	2.9		
1.000	1.3	2.600	2.0	6.500	3.1		

Event: 360 min Winter



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Nanjerrick Court Allet Truro, TR4 9DJ		
Date 28/02/2025 14:38 File	Designed by QD9548 Checked by	
Innovyze		Source Control 2020.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 0.196 Urban 0.000 SAAR (mm) 700 Region Number Region 4 Results 1/s QBAR Rural 0.7 QBAR Urban 0.7 Q100 years 1.7 Q1 year 0.6 Q30 years 1.3 Q100 years 1.7		
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Nanjerrick Court Allet Truro, TR4 9DJ					
Date 28/02/2025 15:22 File ATTENUATION BASIN A7.SRCX		Designed by QD9548 Checked by			
Innovyze		Source Control 2020.1			
Summary of Results for 100 year Return Period (+50%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.356	0.356	1.7	49.3	O K
30 min Summer	99.442	0.442	1.7	64.6	O K
60 min Summer	99.519	0.519	1.7	79.5	O K
120 min Summer	99.583	0.583	1.7	92.7	O K
180 min Summer	99.610	0.610	1.7	98.6	O K
240 min Summer	99.622	0.622	1.7	101.3	O K
360 min Summer	99.627	0.627	1.7	102.3	O K
480 min Summer	99.621	0.621	1.7	101.1	O K
600 min Summer	99.612	0.612	1.7	99.1	O K
720 min Summer	99.603	0.603	1.7	97.0	O K
960 min Summer	99.584	0.584	1.7	93.0	O K
1440 min Summer	99.548	0.548	1.7	85.4	O K
2160 min Summer	99.494	0.494	1.7	74.4	O K
2880 min Summer	99.432	0.432	1.7	62.8	O K
4320 min Summer	99.315	0.315	1.7	42.5	O K
5760 min Summer	99.224	0.224	1.7	28.5	O K
7200 min Summer	99.160	0.160	1.7	19.6	O K
8640 min Summer	99.120	0.120	1.6	14.3	O K
10080 min Summer	99.095	0.095	1.5	11.1	O K
15 min Winter	99.391	0.391	1.7	55.4	O K
30 min Winter	99.485	0.485	1.7	72.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	139.925	0.0	51.0	30	
30 min Summer	91.956	0.0	67.0	44	
60 min Summer	57.620	0.0	84.5	72	
120 min Summer	34.923	0.0	102.4	130	
180 min Summer	25.727	0.0	113.2	188	
240 min Summer	20.597	0.0	120.8	246	
360 min Summer	14.951	0.0	131.6	364	
480 min Summer	11.919	0.0	139.9	478	
600 min Summer	9.991	0.0	146.5	526	
720 min Summer	8.645	0.0	152.1	588	
960 min Summer	6.876	0.0	161.3	714	
1440 min Summer	4.972	0.0	174.8	988	
2160 min Summer	3.589	0.0	189.8	1400	
2880 min Summer	2.845	0.0	200.6	1800	
4320 min Summer	2.048	0.0	216.5	2512	
5760 min Summer	1.621	0.0	228.6	3176	
7200 min Summer	1.351	0.0	238.2	3832	
8640 min Summer	1.163	0.0	246.1	4504	
10080 min Summer	1.025	0.0	253.0	5152	
15 min Winter	139.925	0.0	57.1	30	
30 min Winter	91.956	0.0	75.1	44	
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Innovyze			Source Control 2020.1		
Summary of Results for 100 year Return Period (+50%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.568	0.568	1.7	89.6	O K
120 min Winter	99.638	0.638	1.7	104.9	O K
180 min Winter	99.670	0.670	1.7	112.0	O K
240 min Winter	99.685	0.685	1.7	115.6	O K
360 min Winter	99.694	0.694	1.7	117.8	O K
480 min Winter	99.692	0.692	1.7	117.4	O K
600 min Winter	99.684	0.684	1.7	115.5	O K
720 min Winter	99.673	0.673	1.7	112.7	O K
960 min Winter	99.650	0.650	1.7	107.6	O K
1440 min Winter	99.603	0.603	1.7	97.0	O K
2160 min Winter	99.527	0.527	1.7	81.0	O K
2880 min Winter	99.436	0.436	1.7	63.5	O K
4320 min Winter	99.257	0.257	1.7	33.5	O K
5760 min Winter	99.144	0.144	1.7	17.4	O K
7200 min Winter	99.091	0.091	1.5	10.7	O K
8640 min Winter	99.076	0.076	1.3	8.8	O K
10080 min Winter	99.067	0.067	1.2	7.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	57.620	0.0	94.6	72	
120 min Winter	34.923	0.0	114.7	128	
180 min Winter	25.727	0.0	126.8	186	
240 min Winter	20.597	0.0	135.3	242	
360 min Winter	14.951	0.0	147.4	356	
480 min Winter	11.919	0.0	156.6	468	
600 min Winter	9.991	0.0	164.1	574	
720 min Winter	8.645	0.0	170.4	670	
960 min Winter	6.876	0.0	180.6	756	
1440 min Winter	4.972	0.0	195.7	1066	
2160 min Winter	3.589	0.0	212.6	1520	
2880 min Winter	2.845	0.0	224.7	1956	
4320 min Winter	2.048	0.0	242.5	2604	
5760 min Winter	1.621	0.0	256.1	3224	
7200 min Winter	1.351	0.0	266.8	3752	
8640 min Winter	1.163	0.0	275.7	4416	
10080 min Winter	1.025	0.0	283.4	5144	
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.400</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+50</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.196 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.049</td> <td>4 8</td> <td>0.049</td> <td>8 12</td> <td>0.049</td> <td>12 16</td> <td>0.049</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.000	Shortest Storm (mins)	15	Ratio R	0.400	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+50	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	0 4	0.049	4 8	0.049	8 12	0.049	12 16	0.049
Rainfall Model	FSR	Winter Storms	Yes																																															
Return Period (years)	100	Cv (Summer)	0.750																																															
Region	England and Wales	Cv (Winter)	0.840																																															
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Summer Storms	Yes	Climate Change %	+50																																															
Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area																																											
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)																																											
0 4	0.049	4 8	0.049	8 12	0.049	12 16	0.049																																											
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Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	110.0	1.000	309.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0066-1700-0700-1700
Design Head (m)	0.700
Design Flow (l/s)	1.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	66
Invert Level (m)	99.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

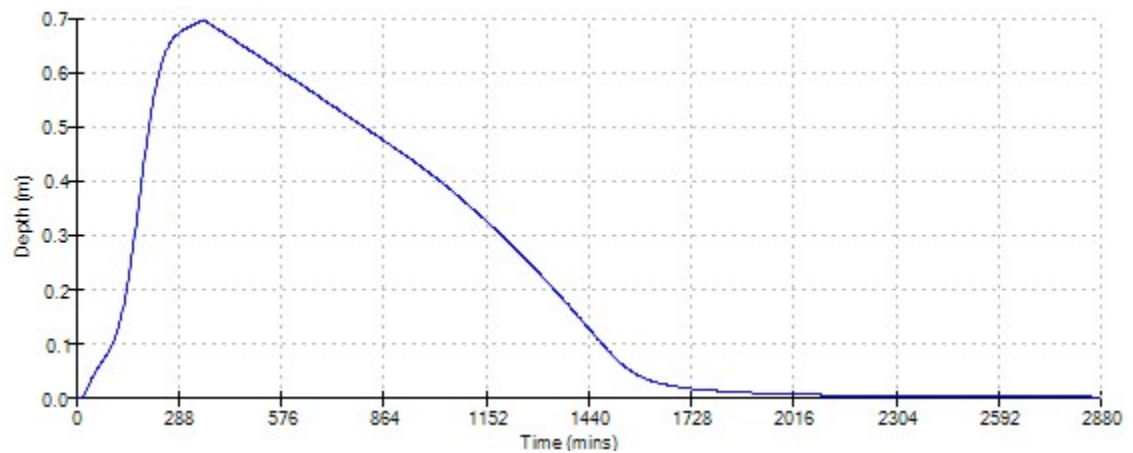
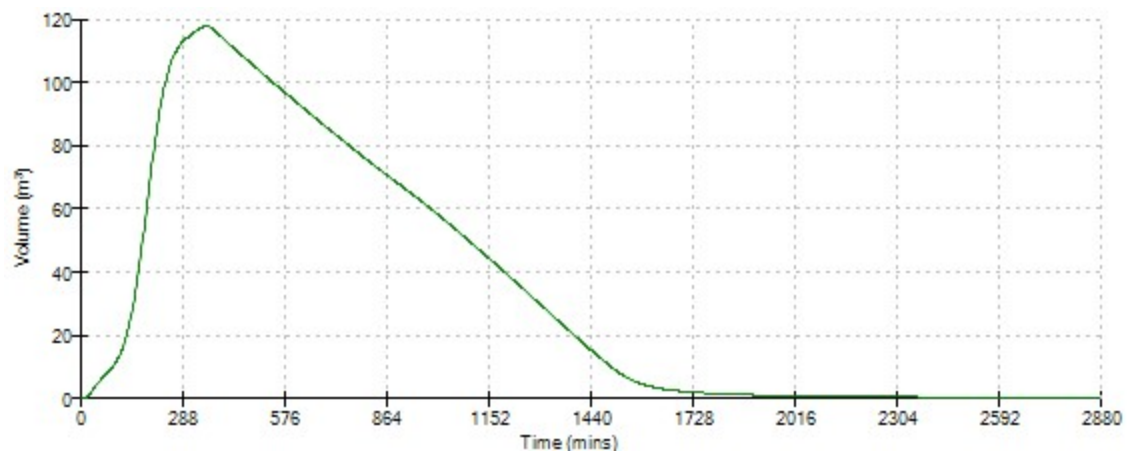
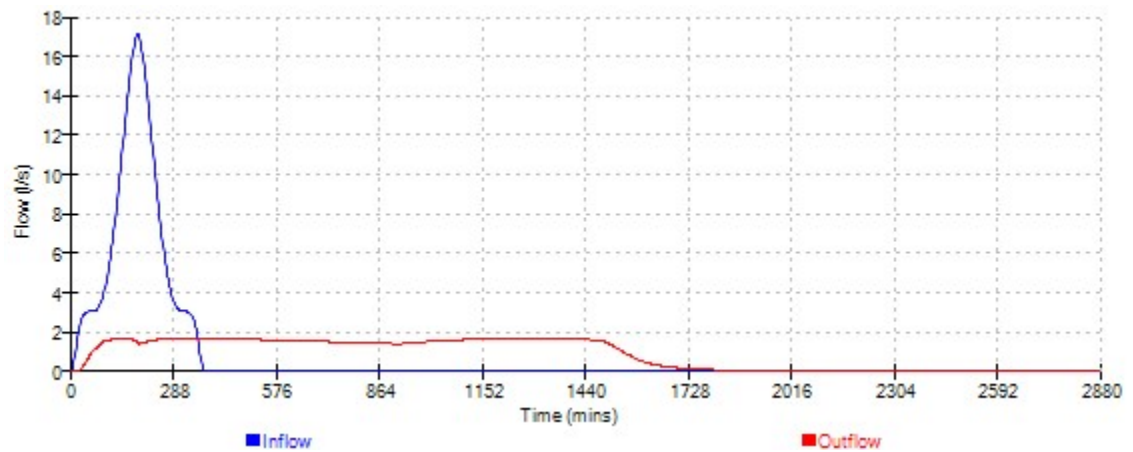
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	1.7
Flush-Flo™	0.210	1.7
Kick-Flo®	0.449	1.4
Mean Flow over Head Range	-	1.5

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	1.6	1.200	2.2	3.000	3.3	7.000	4.9
0.200	1.7	1.400	2.3	3.500	3.6	7.500	5.1
0.300	1.7	1.600	2.5	4.000	3.8	8.000	5.2
0.400	1.5	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.5	2.000	2.7	5.000	4.2	9.000	5.6
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.7
0.800	1.8	2.400	3.0	6.000	4.6		
1.000	2.0	2.600	3.1	6.500	4.7		

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Event: 360 min Winter



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Nanjerrick Court Allet Truro, TR4 9DJ		
Date 28/02/2025 14:39 File	Designed by QD9548 Checked by	
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Source Control 2020.1		
ICP SUDS Mean Annual Flood Input Return Period (years) 100 Soil 0.400 Area (ha) 0.413 Urban 0.000 SAAR (mm) 700 Region Number Region 4 Results 1/s QBAR Rural 1.4 QBAR Urban 1.4 Q100 years 3.6 Q1 year 1.2 Q30 years 2.8 Q100 years 3.6		
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Nanjerrick Court Allet Truro, TR4 9DJ					
Date 28/02/2025 15:26 File ATTENUATION BASIN BESS....		Designed by QD9548 Checked by			
Innovyze		Source Control 2020.1			
Summary of Results for 100 year Return Period (+50%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.169	0.669	3.6	103.7	O K
30 min Summer	99.307	0.807	3.6	135.8	O K
60 min Summer	99.426	0.926	3.6	166.8	O K
120 min Summer	99.521	1.021	3.6	193.9	O K
180 min Summer	99.560	1.060	3.6	205.8	O K
240 min Summer	99.577	1.077	3.6	211.0	O K
360 min Summer	99.581	1.081	3.6	212.2	O K
480 min Summer	99.570	1.070	3.6	208.8	O K
600 min Summer	99.554	1.054	3.6	203.9	O K
720 min Summer	99.539	1.039	3.6	199.2	O K
960 min Summer	99.509	1.009	3.6	190.2	O K
1440 min Summer	99.452	0.952	3.6	174.0	O K
2160 min Summer	99.369	0.869	3.6	151.5	O K
2880 min Summer	99.282	0.782	3.6	129.5	O K
4320 min Summer	99.073	0.573	3.6	83.7	O K
5760 min Summer	98.906	0.406	3.6	53.4	O K
7200 min Summer	98.785	0.285	3.6	34.6	O K
8640 min Summer	98.705	0.205	3.4	23.7	O K
10080 min Summer	98.654	0.154	3.2	17.2	O K
15 min Winter	99.227	0.727	3.6	116.7	O K
30 min Winter	99.374	0.874	3.6	152.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	139.925	0.0	108.0	30	
30 min Summer	91.956	0.0	142.0	44	
60 min Summer	57.620	0.0	178.3	72	
120 min Summer	34.923	0.0	216.2	130	
180 min Summer	25.727	0.0	238.9	188	
240 min Summer	20.597	0.0	255.0	246	
360 min Summer	14.951	0.0	277.7	364	
480 min Summer	11.919	0.0	295.1	476	
600 min Summer	9.991	0.0	309.2	524	
720 min Summer	8.645	0.0	321.1	586	
960 min Summer	6.876	0.0	340.5	712	
1440 min Summer	4.972	0.0	369.2	986	
2160 min Summer	3.589	0.0	400.1	1396	
2880 min Summer	2.845	0.0	422.9	1816	
4320 min Summer	2.048	0.0	456.6	2516	
5760 min Summer	1.621	0.0	481.9	3176	
7200 min Summer	1.351	0.0	502.0	3832	
8640 min Summer	1.163	0.0	518.9	4504	
10080 min Summer	1.025	0.0	533.4	5160	
15 min Winter	139.925	0.0	121.0	30	
30 min Winter	91.956	0.0	159.0	44	
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Nanjerrick Court Allet Truro, TR4 9DJ					
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Innovyze		Source Control 2020.1			
Summary of Results for 100 year Return Period (+50%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.502	1.002	3.6	188.1	O K
120 min Winter	99.606	1.106	3.6	219.9	O K
180 min Winter	99.651	1.151	3.6	234.5	O K
240 min Winter	99.673	1.173	3.6	241.8	O K
360 min Winter	99.684	1.184	3.6	245.6	O K
480 min Winter	99.679	1.179	3.6	244.0	O K
600 min Winter	99.665	1.165	3.6	239.3	O K
720 min Winter	99.646	1.146	3.6	232.9	O K
960 min Winter	99.610	1.110	3.6	221.3	O K
1440 min Winter	99.538	1.038	3.6	198.8	O K
2160 min Winter	99.421	0.921	3.6	165.4	O K
2880 min Winter	99.291	0.791	3.6	131.8	O K
4320 min Winter	98.967	0.467	3.6	63.8	O K
5760 min Winter	98.753	0.253	3.5	30.1	O K
7200 min Winter	98.649	0.149	3.2	16.6	O K
8640 min Winter	98.607	0.107	2.8	11.5	O K
10080 min Winter	98.593	0.093	2.5	9.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	57.620	0.0	199.7	72	
120 min Winter	34.923	0.0	242.1	128	
180 min Winter	25.727	0.0	267.6	186	
240 min Winter	20.597	0.0	285.6	242	
360 min Winter	14.951	0.0	311.0	356	
480 min Winter	11.919	0.0	330.5	466	
600 min Winter	9.991	0.0	346.3	574	
720 min Winter	8.645	0.0	359.6	670	
960 min Winter	6.876	0.0	381.3	756	
1440 min Winter	4.972	0.0	413.4	1066	
2160 min Winter	3.589	0.0	448.1	1520	
2880 min Winter	2.845	0.0	473.7	1964	
4320 min Winter	2.048	0.0	511.4	2604	
5760 min Winter	1.621	0.0	539.7	3184	
7200 min Winter	1.351	0.0	562.3	3816	
8640 min Winter	1.163	0.0	581.1	4408	
10080 min Winter	1.025	0.0	597.4	5136	
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+50

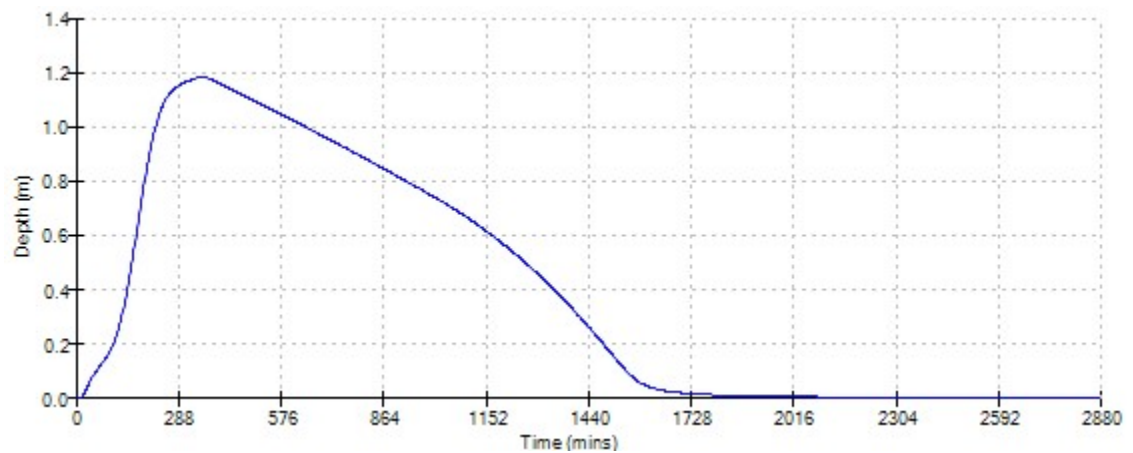
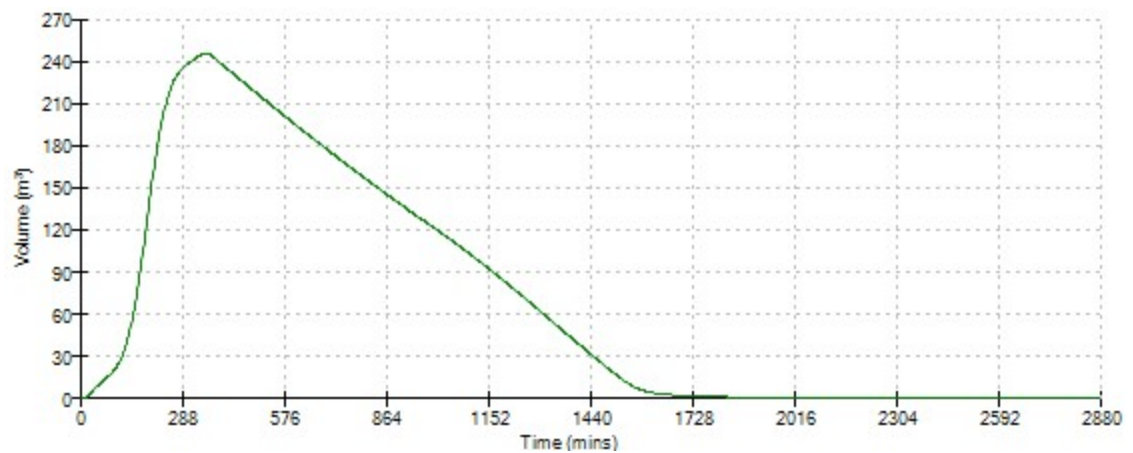
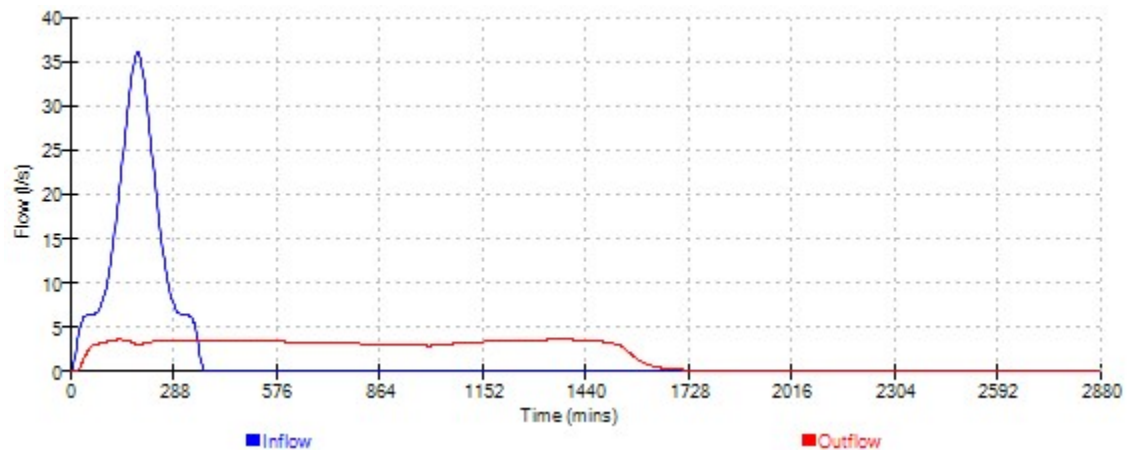
Time Area Diagram

Total Area (ha) 0.413

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)	From: To: (ha)
0 4 0.104	4 8 0.104	8 12 0.104	12 16 0.101				

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Model Details Storage is Online Cover Level (m) 100.000 Tank or Pond Structure Invert Level (m) 98.500 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>100.0</td><td>1.500</td><td>425.8</td></tr></tbody></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0087-3600-1200-3600 Design Head (m) 1.200 Design Flow (l/s) 3.6 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 87 Invert Level (m) 98.500 Minimum Outlet Pipe Diameter (mm) 100 Suggested Manhole Diameter (mm) 1200 <table><thead><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>Design Point (Calculated)</td><td>1.200</td><td>3.6</td></tr><tr><td>Flush-Flo™</td><td>0.362</td><td>3.6</td></tr><tr><td>Kick-Flo®</td><td>0.742</td><td>2.9</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>3.2</td></tr></tbody></table> 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 <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>2.7</td><td>1.200</td><td>3.6</td><td>3.000</td><td>5.5</td><td>7.000</td><td>8.2</td></tr><tr><td>0.200</td><td>3.4</td><td>1.400</td><td>3.9</td><td>3.500</td><td>5.9</td><td>7.500</td><td>8.5</td></tr><tr><td>0.300</td><td>3.6</td><td>1.600</td><td>4.1</td><td>4.000</td><td>6.3</td><td>8.000</td><td>8.8</td></tr><tr><td>0.400</td><td>3.6</td><td>1.800</td><td>4.3</td><td>4.500</td><td>6.7</td><td>8.500</td><td>9.0</td></tr><tr><td>0.500</td><td>3.5</td><td>2.000</td><td>4.6</td><td>5.000</td><td>7.0</td><td>9.000</td><td>9.3</td></tr><tr><td>0.600</td><td>3.4</td><td>2.200</td><td>4.8</td><td>5.500</td><td>7.3</td><td>9.500</td><td>9.5</td></tr><tr><td>0.800</td><td>3.0</td><td>2.400</td><td>5.0</td><td>6.000</td><td>7.6</td><td></td><td></td></tr><tr><td>1.000</td><td>3.3</td><td>2.600</td><td>5.2</td><td>6.500</td><td>7.9</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	100.0	1.500	425.8	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.200	3.6	Flush-Flo™	0.362	3.6	Kick-Flo®	0.742	2.9	Mean Flow over Head Range	-	3.2	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	2.7	1.200	3.6	3.000	5.5	7.000	8.2	0.200	3.4	1.400	3.9	3.500	5.9	7.500	8.5	0.300	3.6	1.600	4.1	4.000	6.3	8.000	8.8	0.400	3.6	1.800	4.3	4.500	6.7	8.500	9.0	0.500	3.5	2.000	4.6	5.000	7.0	9.000	9.3	0.600	3.4	2.200	4.8	5.500	7.3	9.500	9.5	0.800	3.0	2.400	5.0	6.000	7.6			1.000	3.3	2.600	5.2	6.500	7.9		
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Event: 360 min Winter





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