

To: Quercus Nursery Ltd

From: Michael Underwood / Lee Clarke

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Re: Quercus Nursery - Surface Water Drainage Scheme

Date: 13/03/2018

APPLICATION: FG/95/16/PL
APPLICANT: QUERCUS NURSERY LTD
PROPOSAL: POLYTUNNELS, OUTDOOR GROWING BEDS, TREE NURSERY, STORAGE & WELFARE FACILITIES FOR A HORTICULTURAL ENTERPRISE
LOCATION: QUERCUS NURSERY, LITTLEHAMPTON ROAD, FERRING, WORTHING, WEST SUSSEX, BN12 6PG

1 INTRODUCTION

1.1 Background and Scope

Quercus Nursery Ltd have planning permission (FG/95/16/PL) for the erection of polytunnels, outdoor growing beds, a tree nursery, storage and welfare facilities for a horticultural enterprise at their site at Quercus Nursery, Littlehampton Road, Ferring, BN12 6PG ("the Site"). The planning permission was granted by Arun District Council in August 2016 subject to a set of conditions.

This report has been prepared by Envireau Water on behalf of Quercus Nursery Ltd to provide information to discharge Planning Condition No.6 of the planning permission (FG/95/16/PL) at the Site. Planning Condition No.6 is related to surface water drainage and maintenance and states the following:

Condition No.6:

Development shall not commence until full details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority.

The design should follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations, the recommendations of the SUDS Manual produced by CIRIA.

Winter groundwater monitoring to establish highest annual ground water levels and Percolation testing to BRE 365, or similar approved, will be required to support the design of any Infiltration drainage.

No building shall be occupied until the complete surface water drainage system serving the property has been implemented in accordance with the agreed details and the details so agreed shall be maintained in good working order in perpetuity.

1.2 Objectives of this Report

The objectives of this report are to fulfil Planning Condition No.6 by providing a surface water drainage scheme for the developments that follows the Sustainable urban Drainage Systems (SuDS) Hierarchy and a maintenance plan for the drainage scheme.

2 SITE SOIL INFILTRATION TESTING

Soil infiltration testing was conducted at the Site on the 12th February 2018. The purpose of the testing was to assess the suitability of infiltration methods for the disposal of runoff from the development. Ground conditions were wet and heavy rainfall occurred during the testing.

A total of three trial pits (TP1, TP2 and TP3) were dug at three different locations across the Site. The locations of the trial pits are shown on Figure 1. For each trial pit location, a 0.6m wide x 1m deep x 1.5m long pit was dug into the soils.

In accordance with the Building Research Establishment (BRE) Digest365, the pits were filled to the top with freshwater and allowed to drain away to near empty. A total of three tests were completed; one at each trial pit. During each test, the soil infiltration rate was calculated from the time taken for the water level in the pit to fall from 75% to 25% of the effective storage depth. The fall in water level during each test was recorded.

The results of the infiltration testing are provided in Table 1. The tests show that the infiltration rates for all three pits (TP1, TP2 and TP3) are sufficient to be a viable method for disposing of surface water runoff by infiltration to ground.

Table 1 Soil Infiltration Rate Testing Results

Trial Pit	Calculated Soil Infiltration Rate (m/s)
TP1	1.36×10^{-5}
TP2	7.28×10^{-6}
TP3	5.99×10^{-6}

3 SuDS HIERARCHY ASSESSMENT FOR DISCHARGES

The CIRIA C753 SuDS Manual 2015 [Ref. 1] and Building Regulations 2010 (2015 edition) Part H3 – Drainage and Waste Disposal [Ref. 2] state that a surface water drainage system shall dispose of runoff to one of the following listed in order of priority:

- Into the ground (infiltration) – an adequate soakaway or other infiltration system; or, where it is not reasonably practicable;
- A watercourse or surface water body; or where it is not reasonably practicable;
- A public sewer.

In line with the SuDS hierarchy, each surface water discharge method has been considered for the Site in sequential order.

3.1 Infiltration

The first preference is to discharge surface water runoff generated over developments via infiltration based methods.

Soil infiltration testing carried out at the Site (Table 1) concluded that the soils have a sufficient permeability to be a viable method for the disposal of surface water runoff from the developments.

3.2 Watercourse/Surface Water Body

If it is not possible to discharge surface water via infiltration, then the secondary preference is to discharge to a watercourse or surface water body.

The nearest receiving watercourse is the Ferring Rife which flows approximately 100m to the south of the Littlehampton Road, in an east to west direction within a residential area of Ferring village. A connection to the Ferring Rife would require significant ground and drainage works. The size and nature of the developments also does not warrant the cost and disruption caused by the associated works.

3.3 Public Sewer

If it is not possible to discharge surface water to a watercourse or surface water body then the final preference is to discharge to a local public sewer network.

The Littlehampton Road drainage system could provide a means of discharging surface water from the developments. However, a connection would require ground and drainage works.

3.4 Summary

Based on the above, the most suitable method for disposing of surface water from the developments is by infiltration given the results of the soil infiltration testing carried out at the Site.

4 SITE SURFACE WATER DRAINAGE SCHEME

4.1 Developments

The layout of the developments and the proposed drainage scheme are shown on Figure 2.

The Site covers a total area of approximately 13,500m². Polytunnel structures (695m²), concrete access pathways (360m²), welfare facilities with roof space (50m²), trolley store and concrete crossover pad (85m²), and general store with roof space (25m²) are to be constructed at the Site forming a total impervious area of 1215m².

Other developments of a permeable nature include: outdoor growing beds (965m²), plant beds (420m²), a drive/access track (350m²), and a yard area (1210m²). The remainder of the land at the Site will remain as grassed ground. The permeable development areas form a total footprint of 2945m².

4.2 Design and Arrangement

The overall design of the drainage scheme is to intercept and contain runoff generated over the developments and promote infiltration to ground in a series of stages across the Site, thus resulting in low runoff velocities and low runoff volumes being generated.

Runoff generated over the polytunnel structures will fall directly into gutters which are secured into the Y piece of the polytunnel stands and anchored to the steel hoop arches. Down pipes are fitted at the end of each polytunnel structure and drain collected runoff via a gravel strip drain, sloping to a soakaway trench running along the entire length of the polytunnels. The soakaway trench will also receive runoff from the concrete pathways skirting the polytunnels.

The soakaway trench measures 29m long, 0.4m wide and 1m deep with an effective storage capacity of 3.5m³ and is designed as an initial interception, containment and infiltration area for runoff during normal rainfall events. During storm events, the storage capacity within the soakaway trench will be exceeded and any surface water that is unable to infiltrate will initiate as low velocity overland flow draining to the adjacent outdoor growing beds or plant beds where runoff will be further contained and allowed to infiltrate to ground.

The outdoor growing beds will form a further soakaway and runoff containment area with a total footprint of 1265m². The growing beds are constructed with a layer of 20mm gravel spread beneath the entire bed areas. Similarly, the plant beds will also contain a layer of gravel, containing runoff and promoting infiltration to ground in these areas. From these areas, runoff that is unable to infiltrate will drain to the permeable access track and yard area at the southern and eastern sections of the Site.

The access track and yard area will form the principal soakaway area for the management of storm water runoff. The principal soakaway area has a footprint of 1560m² and is comprised of a crushed concrete sub-base to a minimum depth of 0.6m with a 0.05m road planning surface. The effective storage capacity within the principal soakaway area has been calculated as 187m³. This includes a porosity value for the crushed concrete sub-base backfill of 20%.

The drained area to the principal soakaway incorporates the access track and yard footprint, polytunnels, concrete pathways and a portion of the trolley store and concrete crossover pad totalling 2655m². Runoff over the roof spaces of the welfare facilities and storage building will drain via a down pipe directly into the principal soakaway.

Soil infiltration testing at the Site resulted in calculated infiltration rates of between 5.99×10^{-6} - 1.36×10^{-5} m/s (Table 1). A representative infiltration rate for the principal soakaway area has been derived from the trial pits closest to the soakaway area (TP1 and TP3), resulting in a rate of 9.78×10^{-6} m/s. Using the rate of 9.78×10^{-6} m/s and footprint of the principal soakaway, results in the loss of water to the ground from the soakaway area that is equivalent to a discharge rate of circa. 15 l/s.

4.3 Storm Water Storage Requirements

An assessment of the storm water storage requirement for a 1 in 100 year design storm (+5% climate change allowance for increases in peak rainfall intensity) has been undertaken using a Flood Estimation Handbook (FEH) 2013 rainfall frequency-duration model. A 5% climate change allowance, in line with the latest statutory guidance for flood risk climate change allowances [Ref. 3] has been adopted.

The model incorporates the positively drained area (2655m²), principal soakaway area (1560m²) and loss of water to the ground within the soakaway at circa. 15 l/s to estimate the storm water storage requirement. The graphed output from the assessment is presented in Figure 3. The storm water storage requirement is estimated to be 63m³. The soakaway trench and the principal soakaway area have a combined storage capacity of 190m³ and therefore have sufficient capacity to accommodate a 1 in 100 year storm (+5% climate change allowance).

The soakaway trench and the gravel beds have the capacity to accommodate a 1 hour, 1 in 1 year storm event before spilling to the principal soakaway area.

5 MANAGEMENT, MAINTENANCE AND ADOPTION

As part of the active management of the surface water drainage scheme, a maintenance and monitoring schedule for the drainage network is required to ensure efficient operation and prevent failures.

The drainage system design takes account of the construction, operation and maintenance requirements of both surface and subsurface components, allowing for any personnel, vehicle or machinery access required to undertake this work. The drainage system will be adopted, managed, and maintained by the site operators Quercus Nursery Ltd. A maintenance activity plan is provided in Table 2.

Table 2 Drainage Scheme Maintenance Activity Plan

	Maintenance Activity	Frequency of activity						
		After Rainstorm	Daily	Weekly	1 monthly	3 monthly	6 monthly	12 monthly
	Principal Soakaway Area							
1	Removal of debris / vegetation / silt build-ups	x			x			
2	Hand pull or spot treat individual weed growth				x			
3	Mow grass edges of soakaway area at minimum 100mm				x			
4	Remedial works - monitor effectiveness of soakaway. Reinstatement of top layers or cleaning							x
5	Record maintenance inspection in log book	x			x			x
	Polytunnel and Building Guttering							
6	Check gutters / downpipes are undamaged, securely fitted and are not loosely fitted				x			
7	Remove any debris / silt present. Check for a clear outfall and if so flush channel with clean water							
8	Record maintenance inspection in log book	x			x			
	Soakaway Trench							
9	Inspection for abnormalities	x			x			
10	Flush to clear sediment collection or remove sediment accumulation	x			x			
11	Hand pull or spot treat individual weed growth				x			
12	Record maintenance inspection in log book	x			x			

Post-implementation of the drainage scheme, the situation will be monitored to ensure the drainage system is behaving in the way described. If it is perceived that this is not the case, then additional mitigation measures should be put in place and the principal of runoff attenuation reviewed. Should the control measures not be sufficient to manage attenuate surface runoff, additional measures will need to be incorporated following discussion with the local planning authority, Arun District Council.

Should Quercus Nursery Ltd sell or lease the land and the proposed developments and drainage system are still to be used, then there will be a legal agreement put in place with the lease holder or new land owner to manage and maintain the drainage system.

6 SUMMARY

- Soil infiltration testing has been undertaken at the Site. It concluded that the use of infiltration methods would be a viable method for disposing of surface water runoff generated over the developments.
- A SuDS drainage hierarchy assessment for the developments has been undertaken. It concluded that the use of infiltration methods would be the most suitable and viable option for disposing of surface water runoff.
- A sustainable surface water drainage scheme for the Site that satisfies the SuDS hierarchy has been developed. The scheme is designed to intercept, contain runoff generated over the developments and promote infiltration to ground in a series of stages across the Site. A principal soakaway area (access track and yard area) will provide sufficient storm water storage capacity for the impervious developments and areas at the Site.
- FEH2013 rainfall frequency-duration curve modelling has shown that the principal soakaway area at the Site has sufficient capacity to accommodate a 1 in 100 year storm event (plus 5% climate change allowance) with a loss of water to ground from the principal soakaway area that is equivalent to a discharge rate of circa. 15 l/s (based on effective soakaway area and calculated soil infiltration rate).
- The proposed drainage scheme will be adopted and maintained by the site operators, Quercus Nursery Ltd. A maintenance activity plan has been drawn up for the developments.

Envireau Water

13th March 2018

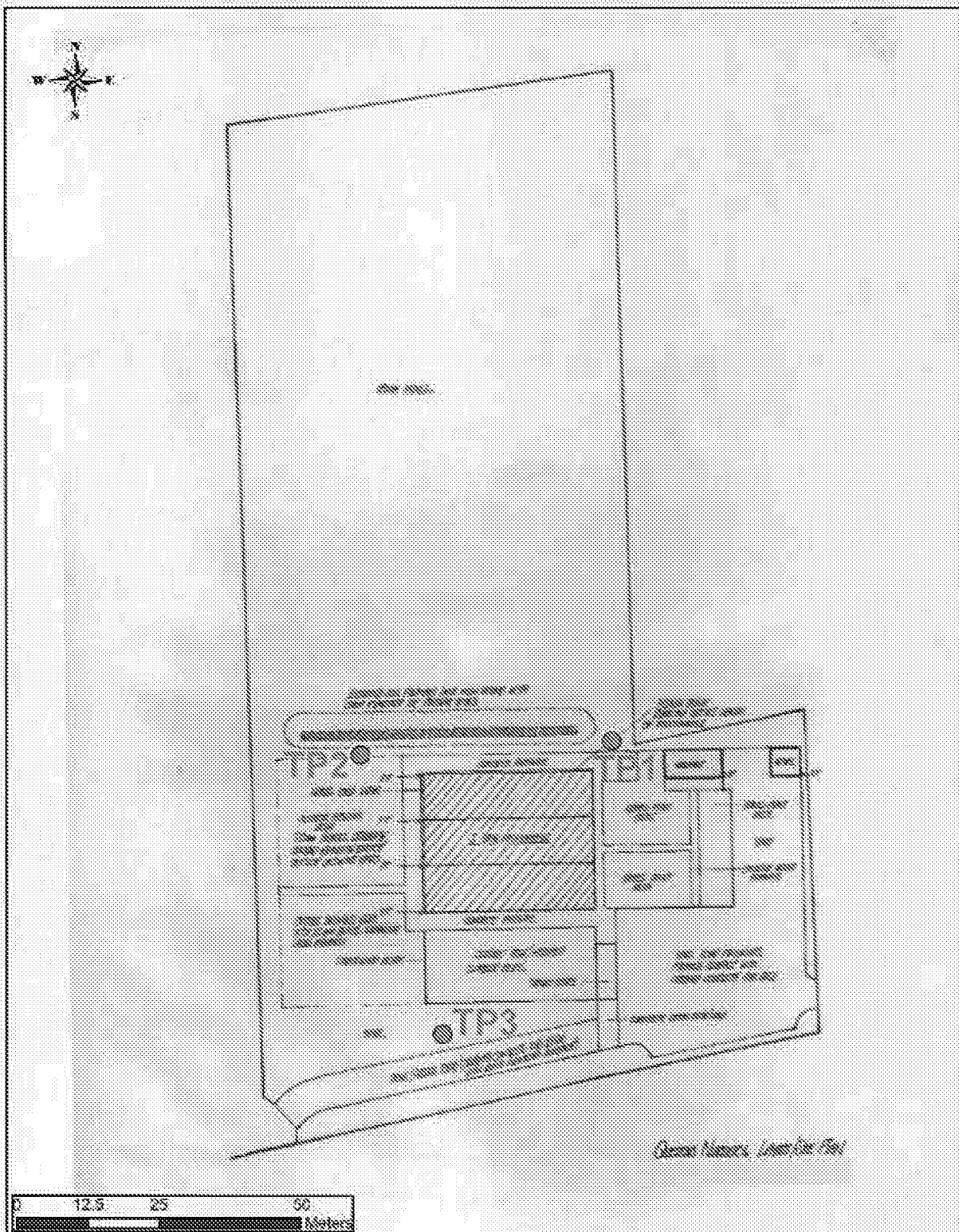
7 REFERENCES

Ref. 1: CIRIA. (2015). C753 SuDS Manual.

Ref. 2: Building Regulations 2010 (2015 edition) Part H3 – Drainage and Waste Disposal.

Ref. 3: Environment Agency. (2016). Flood Risk Assessments: Climate Change Allowances.
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>.

FIGURES



KEY

- Trial pit for soil infiltration testing

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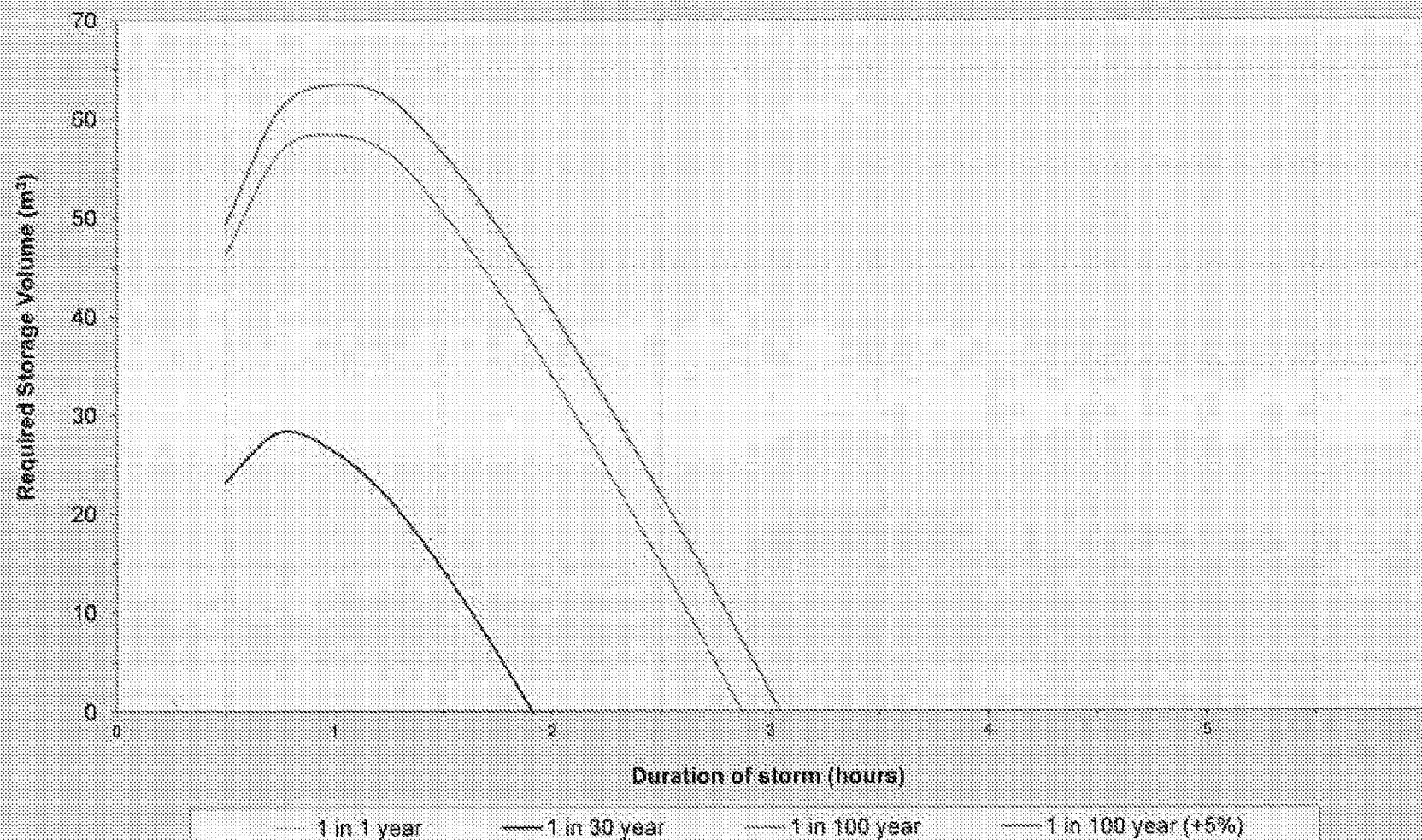
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Figure 1

Soil Infiltration Testing Locations

**FEH2013 Rainfall Frequency-Duration Curves for Storm Water Storage Volume
Assessment (Incorporating loss of water to ground within access track/yard (principal)
soakaway area at circa. 15 l/s)**



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Figure 3

FEH2013 Model - Principal Soakaway Storm Water Storage Requirement