

Fleurie Nursery, Lake Lane, Barnham. **Drainage system outline.**

This document forms the basis of the application and should be read first, in conjunction with the drawing "Site layout" and this will give a basis for understanding the system as a whole. Other drawings and annexes are referenced, and a list of these is given at the end. If you do not have all these for any reason please ask.

1. Historical narrative.

The site is a long established greenhouse site, and the drainage proposals relate to the approved planning application for site redevelopment as a modern nursery, basically clearing areas of existing structures and erecting larger single ones in their place. This application (WA/75/20/PL) was approved (21.1.2021) with conditions, and some conditions discharged in (27.10.2022) but it must be emphasised that the approval allowed for construction to take place before the conditions were discharged. As such a large part of the drainage scheme has already been installed, and therefore we believe that this application for discharging Conditions 3 and 4 should be assessed according to the pre-June 2025 DEFRA Guidance Note "National Standards for Sustainable Drainage Systems" and their incorporation into ADC policy.

Initial discussions were with the ADC drainage engineer, see Annexe 1b (emails), which states that in the SUDS hierarchy infiltration can be eliminated, and the Qbar and CCA criteria to be applied, and which formed the basis for the design. Subsequent to the initial submission a list of requirements was provided by the ADC Drainage Officer which would lead to a discharge of the condition / removal of the objection.

This ongoing submission of information and amendments to meet requirements stipulated led to the following being agreed (see Annexe 1).

- Infiltration is not a viable option.
- Attenuation with controlled limited discharge into the river is acceptable in principle.
- Attenuation design to be based on 1:100 event + 40% CCA.
- Permitted discharge to be based on the greenfield run off rate qBar.
- Attenuation system to have 'normal' low rate discharge, and 'high rate' one which can only operate with rainfall events of greater than 1 in 30 years.
- Exceedance plans were required to capture a failure of an attenuation tank (catastrophic failure).

Annexe 1 shows 2 of the documents received from ADC, the first of which stipulates precisely what was required by ADC from us to discharge the conditions, and this is what we have responded to and maintain that we have done. The third email is from an ADC Planning Officer acknowledging the points raised about it being an unusual approval due to the permission to build prior to the conditions being discharged, which backs up our points below on how the drainage design should be assessed.

Most if not all of the design had been submitted and agreed when we were told that the condition could not be discharged until there was a discharge consent in place (Point 11 on Annexe 1). When contacting the West Sussex Flood Risk Partnership to commence this application process we were initially informed that a discharge consent could not be issued until the drainage element of the planning had been approved, however once we pointed out that this was a Catch 22 situation they relented and agreed to allow us to apply for the Discharge Consent. This took quite a considerable period of time to sort out, and the Ordinary Watercourse Discharge Consent application was eventually submitted on 4.3.24 and granted conditionally on 31.10.24, subject to ultimately obtaining planning approval. The same lot of calculations and drawings were submitted, with additional information regarding the design of the outfall. Some modifications and changes were required and this was approved, see annexe 8.

This re-application follows from a previous rejection which we believe was due to our failure to take into account that there would be no continuity of assessment, thus we didn't explain previous work sufficiently, and assumed that previously accepted work was already dealt with. It should be noted that reasons listed for rejecting the earlier application were lack of detail / clarity, not an 'in-principle' objection.

2. Design fundamentals.

Key points to note:

- There is **no foul drainage** involved in this system at all.
- Water entering the attenuation tanks is purely roof water from rain, there is **no pollution risk**. There is no yard water or any other water entering the system.
- Attenuation is provided with controlled discharge to the watercourse, to cater for the **1:100 event + 40% CCA**.
- Discharge to the outfall is limited to the greenfield rate for a 1:1 event under normal conditions, with the rate for the 1:30 event being used for events greater than 1:30.
- This high level discharge only operates for the 1:30 event and greater, and the attenuation system maintains levels within capacity on this basis.

2.1 Site layout basics.

The approved plan is for a redevelopment of an existing site, with some older greenhouses being dismantled and removed and newer ones constructed. Existing yard and access areas remain largely the same. All yard areas are permeable.

Existing drainage

There is a stream (Rive) flowing from North to South through the site, and surface and sub-surface water naturally drains to this. This is in the ownership of the applicant. The existing structures are mostly un-drained, in the sense that they have no gutters (as in the case of the Haygrove tunnels) or are small, such as the ancillary buildings. The existing greenhouse (East) has roof gutters that feed to the existing reservoir / pond. The yard areas are all permeable type.

The site is low risk for flooding - see Annexe 10 "Flood Risk Assessment" which formed part of the original approved planning application.

Proposal

The redevelopment comprises 4 discrete areas, for the purposes of this submission referred to as North Greenhouse, South Tunnels, South Glass, and East Greenhouse. These are shown on Drawing "Site layout". The calculations and drawings for these are detailed separately in the sections following (sections 3.2 to 3.5)

North Greenhouse - 0.6 ha

East Greenhouse - 0.7 ha

South tunnels - 1.0 ha

South Glass - 1.4 ha

Total - 3.7 ha

The approved Discharge Consent (LDC/ARUN/2024/015) is for 2 outfalls, referred to as North Outfall and South Outfall. The position of these is indicated on the drawing "Site Layout".

Access and yard areas.

These have not changed significantly, although the metalled track on the east side of the rive is to be removed once the new greenhouse is built. The existing area of permeable (gravel) hard standing is also being reduced.

2.2 Attenuation

Attenuation is by means of above ground steel tanks with butyl EPDM liners, with orifice plate discharges to the consented outfalls. These are detailed further in the individual section (3) below relating to the four individual areas of greenhouse.

All tanks are designed and manufactured to BS2989 and installed in accordance with manufacturer's instructions.

2.3 Basics of water collection and delivery to attenuation tanks.

Key point to note - this is a gravity fed system, **it is not pumped**, and does not rely on a pump for operation. There are pumps in the system but these are for other reasons, they do not pump the roof water to the tanks.

Greenhouse blocks have multiple gutters, then header pipes (some high level, mostly below ground) to collect the roof gutter water, and these headers are installed so as to feed into the attenuation tanks by gravity, the rooves being higher than the tanks. The pipe system is a sealed one, such that the downpipes headers can drop down to below ground level for protection against mechanical damage, and then rise up and over the edge of the tanks to discharge into them. It is thus only dependent upon gravity for this, driven by the hydraulic gradient of the static height difference. At the low point near the tanks there are, however, sumps with small submersible pumps operated by float switches, which are there purely to empty the pipes after a rainfall event to stop them sitting permanently flooded. The operation of the system is not dependent upon these pumps in any manner whatsoever. This is a very common approach for greenhouse drainage, and has been employed successfully for decades. Details of the drain down system including pump model and performance details sumps are given in Annexe 2 and drawing "Drain down sump".

Multiple tanks are connected by inter-connectors.

2.4 Outfalls

The 4 areas each have their own attenuation tanks with their own discharges through orifice plates, and these are connected to the outfalls. The North Glass has its own outfall, "Outfall North". The remaining blocks all connect to the southern outfall, "Outfall South". These are detailed in the drawings of these names. Outfalls have been fully approved as part of the Ordinary Water Course Discharge Consent, including full construction details and flap valves (Annexe 1a, Point 6).

2.5 Exceedance (Annexe 1a Point 7)

The drainage system is designed to cope with the 1:100 event plus 40% CCA. Guidance dictates that exceedance routes must be considered, and managed appropriately. We were instructed to include catastrophic failure of a tank as an exceedance event. This has been dealt with by incorporating bunded containment areas sufficient to hold the contents of the largest tank, see details below in each section. It may be assumed that the likelihood of a greater than 1:100 + 40%CCA coinciding with a catastrophic failure can be ignored, and therefore any exceedance due to a greater event than the 1:100 + 40% will be contained within these bunded areas, which permit attenuation of a capacity equal to the largest tank, typically 30%. The most likely result of any excess flow from elsewhere on the site is that there will be over spill at multiple locations, and therefore as an agricultural site it is accepted that exceedance flow will be through the outside plant beds, with possible damage being accepted. Knowledge of the site over many years indicates that there is no ingress of flow from outside the site.

Exceedance routes are shown on drawing "Exceedance routes".

2.6 Outfall surcharging

The outfall discharges are from the attenuation tanks, and under extreme conditions will have a nominal head equivalent to the static head of the water in the tank, thus in excess of 3m above normal outfall levels, and as such able to cope with any conceivable top water rise, therefore detailed modelling is not required.

2.6 Pipework details common to all parts of the site

All pipes are PVC Class 51, with socketed and gasketed joints. Pipes are laid on 100mm sand / suitably screened (10mm) 'as dug' material as appropriate, and covered to depth of 75mm with similar.

Inspection chambers. The system (other than the discharges to outfalls) is a flooded one, thus the height difference from the greenhouse gutter to the attenuation tanks provided the hydraulic gradient to allow for gravity operation. As such it is in general undesirable to have inspection chambers since these require to be sealed. Consequently these are only provided in limited locations: for the drain down sump / pumps, for the discharge from the orifice plates, and for the connection of the 3 orifice plate discharges to the southern outfall. This is normal in commercial greenhouse installations, which are of course unadopted drainage systems, and it is common to have drain pipe runs in excess of 500m with no ICs. Experience over decades on very many sites dictates that this is not a problem. The purpose of an IC is generally accepted to be for (a) inspection, and (b) maintenance. Inspection is not required in this manner since it is evident from the operation of the system, thus if there is a blockage along the main collector run it would be evidenced by overflow from the gutters up to that point, and if it were after the collector then all gutters would manifest it. Proper operation is evidenced by visible flow into the attenuation tanks. Experience and reason also dictate that for a large bore pipes with solely clean water in large volumes going along them blockages are not likely to occur. Self propelled CCTV inspection devices can reach 200m from entry, and none of our runs are as long as this so this is not a problem if required.

3. Details and calculations

In this section the basis of the design calculations is detailed first, then each of the 4 greenhouse areas are detailed in turn, and finally other aspects.

3.1 Site run-off details (Qbar)

The Qbar figure is based on the greenfield run-off rate, and is taken from the UK SUDS Calculator, as below. This is a summary of their calculations.

Contributing area 3.7 ha (see 2.1 above).

Assume an arable greenfield site run-off equivalent for 3.7 ha.

Using IH24 formula as per UKSuds:

$$\begin{aligned} Qbar_{rural} &= 0.00108 \times (0.01 \times AREA)^{0.89} \times SAAR^{1.17} \times SPR^{2.17} \\ &= 23.5 \text{ l/s (1:100 years)} \end{aligned}$$

and

$$\mathbf{1:1 \text{ year} = 6.3 \text{ l/s}}$$

$$\mathbf{1:30 \text{ year} = 17.0 \text{ l/s}}$$

(output from UK SUDS on line calculator)

where:

Qbar_{rural} is the mean annual flood flow from a rural catchment (approximately 2.3 year return period).

AREA is the area of the catchment in ha.

SAAR is for the period 1961 - 1990.

SPR is Standard Percentage Runoff coefficient for the SOIL category.

Rainfall data

We have used Met Office data specific to the site co-ordinates (*ITED Rainfall Analysis report centred on customer location of Latitude, Longitude 50.832134 , -0.617636 (Fleurie Nursery, Lake Lane, Barnham W Sussex PO22 0AL).*

3.2 North

See drawing "North drainage" for overall layout of drainage system for these blocks, and for attenuation tank locations, levels, and connections.

This comprises a single block of glass with headers connecting to buried flooded system as outlined in 2.3 above, feeding to 3 attenuation tanks. Attenuation tanks are inter-connected at low level by pipes, see Annexe 3 for details and calculations.

There are 3 attenuation tanks, capacities 338m³, 235m³ and 75m³, total 648m³.

See drawing "North pipe and invert" for pipe diameters and levels.

The controlled discharge from these is released into the river at the North Outfall via orifice plates - see drawing "North Orifice Plates". For details of the North Outfall see drawing "Outfall North".

The attenuation system impoundment, as requested in case of catastrophic failure, is detailed in drawing "North Exceedance".

Pipe schedule (see drawing "North Pipe and Invert)

Pipe ID	Diameter (mm)	Length (m)	Invert level at start of run
East block			
A	250	25	9.2
B	315	26	9.0
C	400	15	8.8
West block			
D	250	24	9.1
E	250	32	8.9

3.3 South tunnels

See drawing “South Tunnel Drainage” for overall layout of drainage system for these blocks, and for attenuation tank locations, levels, and connections.

This comprises a multi-span plastic clad structure with downpipes dropping to an underground header forming the flooded system as outlined in 2.3 above, feeding to 2 attenuation tanks. Attenuation tanks are inter-connected at low level by pipes, see Annexe 3 for details and calculations.

There are 2 attenuation tanks, each with a capacity of 512m³, total capacity 1024m³.
See drawing “South Tunnel Pipe and Invert” for pipe diameters and levels.

The controlled discharge from these is released into the river at the South Outfall via orifice plates - see drawing “South Tunnel Orifice Plates”. For details of the South Outfall see drawing “Outfall South”.

The attenuation system impoundment, as requested in case of catastrophic failure, is detailed in drawing “South Tunnel Exceedance”.

Pipe schedule (see drawing “South Tunnel Pipe and Invert”)

Pipe ID	Diameter (mm)	Length (m)	Invert level at start of run
A	250	25	9.2
B	315	50	9.1
C	400	61	8.9
D	500	7	8.6

3.4 South glass

See drawing “South Glass Drainage” for overall layout of drainage system for these blocks, and for attenuation tank locations, levels, and connections.

This comprises a multi-span glasshouse structure with downpipes dropping to an underground header forming the flooded system as outlined in 2.3 above, feeding to 3 attenuation tanks. Attenuation tanks are inter-connected at low level by pipes, see Annexe 3 for details and calculations.

There are 3 attenuation tanks, each with a capacity of 512m³, total capacity 1536m³.
See drawing “South Glass Pipe and Invert” for pipe diameters and levels.

The controlled discharge from these is released into the river at the South Outfall via orifice plates - see drawing “South Glass Orifice Plates”. For details of the South Outfall see drawing “Outfall South”.

The attenuation system impoundment, as requested in case of catastrophic failure, is detailed in drawing “South Glass Exceedance”.

Pipe schedule (see drawing “South Glass Pipe and Invert”)

Pipe ID	Diameter (mm)	Length (m)	Invert level at start of run
A	250	45	9.4
B	315	29	9.1
C	400	44	9.0
D	500	53	8.7
E	500	16	8.4

3.5 East glass

See drawing “East Glass Drainage” for overall layout of drainage system for these blocks, and for attenuation tank locations, levels, and connections.

This comprises a multi-span glasshouse structure with downpipes dropping to an internal intermediate header, and a final header, both underground forming the flooded system as outlined in 2.3 above, feeding to 2 attenuation tanks. Attenuation tanks are inter-connected at low level by pipes, see Annexe 3 for details and calculations.

There are 2 attenuation tanks, each with a capacity of 400m³, total capacity 800m³.
See drawing “East Glass Pipe and Invert” for pipe diameters and levels.

The controlled discharge from these is released into the river at the South Outfall via orifice plates - see drawing “East Glass Orifice Plates”. For details of the South Outfall see drawing “Outfall South”.

The attenuation system impoundment, as requested in case of catastrophic failure, is detailed in drawing “East Glass Exceedance”.

Pipe schedule (see drawing “East Glass Pipe and Invert)

Pipe ID	Diameter (mm)	Length (m)	Invert level at start of run
A	250	25	9.1
B	400	26	8.1
C	400	15	7.8
D	400	27	7.6

3.6 Other.

Visual impact

Although the attenuation tanks are high visual impact they are significantly less so that the greenhouses, which have been approved, and therefore this is not relevant. Additionally there are existing irrigation tanks on site, as is common with greenhouse sites. The application (approved) includes a wildlife corridor along the river, and this is unchanged by any of the drainage details.

Trees.

The positions of trees are indicated on the drawing “Site Layout”, taken from the 2023 topographical site survey. As can be seen from this none of the drainage works affect these.

Ordinary water course maintenance access.

A 3m maintenance access adjacent to the river has been maintained.

Enclosures:

Enclosed should be the following drawings and annexes. In the absence of any of these PLEASE REQUEST the missing item.

Drawings.

Overall site layout

North drainage

North pipe and invert

North exceedance

North orifice plate

South Tunnel drainage

South Tunnel pipe and invert

South Tunnel exceedance

South Tunnel orifice plate

South Glass drainage

South Glass pipe and invert

South Glass exceedance

South Glass orifice plate

East drainage

East pipe and invert

East exceedance

East orifice plate

Drain down sump

Outfall north

Outfall south

Exceedance routes

Annexes.

1 Documents: ADC Drainage Officer Recommendation and Requirements 20.6.2022 and email 15.1.2021

2 Drain down system details

3 Attenuation tank inter-connector details and calculations

4 North calculations

5 South tunnel calculations

6 South glass calculations

7 East calculations

8 OWC Discharge Consent (granted)

9 Tank installation manual

10 Flood Risk Assessment (from approved application WA/75/20/PL)

11. Maintenance and operation.

12. Steel tank installation and strainer / filter details