
Sandgate Nurseries, Henfield

Flood Risk Assessment & Drainage Strategy Report

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Job Number: **30512**

Date	Revision	Notes/Amendments/Issue Purpose
September 2024	P05	Revised water treated report added
October 2024	P06	Amendments following Natural England comments
February 2025	P07	Revised to address Natural England comments
October 2025	P08	Revised EA flood maps as per LLFA comments
December 2025	P09	Water Neutrality section removed

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Acronyms	
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Survey
CIRIA	Construction Industry Research and Information Association
DCG	Design and Construction Guidance
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
PRA	Preliminary Risk Assessment
SFRA	Strategic Flood Risk Assessment
SWMP	Surface Water Management Plan
SuDS	Sustainable Drainage Systems

1 Introduction

Price & Myers have been commissioned to undertake a Flood Risk Assessment (FRA) and Drainage Strategy report for the proposed development at Sandgate Nurseries, located off West End Lane which forms part of West Sussex County Council and Horsham District Council.

The National Planning Policy Framework (NPPF) states that an appropriate FRA will be required for all development proposals of 1 ha or greater in Flood Zone 1 and for any development within Flood Zones 2 or 3.

The EA's flood risk map for planning shows that the site is in Flood Zone 1, however the total site area is greater than 1 ha. This assessment will therefore focus on the flood risk stormwater management, as well as assessing the flood risk from all other sources.

This report will also outline the proposed drainage strategy for the site including a detailed Sustainable Drainage Systems (SuDS) assessment.

1.1 Relevant Policy

This FRA has been carried out in accordance with the NPPF and the accompanying Planning Practice Guidance (PPG) "Flood Risk and Coastal Change". This FRA also incorporates advice and guidance from the Environment Agency (EA), the Horsham District Council Strategic Flood Risk Assessment (SFRA) (2010), The West Sussex LLFA Policy for the Management of Surface Water (2018) and CIRIA documents.

The surface water drainage strategy is in accordance with:

- the Department for Environment, Food and Rural Affairs (DEFRA) "Non-Statutory Technical Standards for Sustainable Drainage Systems".
- the Lead Local Flood Authority (LLFA) guidance document on SuDS/Drainage.

2 Site Description and Location

The site is located off West End Lane, within West Sussex County Council and Horsham District Council. The full site address is Sandgate Nurseries, West End Lane, Henfield, Horsham, West Sussex, BN5 9UL. The OS grid reference is 520425 X, 116061 Y.

The site occupies an area of approximately 38,007m² (3.80 ha), the majority of which comprises of soft landscaping. The site can be accessed via an access road from West End Lane which leads to the existing vacant garden nurseries and associated structures (sheds and glasshouses).

The site is bound by West End Lane to the North, residential dwellings to the east, Hollands Lane to the south and a residential dwelling and agricultural land to the west.

The topographical survey for the site (available in Appendix A) shows that the levels in the northern half of the site generally fall from east to west, with levels ranging from approximately 21mAOD to 17mAOD. The southern half of the site generally slopes to the south towards a level of 16mAOD.



Figure 2.1: Existing site, showing site boundary

2.1 Existing Drainage

Due to the nature of the existing structures, it is assumed that there is no private drainage that serves the existing site.

The Southern Water Sewer Records show that the closest public sewer to the site is a 225mm diameter public foul water sewer and foul water pumping chamber that is located in Hollands Lane to the south-east corner of the site.

The Southern Water Sewer Records are available in full in Appendix B.



Figure 2.2: Southern Water Sewer Records.

3 Development Proposal

The Outline application for erection of an extra care retirement community of up to 72 units of accommodation (Use Class C2) and up to 10 supported living units (Use Class C3) with associated community facilities including medical centre and on-site laundry and catering facilities, with access, infrastructure, open space, landscaping and associated works (all matters reserved except for access).

The proposed development proposals are available in full in Appendix C.



Figure 3.1: Proposed layout

4 Flood Risk Assessment

4.1 Flood Risk from Watercourses

The EA's flood map for planning shows that the site is located in Flood Zone 1 and is at very low risk of flooding (less than 0.1% annual probability of river or sea flooding) from watercourses. Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.

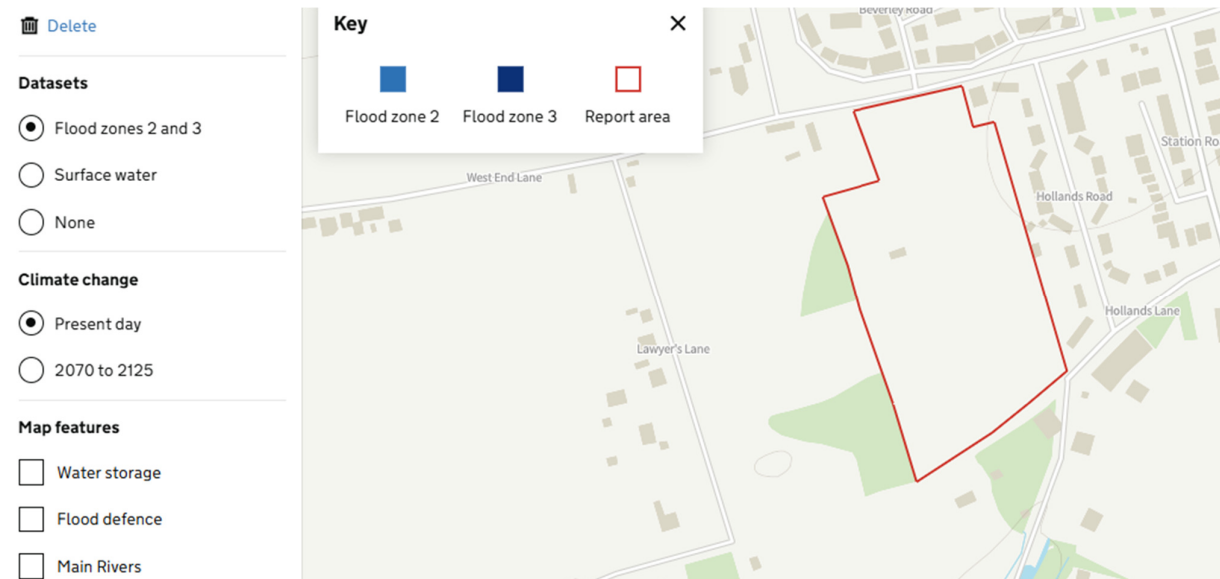


Figure 4.1: EA Flood Map for Planning

The map also indicates that the site is expected to remain in Flood Zone 1 between the years 2070 and 2125, as shown in Figure 4.2.

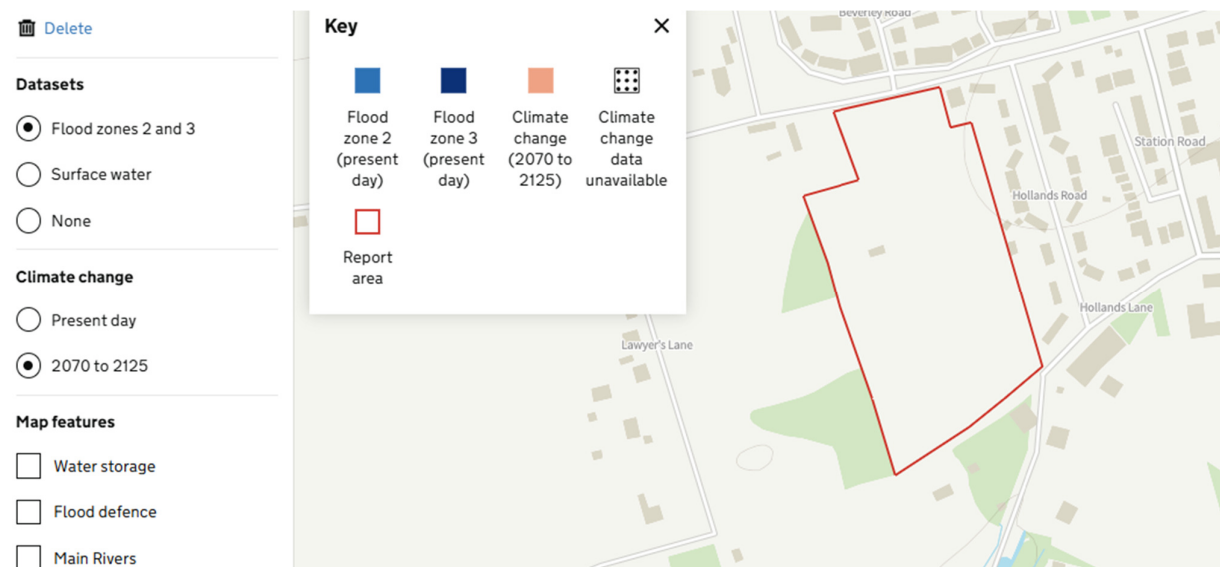


Figure 4.2: EA Flood Map for Planning, between the years 2070 to 2125

4.2 Flood Risk from Groundwater

Groundwater flooding occurs when water originating from sub-surface permeable strata emerges from the ground, typically after prolonged rainfall.

A Preliminary Risk Assessment (PRA) was carried out by Aviron Associates Ltd in August 2022. The report includes information on the anticipated geology based on information provided by the British Geological Survey (BGS). The BGS data shows that the site comprises of superficial deposits of Brighton and Worthing (clay, silt, sand and gravel). The bedrock geology comprises of Lower Greensand Group (sandstone).

The report contains recorded borehole logs for historical drilling or excavation works within 1000m of the site. Out of the five closest borehole logs, the shallowest groundwater level was recorded at a depth of 7.4m below ground level (bgl).

Furthermore, the proposals do not comprise of lower ground floors or basements which are more prone to groundwater flooding. Therefore, the risk of flooding from groundwater is considered to be very low.

4.3 Flood Risk from Surface Water and Overland Flows

Surface water flooding occurs when intense rainfall is unable to soak into the ground or enter a drainage system due to blockages or the capacity of the system being exceeded. Overland flows can also be generated by burst water mains, failed dams and any failure in a system storing or transferring water.

The EA's surface water flooding map, Figure 4.3, shows that the majority of the site is at very low risk of surface water flooding (a chance of flooding of less than 0.1% each year). A small area to the north of the site, adjacent to the existing access road, is at low risk (between 0.1% and 1% chance of flooding each year) to high risk (more than 3.3% chance of flooding each year) of surface water flooding. A small, narrow strip of land along the western boundary is also shown to be at low risk of surface water flooding.

The map indicates that these areas are expected to remain at low to high risk of surface water flooding between the years 2040 and 2060 due to the effects of climate change, as shown in Figure 4.4.

Ground levels from the topographical survey indicate that the northern section of the site, which is at low to high risk of surface water flooding, corresponds to a local low point where surface water from the site may naturally accumulate due to existing ground levels, rather than being part of a defined surface water flow path. As part of the proposed development, this area will be retained as soft landscaping, incorporating meadow and native shrub planting, with the ground levels regraded. Therefore, the overall surface water flood risk to the development is considered to be very low.

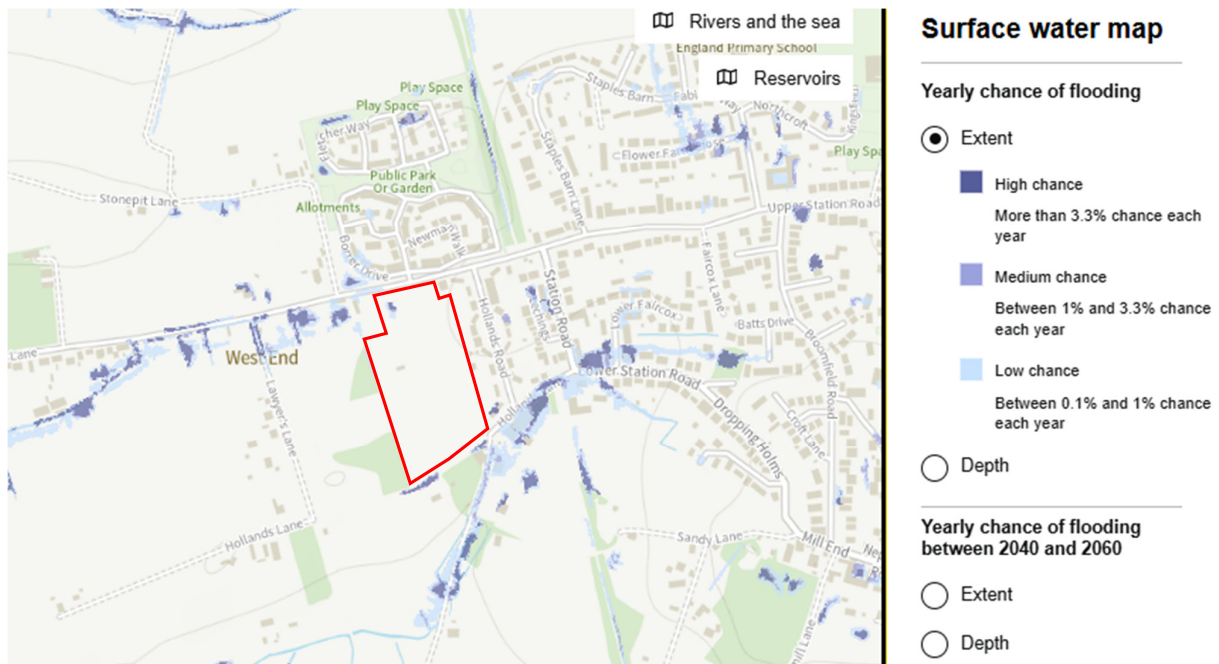


Figure 4.3: EA Surface Water Flood Risk Map

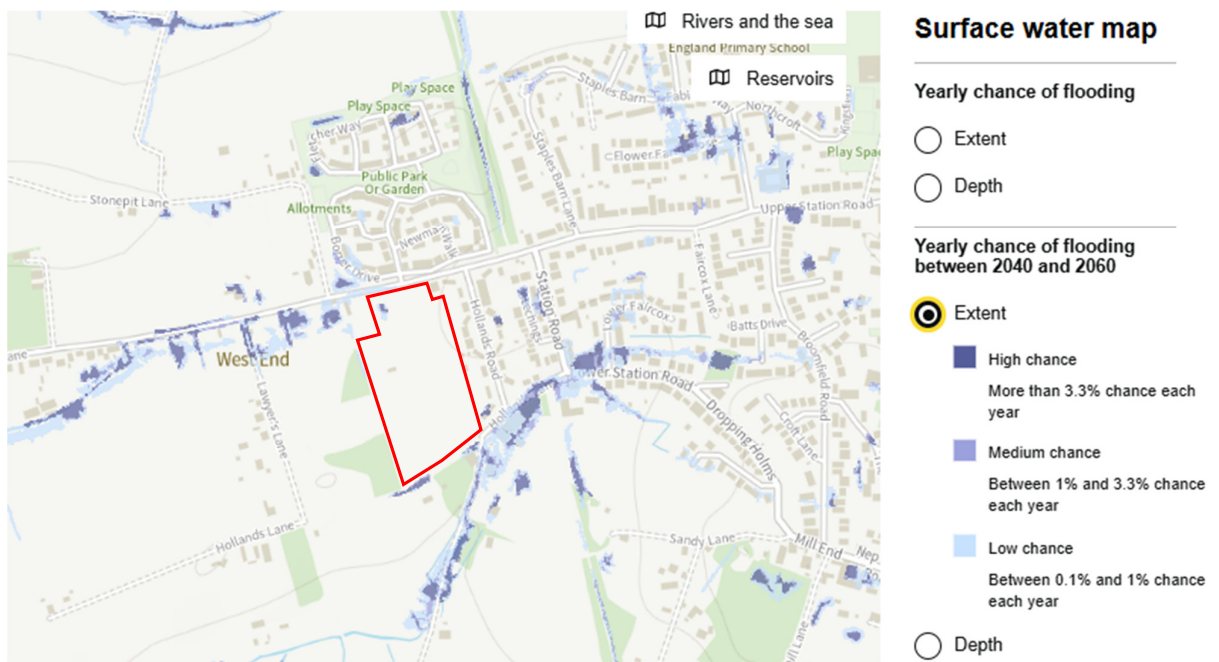


Figure 4.4: EA Surface Water Flood Risk Map, between the years 2040 and 2060

The Flood Estimation Handbook (FEH) hydraulic catchment information that covers the site is shown in Figure 4.5. The site is seen to be located near the upper edges of the catchment, with a small area of land in the catchment located to the north. Therefore, it is expected that there will not be significant overland flow from these areas entering the site. This is especially evident when considering that any upstream catchment flows will have to cross West End Lane, which is assumed to have a formal drainage arrangement, as well as upstand kerbs which provide barriers to overland flows.

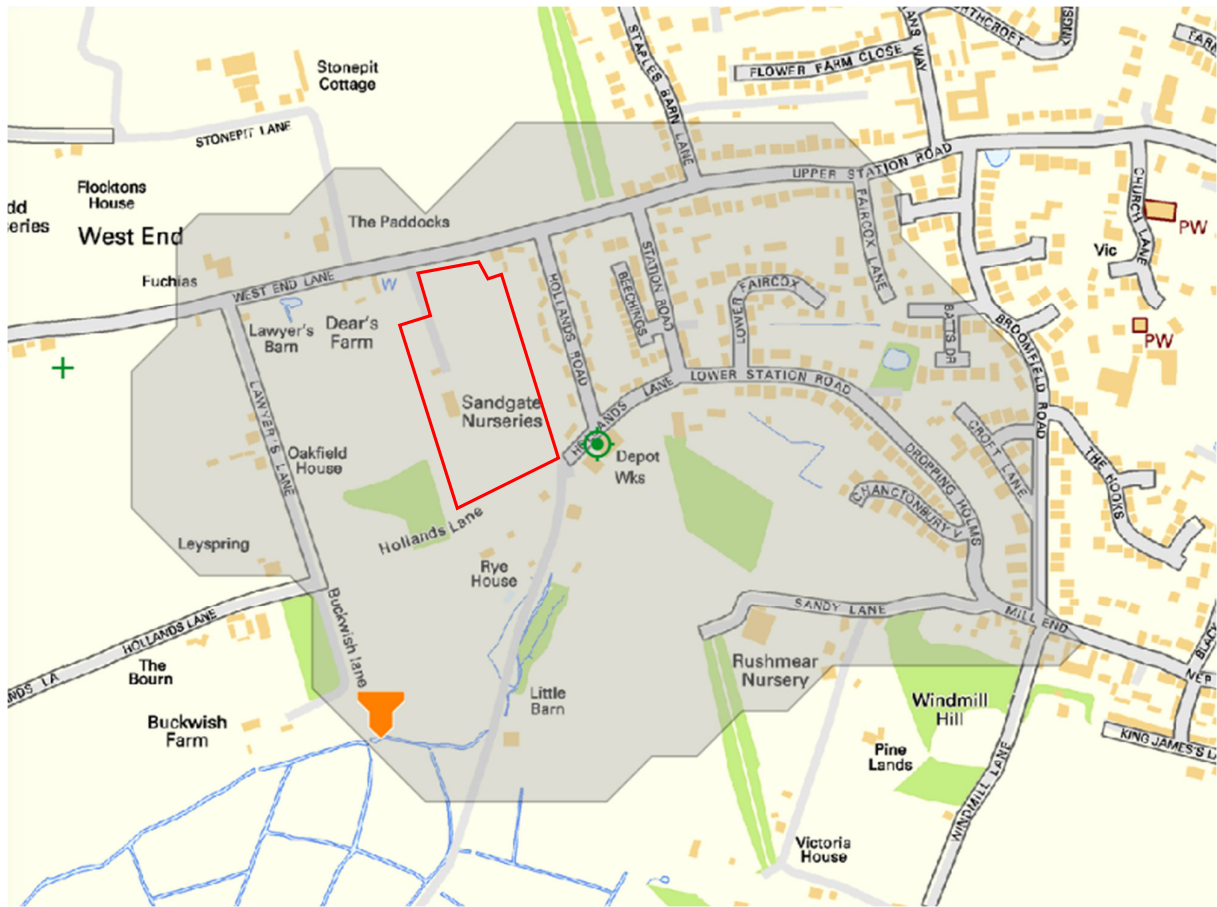


Figure 4.5: UK Centre for Ecology & Hydrology: Flood Estimation Handbook Catchment Outline

4.4 Flood Risk from Reservoirs

The EA provides information on flood risk from reservoirs. The map showing the maximum extent of flooding from reservoirs was updated in 2021 and now shows the combined effects of flooding from reservoirs and rivers. The Figure 4.6 overleaf shows that the site is at very low risk of reservoir flooding.



Figure 4.6: EA Risk of Reservoir Flooding Map

4.5 Flood Risk from Sewers

Sewer flooding occurs when the flow entering the sewerage network is greater than the capacity of the sewers.

There are no surface water sewers in close proximity to the site. Therefore, the risk from sewer flooding is very low.

5 Surface Water Run-off Assessment

The total site area is approximately 38,000m² or 3.80 ha which can largely be described as greenfield land. The proposed impermeable areas total to approximately 16,500m² or 1.65 ha.

The existing greenfield run-off rates, of the new impermeable areas, for storm events of several different return periods were calculated using the Greenfield Run-off Estimator tool from uksuds.com, as shown below. Supporting documentation is contained in Appendix D.

$Q_{1 \text{ Gr}}$	=	5.3 l/s
Q_{BAR}	=	6.3 l/s
$Q_{30 \text{ Gr}}$	=	14.4 l/s
$Q_{100\text{Gr}}$	=	23.4 l/s

5.1.1 Climate Change

The EA's Climate Change Allowances for Peak Rainfall in England Maps show that the site is within the Adur and Ouse Management Area. These maps show that the upper end allowance of 45% must be used in the hydraulic calculations for the proposed development.

6 SuDS Strategy

In accordance with EA guidelines and CIRIA documents, surface water run-off should be managed as close to its source as possible. The West Sussex LLFA Policy for the Management of Surface Water states that the following drainage hierarchy should be used to determine run-off destination.

6.1.1 Rainwater Used as a Resource (e.g., Rainwater Harvesting)

Rainwater harvesting promotes the storage and re-use of rainwater collected from roofs and hard surfaced areas. This type of system contributes to the reduction of runoff rates and volumes within a development.

There is potential to implement rainwater harvesting tanks on the individual dwellings to collect surface water runoff from the roof areas.

The capacity of rainwater harvesting systems to attenuate rainwater depends on the water use within the building. If there is no activity in the building or other water use and the harvester is full, no attenuation will be provided during a subsequent storm event. In the worst case scenario, the rainwater harvester will provide no attenuation.

6.1.2 Infiltration Into the Ground

Infiltration testing to BRE365 was carried out on site in March 2023 by Land Science. Three tests were carried out. Two of the three tests failed to infiltrate 50% of the required water depth demonstrating the soil conditions are not suitable permeable (see Appendix E). Therefore, soakaways or other infiltration systems are not considered to be viable for surface water disposal.

6.1.3 To a Surface Water Body

There is an existing watercourse located along the unnamed road that splits Hollands Lane to the north west and the Southern Water pumping station to the east. An adequate discharge point to this watercourse is located approximately 320m down the unnamed road from the fork with Hollands Lane (N:520459, E:115604). According to LIDAR data, at the discharge point, the watercourse has a base level of approximately 2.60 mAOD and a bank level of approximately 3.40 mAOD. From here the watercourse flows, out of the catchment, south east for approximately 1.50 km, through undeveloped fields, until its confluence with the River Adur.

It is proposed to make a new connection to the watercourse from the proposed surface water drainage system that will serve the development. The discharge rate will be restricted to 5.3 l/s, the Q_1 greenfield runoff rate for the drainage area, for all storm events up to and including the 100 year plus 45% climate change event, in line with the West Sussex LLFA Policy for the Management of Surface Water. The watercourse is an ordinary watercourse and an application for Ordinary Watercourse Consent will be made with Horsham District Council.

Due to the large change in levels, of approximately 10m, from the flow control on site to the outfall along with satisfactory channel depth and conveyance routes, this discharge location is suitable even in high water levels.

Based on a development impermeable drained area of 1.65 ha and allowing for 10% urban creep (1.815ha), preliminary calculations have been carried out to determine the volume of attenuation

storage required to restrict the discharge rate to 5.3 l/s for the 100 year plus 45% climate change event which show that approximately 1,750m³ of storage is required (see Appendix F- please note that FEH 22 data for the site has been used however, the MicroDrainage printout incorrectly indicates the rainfall version used is FEH 13).

The attenuation storage will be provided in four detention basins. Three are located along the western boundary of the site, together with one in the south eastern corner. The detention basin will not only provide attenuation storage but will additionally provide biodiversity and amenity benefits to the site. Permeable paving is proposed to be incorporated into the private driveways and hardstanding areas. Rainwater harvesting will also be incorporated and the use of hybrid systems that provide attenuation and rainwater harvesting will be incorporated at detailed design stage. The below ground drainage strategy drawing is available in Appendix F.

6.2 Water Quality

SuDS have the potential to provide water quality benefits to run-off entering the environment. The SuDS Manual states that SuDS should be designed to treat run-off to reduce the risk of environmental pollution. Chapter 26 of The SuDS Manual sets out the 'simple index approach' to water quality risk management. This approach has been used to quantify the benefits of the proposed SuDS scheme on water quality.

Step 1 of the simple index approach is to identify the pollution hazard indices for the proposed land use. The proposed residential development is considered to have a 'very low' pollution hazard level and Table 6.1 below shows the associated pollution hazard indices:

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs	Low	0.3	0.2	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change	Low	0.5	0.4	0.4

Table 6.1: Pollution Hazard Indices, taken from Table 26.2 of The SuDS Manual (CIRIA, 2015)

Step 2 of the simple index approach is to select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index.

As the destination of the runoff is to a watercourse, the surface water pollution mitigation indices should be used as shown in Table 6.2 below:

Type of SuDS Component	TSS	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6

Table 6.2 Surface Water Pollution Mitigation Indices, taken from Table 26.3 of The SuDS Manual

Provided that the mitigation indices of the treatment techniques are greater than or equal to the hazard indices for the proposed development then there should be no reduction in the overall water quality within the receiving watercourse or groundwater body. Therefore, the incorporation of permeable paving and detention basins will provide suitable prevention from pollution to the receiving surface water bodies.

7 Surface Water Maintenance Strategy

The successful implementation and operation of a SuDS system depends on a robust and clear maintenance strategy being implemented. The following measures should form part of the site's proposed management plan.

It is envisaged that the majority of the SuDS will be maintained by the client and will form part of the overall maintenance regime for the site.

SuDS Element	Maintenance		
	Activity	Required Action	Typical Frequency
Detention Basins	Monitoring / Inspections	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
		Inspect banksides, structures, pipework etc. for evidence of physical damage	
		Inspect infiltration surfaces for compaction and ponding	
		Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Regular Maintenance	Remove litter, debris and trash	Monthly
		Cut grass – for landscaped areas and access routes	Monthly during growing season or as required
		Cut grass – meadow grass in and around basin	Half yearly: before nesting season in spring and in autumn
		Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Occasional Maintenance	Reseed areas of poor vegetation growth	Annually, or as required
		Prune and trim trees and remove cuttings	As required
		Remove sediment from pre-treatment system when 50% full	
	Remedial Actions	Repair erosion or other damage by reseedling or re-turfing	As required
		Realign the rip-rap	
		Repair or rehabilitate inlets, outlets and overflows	
		Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	
		Relevel uneven surfaces and reinstate design levels	

SuDS Element	Maintenance		
	Activity	Required Action	Typical Frequency
Permeable Paving	Monitoring / Inspections	Initial inspection	Monthly for three months after installation
		Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hours after large storms in first six months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually
	Regular Maintenance	Brushing and vacuuming -standard cosmetic sweep over whole surface	Once a year after autumn leaf fall
		Rubbish and litter removal	As required
	Remedial Actions	Remediate any landscaping which through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required
		Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	
		Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required

Table 7.1: SuDS Maintenance Strategy

Effective SuDS design must assess all foreseeable risks during construction and maintenance. These must be mitigated during the detailed design stages where effective design will aim to avoid, reduce and mitigate risks.

This process will also require input from the principal contractor who will ensure the construction of SuDS components are carried out in a safe and sustainable manner.

8 Foul Water Assessment

As outlined in Section 2.1, it is assumed that there is no private drainage that serves the existing site. Therefore, the foul water drainage from the site is proposed to connect to the public foul water sewer located in Hollands Lane via a new gravity connection.

All proposed networks will be designed to Adoptable Standards as outlined in the Design and Construction Guidance (Appendix C of the Sewerage Sector Guidance in relation to the adoption of sewerage assets) (DCG) and in accordance with Building Regulations Part H.

The proposed peak foul water flows from the site are calculated using the figure of 4000 l/dwelling/day as outlined in the DCG.

The development will include the construction of 82 residential dwellings which, assuming a total gravity connection, equates to a potential proposed peak foul water flow of:

$82 \text{ dwellings} \times 4000 \text{ l/dwelling/d} = 3.8 \text{ l/s.}$

Water efficient and smart metering devices will be provided to reduce the water consumption of the development to 110 l/person/day

A 'Pre-development Enquiry' will be submitted to Southern Water to confirm capacity exists within the receiving public sewers.

A Section 106 application will be made to the Water Authority for consent to connect to the public sewer.

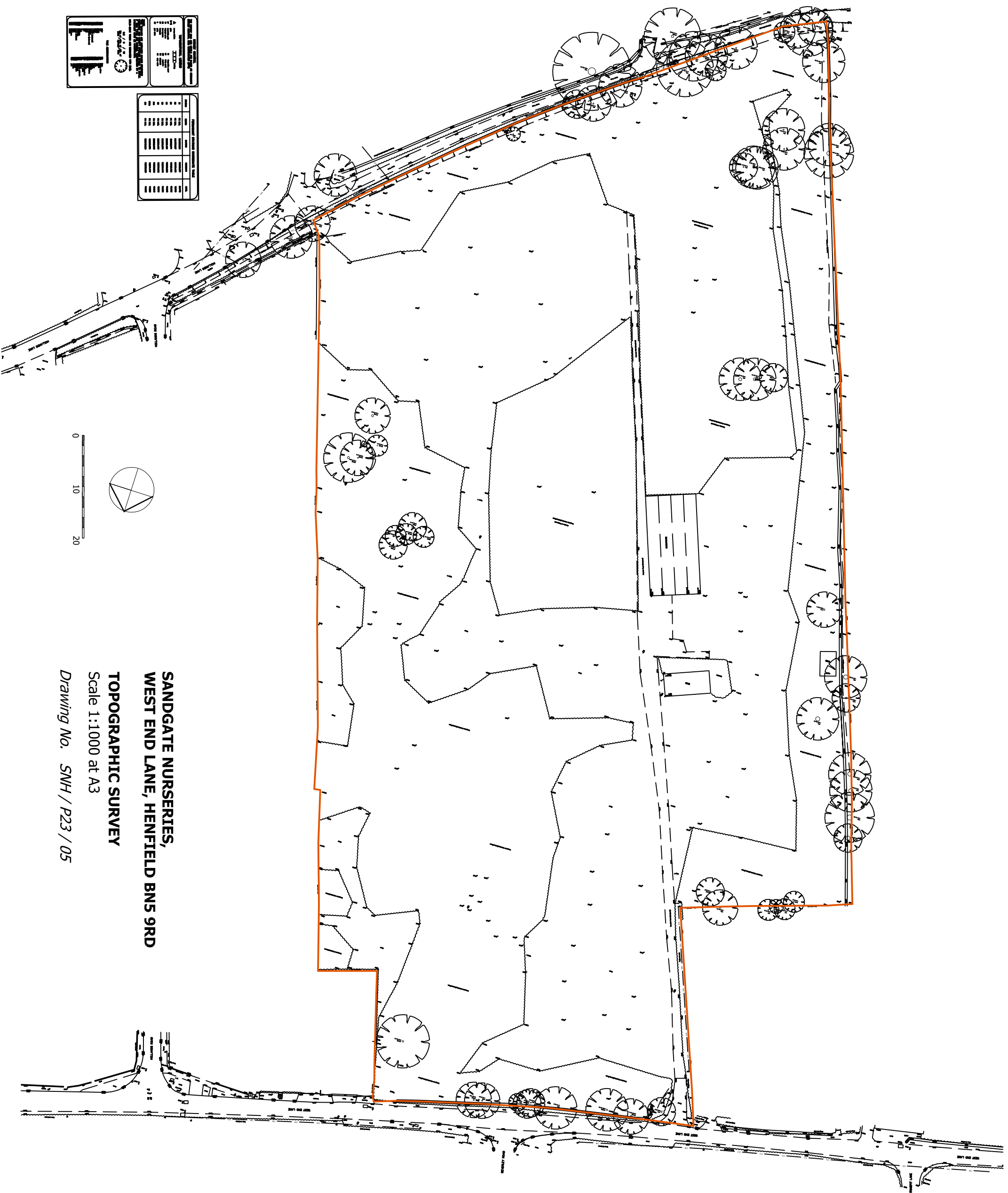
9 Conclusions

- The site is located off West End Lane, within West Sussex County Council and Horsham District Council. The full site address is Sandgate Nurseries, West End Lane, Henfield, Horsham, West Sussex, BN5 9UL. The OS grid reference is 520425 X, 116061 Y.
- The development proposals comprise of the erection of a continuing care retirement community of up to 72 units of accommodation and up to 10 starter homes with associated community facilities including a medical centre and on-site laundry and catering facilities, with access, infrastructure, open space, landscaping and associated works (all matters reserved except for access).
- The EA's flood map for planning shows that the site is located in Flood Zone 1 and is at very low risk of flooding (less than 0.1% annual probability of river or sea flooding).
- The development is considered to be at very low risk of flooding from groundwater, surface water, reservoirs and sewers.
- The surface water drainage strategy includes shallow permeable paving for all driveways. The remainder of the hardstanding areas will be attenuated by four Detention Basins, totalling 1,760m³ and discharging at a combined rate of 5.3 l/s for the 100 year plus 45% climate change event. Rainwater harvesting will also be incorporated and the use of hybrid systems that provide attenuation and rainwater harvesting will be incorporated at the detailed design stage.
- The surface water will discharge to an existing unnamed ordinary watercourse located approximately 320m down the unnamed road from the fork with Hollands Lane (N:520459, E:115604). The watercourse has an approximate base level of 2.60 mAOD and a bank level of approximately 3.40 mAOD. Ordinary Watercourse Consent will be acquired.
- The foul water drainage from the site is proposed to connect to the public foul water sewer located in Hollands Lane via gravity. Water efficient and smart metering devices will be provided to reduce the water consumption of the development to 110 l/person/day.

Appendix A

Topographical Survey



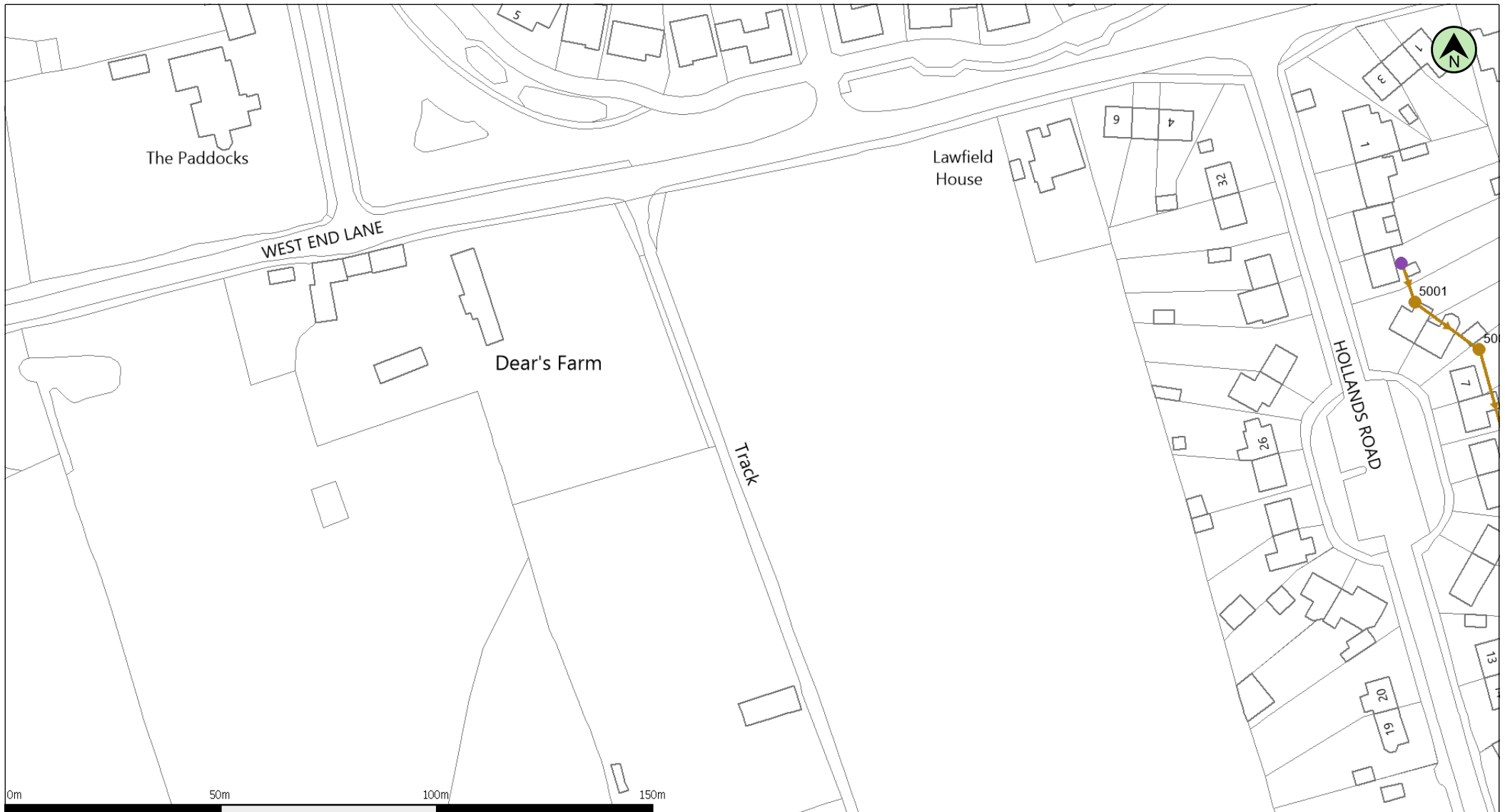


TOPOGRAPHIC SURVEY

Drawing No. SNH / P23 / 05

Appendix B

Southern Water Sewer Records



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Date: 18/08/22

Scale: 1:1250

Map Centre: 520408,116070

Data updated: 21/07/22

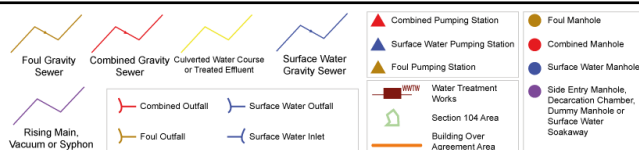
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Wastewater Plan A4

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



nauvinen@pricemyers.com

30512 Sandgate Nur2



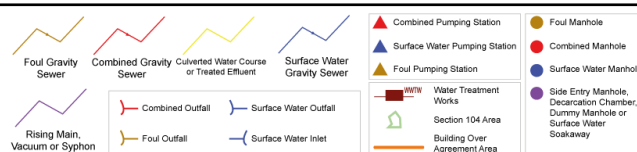


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The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

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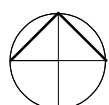
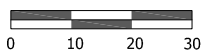
nauvinen@pricemyers.com

30512 Sandgate Nur1



Appendix C

Proposed Development Plans



**SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD**

LOCATION PLAN

Scale 1:1250 at A3

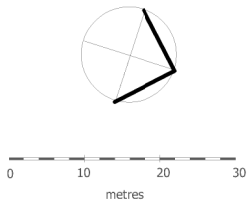
Drawing No. SNH / P23 / 01

**SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD**

PROPOSED SITE LAYOUT

Scale 1:1000 at A3

Drawing No. SNH / P23 / 02 Rev. B



SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD



PROPOSED FLOOR PLANS : SEMI DETACHED UNITS

Scale 1: 200 at A3

Drawing No. SNH / P23 / 04

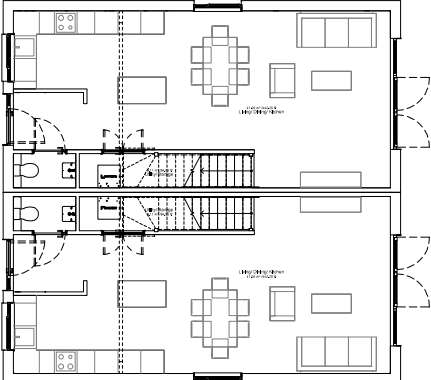
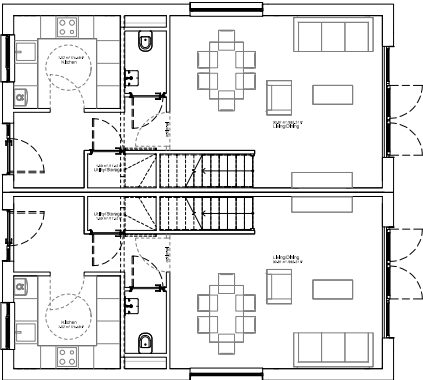
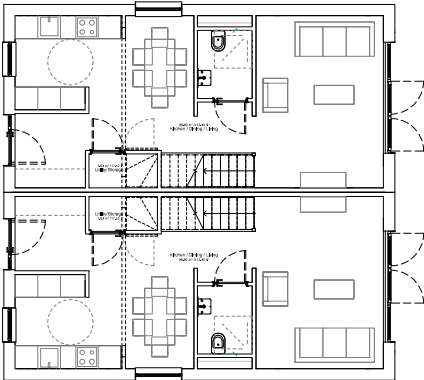
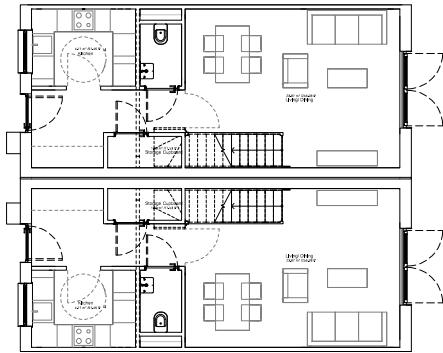
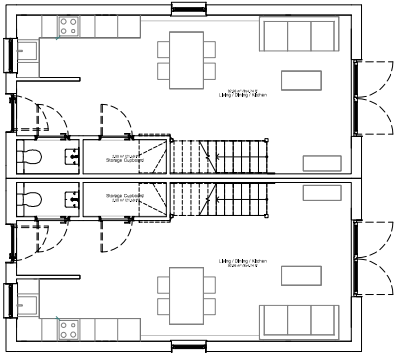
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2Bedroom_4Person

3Bedroom_4Person

3Bedroom_5Person

3Bedroom_5Person



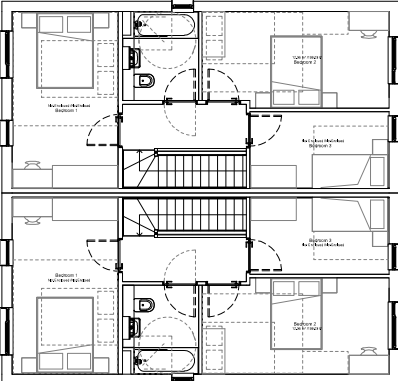
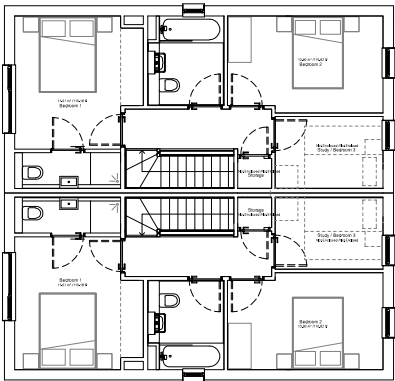
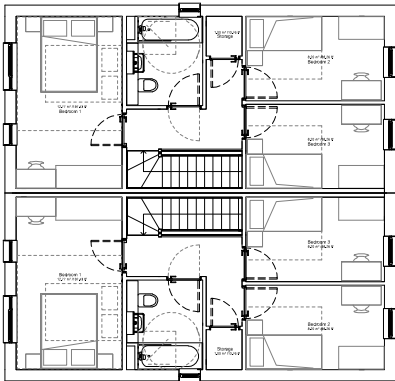
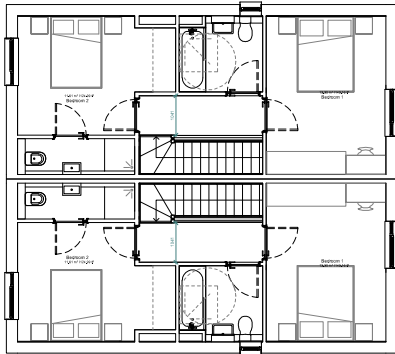
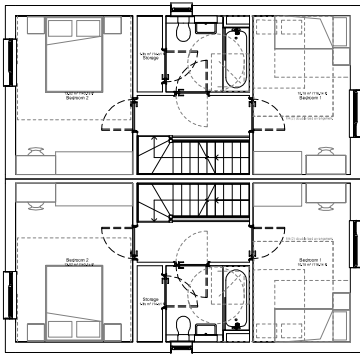
Ground floor plan

Ground floor plan

Ground floor plan

Ground floor plan

Ground floor plan



First floor plan

First floor plan

First floor plan

First floor plan

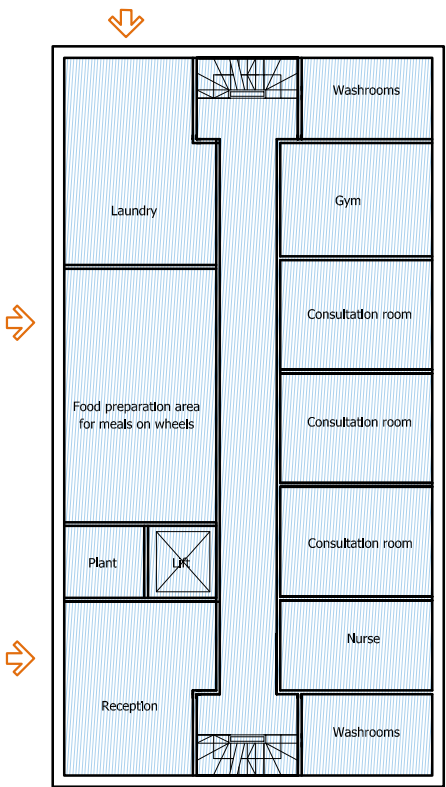
First floor plan

SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD

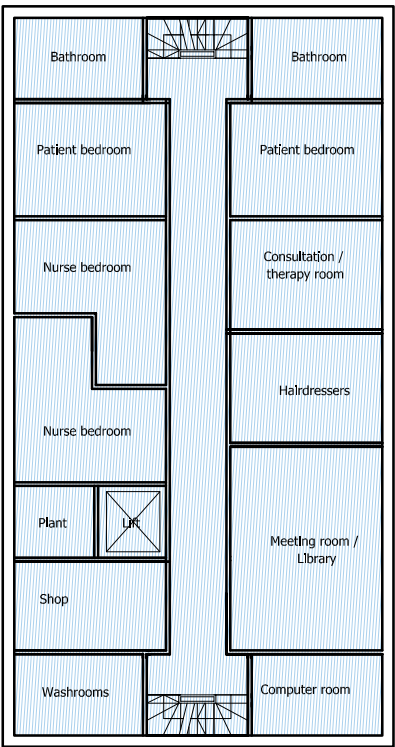
COMMUNAL FACILITIES BUILDING
FLOOR PLANS

Scale 1:200 at A3

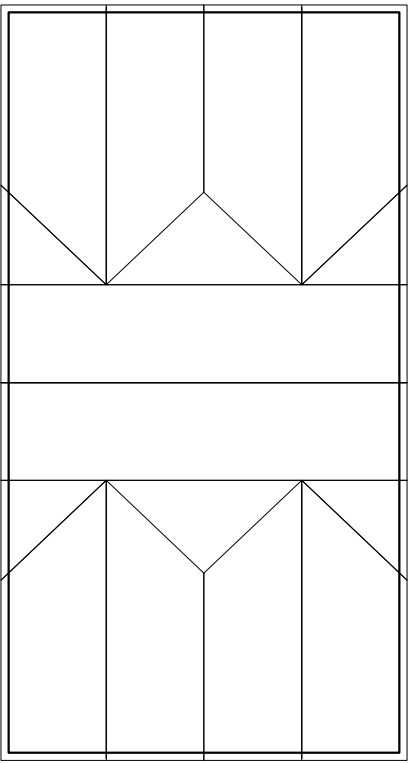
Drawing No. SNH / P23 / 06



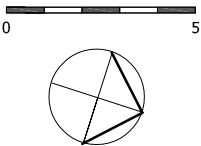
G R O U N D



F I R S T



R O O F



Appendix D

Greenfield Run-off Rates

Calculated by:	Harvey Doran
Site name:	30512
Site location:	Sandgate Nurseries

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	50.93002° N
Longitude:	0.28703° W
Reference:	2400064055
Date:	Jul 31 2023 11:16

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1.815
-----------------------	-------

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	819	819
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default

Edited

Q_{BAR} (l/s):	6.27	6.27
1 in 1 year (l/s):	5.33	5.33
1 in 30 years (l/s):	14.41	14.41
1 in 100 year (l/s):	19.99	19.99
1 in 200 years (l/s):	23.43	23.43

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix E

Infiltration Test Results

Site : Sandgate Nurseries

Client : Solve Planning

Engineer: Land Science

Job Number
LS6786

Sheet
1 / 3

Location	Date	Level	Location
TP01	06/03/2023		

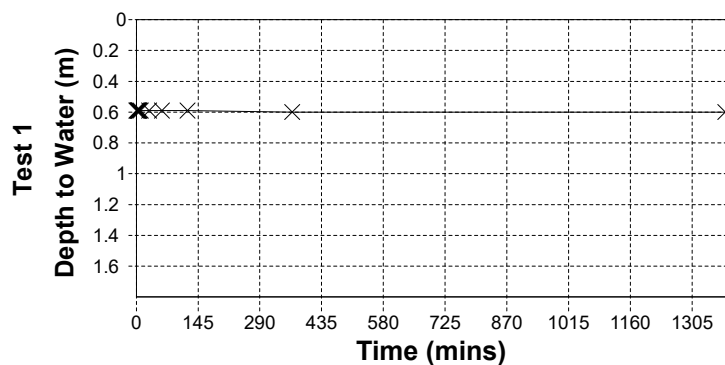
Pit Width (m)	0.40
Pit Depth (m)	1.80
Pit Length (m)	1.50

Soil type at test level
Groundwater
Drain discharge depth
Sidewall stability
Stone filled or open pit

	1
Effective depth (m)	1.21
Volume outflowing between 75% & 25% (m3)	
Mean surface area through which outflow occurs (m2)	
Time for outflow between 75% & 25% (min)	
SOIL INFILTRATION RATE (ms-1), f	Test Failed

Remarks

Elapsed time (mins)	Depth to Water
	Test 1
0	0.59
2	0.59
3	0.59
4	0.59
5	0.59
6	0.59
7	0.59
10	0.59
30	0.59
60	0.59
120	0.59
366	0.60
1383	0.60



Site : Sandgate Nurseries

Client : Solve Planning

Engineer: Land Science

Job Number
LS6786

Sheet
2 / 3

Location	Date	Level	Location
TP02	06/03/2023		

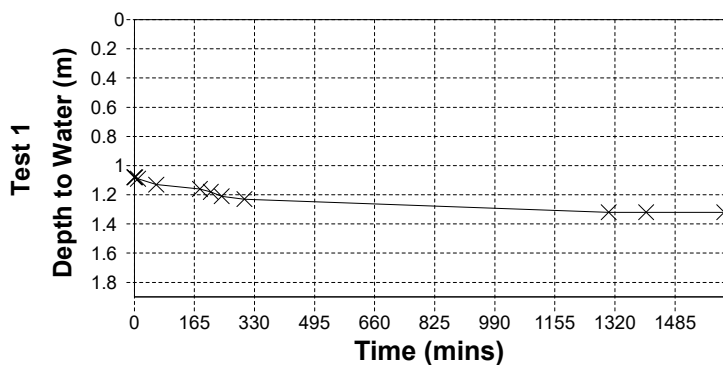
Pit Width (m)	0.40
Pit Depth (m)	1.90
Pit Length (m)	1.50

Soil type at test level
Groundwater
Drain discharge depth
Sidewall stability
Stone filled or open pit

	1
Effective depth (m)	0.82
Volume outflowing between 75% & 25% (m3)	
Mean surface area through which outflow occurs (m2)	
Time for outflow between 75% & 25% (min)	
SOIL INFILTRATION RATE (ms⁻¹), f	Test Failed

Remarks

Elapsed time (mins)	Depth to Water Test 1
0	1.08
1	1.08
2	1.08
10	1.09
60	1.13
180	1.16
210	1.18
240	1.21
302	1.23
1303	1.32
1406	1.32
1620	1.32



Site : Sandgate Nurseries

Client : Solve Planning

Engineer: Land Science

Job Number
LS6786

Sheet
3 / 3

Location	Date	Level	Location
TP03	06/03/2023		

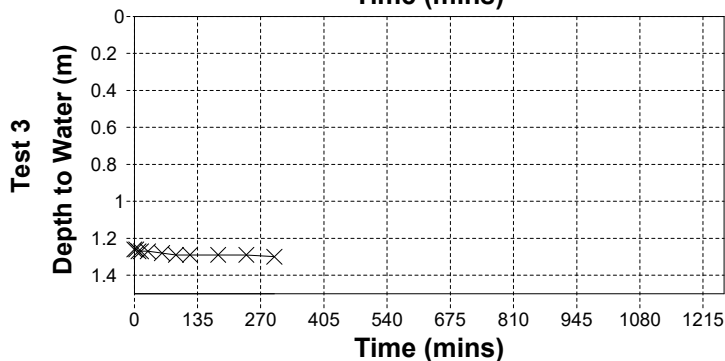
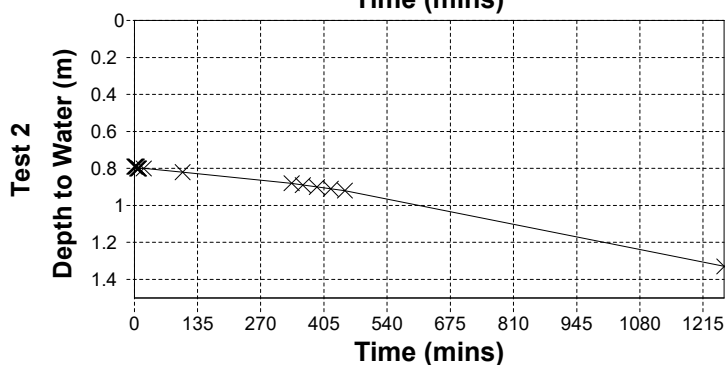
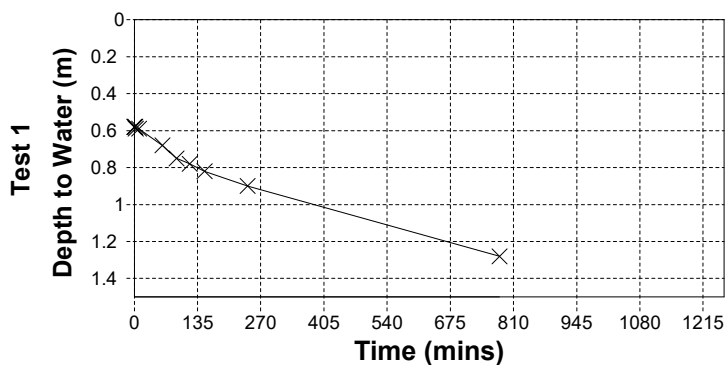
Pit Width (m)	0.40
Pit Depth (m)	1.50
Pit Length (m)	1.90

Soil type at test level
Groundwater
Drain discharge depth
Sidewall stability
Stone filled or open pit

	1	2	3
Effective depth (m)	0.92	0.71	0.24
Volume outflowing between 75% & 25% (m3)	0.35	0.27	
Mean surface area through which outflow occurs (m2)	2.88	2.39	1.31
Time for outflow between 75% & 25% (min)	623.84	701.34	
SOIL INFILTRATION RATE (ms-1), f	3.24E-6	2.68E-6	

Remarks

Elapsed time (mins)	Depth to Water Test 1	Depth to Water Test 2	Depth to Water Test 3
0	0.58	0.79	1.26
1	0.58	0.79	
2	0.58	0.79	
3	0.59	0.79	
4		0.79	1.26
5		0.79	
6		0.80	
7		0.80	
8		0.80	
9		0.80	1.27
10	0.59	0.80	
14			1.27
20		0.80	
29			1.27
59			1.28
60	0.68		
89			1.29
90	0.75		
103		0.82	
118	0.78		
119			1.29
150	0.82		
179			1.29
239			1.29
242	0.90		
299			1.30
336		0.88	
360		0.89	
390		0.90	
420		0.91	
450		0.92	
780	1.28		
1260		1.33	



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Appendix F

Below Ground Drainage Layout



NOTES :

- This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
- Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check that this drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
- All new new surface water pipework routes to be confirmed with an arboriculturalist.
- Health & Safety :
All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules"



DRAINAGE KEY		DRAINAGE KEY	
S1			Permeable Paving
			Catchment 1
			Catchment 2
			Catchment 3
			Detention Basin
			Headwall

DRAINAGE LEGEND			
Site Boundary			
Existing Rising Main			
Existing Foul Sewer			
New SW Drain			
Root Protection Zone			

P04	25.04.24	TP	TS	Drain rerouted to avoid RPA
P03	09.08.23	TP	HD	Revised following infiltration testing
P02	20.04.23	TS	TS	Revised following infiltration testing
P01	27.01.23	SE	YA	Issued for Information
Rev	Date	Drawn	Eng	Amendment

SANDGATE NURSERIES
HENFIELD

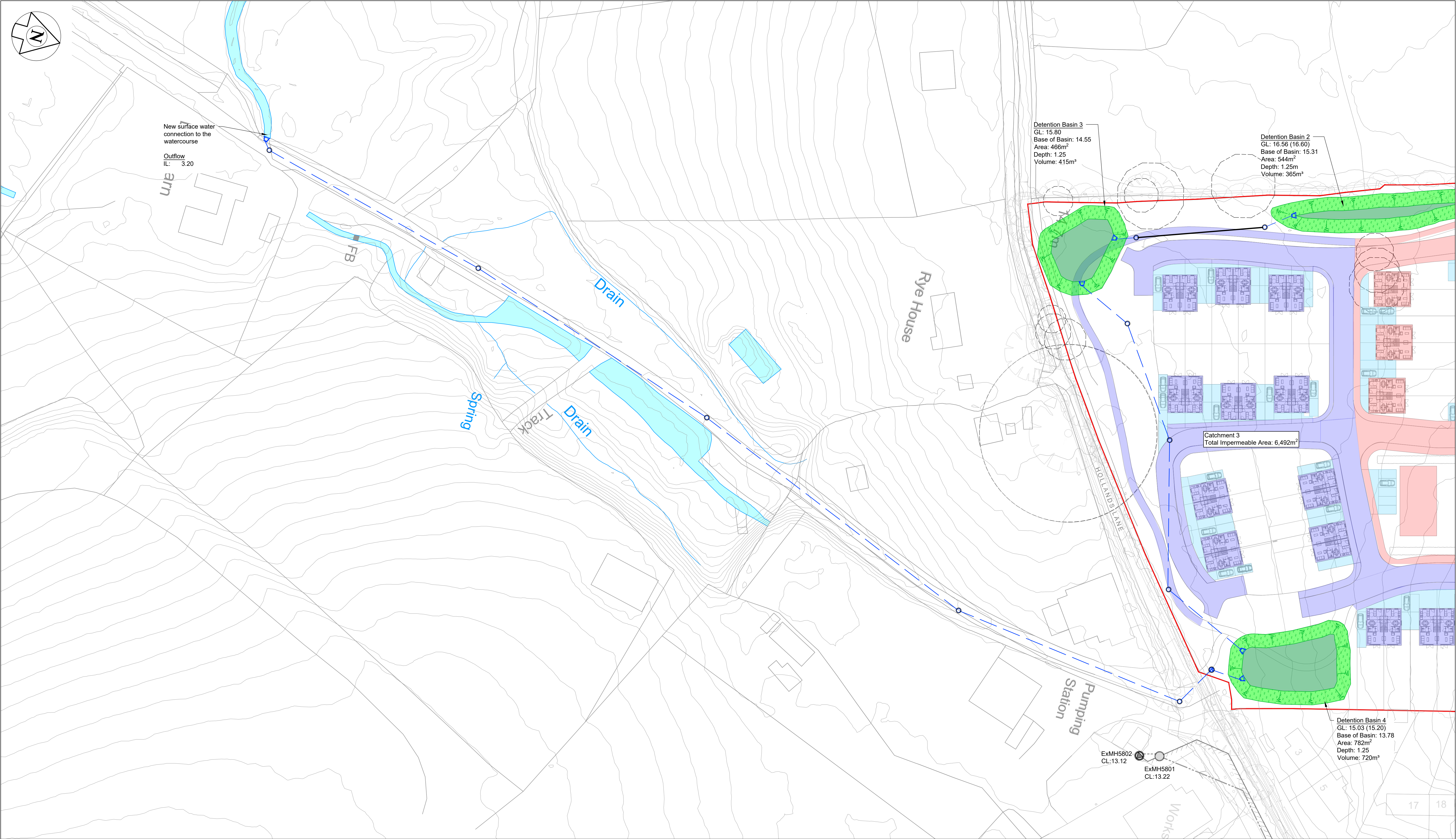
BELOW GROUND
DRAINAGE LAYOUT
SHEET 1

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

Drawn	SE	Eng	YA
Scales	1:500 at A1	1:1000 at A3	
Drawing No	30512/6000	Rev	P04

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Consulting Engineers
37 Alfred Place
London
WC1E 7DP
020 7631 5128
mail@pricemyers.com
www.pricemyers.com



NOTES :

1.

This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
2.

Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check that this drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
3.

All new new surface water pipework routes to be confirmed with an arboriculturalist.
4.

Health & Safety :
All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".



DRAINAGE KEY		DRAINAGE KEY	
S1			Permeable Paving
			Catchment 1
			Catchment 2
			Catchment 3
			Detention Basin
			Headwall

DRAINAGE LEGEND			
Site Boundary			
Existing Rising Main			
Existing Foul Sewer			
New SW Drain			
Root Protection Zone			

P01	25.04.24	TP	HD	Drain rerouted to avoid RPA
P01	09.08.23	TP	HD	Revised following infiltration testing
Rev	Date	Drawn	Eng	Amendment

SANDGATE NURSERIES
HENFIELD

BELOW GROUND
DRAINAGE LAYOUT
SHEET 2

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

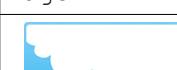
Drawn	TP	Eng	HD
Scales	1:500 at A1	1:1000 at A3	
Drawing No	Rev		
30512/6001	P02		

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Appendix G

Hydraulic Calculations

Price & Myers		Page 1
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole SItE-5.3ls-2yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Summary of Results for 2 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	13.645	0.145	4.3	170.5	O K
30 min Summer	13.691	0.191	4.7	223.9	O K
60 min Summer	13.740	0.240	4.9	281.9	O K
120 min Summer	13.834	0.334	5.2	392.0	O K
180 min Summer	13.889	0.389	5.2	457.2	O K
240 min Summer	13.925	0.425	5.3	499.4	O K
360 min Summer	13.965	0.465	5.3	546.4	O K
480 min Summer	13.987	0.487	5.3	572.2	O K
600 min Summer	13.999	0.499	5.3	586.2	O K
720 min Summer	14.004	0.504	5.3	592.2	O K
960 min Summer	14.003	0.503	5.3	591.5	O K
1440 min Summer	13.999	0.499	5.3	585.9	O K
2160 min Summer	13.989	0.489	5.3	575.0	O K
2880 min Summer	13.979	0.479	5.3	563.2	O K
4320 min Summer	13.964	0.464	5.3	545.3	O K
5760 min Summer	13.952	0.452	5.3	530.8	O K
15 min Winter	13.663	0.163	4.5	191.1	O K
30 min Winter	13.714	0.214	4.8	251.3	O K
60 min Winter	13.769	0.269	5.0	316.6	O K
120 min Winter	13.875	0.375	5.2	441.2	O K
180 min Winter	13.939	0.439	5.3	515.5	O K
240 min Winter	13.980	0.480	5.3	564.1	O K
360 min Winter	14.027	0.527	5.3	619.6	O K
480 min Winter	14.054	0.554	5.3	651.3	O K
600 min Winter	14.070	0.570	5.3	670.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	51.108	0.0	144.2	26
30 min Summer	33.809	0.0	195.2	41
60 min Summer	21.567	0.0	276.2	70
120 min Summer	15.291	0.0	395.2	128
180 min Summer	12.109	0.0	470.1	188
240 min Summer	10.099	0.0	522.4	246
360 min Summer	7.632	0.0	590.1	366
480 min Summer	6.205	0.0	636.4	484
600 min Summer	5.263	0.0	670.4	602
720 min Summer	4.587	0.0	695.7	720
960 min Summer	3.671	0.0	727.6	858
1440 min Summer	2.688	0.0	742.6	1100
2160 min Summer	1.987	0.0	957.3	1496
2880 min Summer	1.620	0.0	1037.7	1908
4320 min Summer	1.243	0.0	1178.3	2732
5760 min Summer	1.047	0.0	1361.1	3576
15 min Winter	51.108	0.0	163.3	26
30 min Winter	33.809	0.0	219.9	40
60 min Winter	21.567	0.0	310.6	68
120 min Winter	15.291	0.0	443.3	126
180 min Winter	12.109	0.0	526.5	184
240 min Winter	10.099	0.0	584.2	242
360 min Winter	7.632	0.0	657.8	358
480 min Winter	6.205	0.0	706.6	474
600 min Winter	5.263	0.0	740.5	588

Price & Myers		Page 2
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole SItE-5.3ls-2yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Summary of Results for 2 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
720 min Winter	14.079	0.579	5.3	679.9	O K
960 min Winter	14.081	0.581	5.3	683.2	O K
1440 min Winter	14.070	0.570	5.3	669.7	O K
2160 min Winter	14.054	0.554	5.3	651.3	O K
2880 min Winter	14.036	0.536	5.3	629.4	O K
4320 min Winter	14.002	0.502	5.3	589.5	O K
5760 min Winter	13.971	0.471	5.3	553.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
720 min Winter	4.587	0.0	763.0	702
960 min Winter	3.671	0.0	782.7	920
1440 min Winter	2.688	0.0	770.8	1186
2160 min Winter	1.987	0.0	1071.7	1628
2880 min Winter	1.620	0.0	1160.9	2084
4320 min Winter	1.243	0.0	1309.6	2988
5760 min Winter	1.047	0.0	1524.9	3856

Price & Myers		Page 3
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole Site-5.3ls-2yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 520350 115600 TQ 20350 15600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.815

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.605	4 8	0.605	8 12	0.605

Price & Myers		Page 4
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole Site-5.3ls-2yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 15.000

Tank or Pond Structure

Invert Level (m) 13.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1175.0	1.500	1175.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0101-5300-1500-5300	
Design Head (m)	1.500
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	13.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.3	Kick-Flo®	0.903	4.2
Flush-Flo™	0.442	5.3	Mean Flow over Head Range	-	4.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.7	2.000	6.1	4.000	8.4	7.000	10.9
0.200	4.7	1.000	4.4	2.200	6.3	4.500	8.9	7.500	11.3
0.300	5.1	1.200	4.8	2.400	6.6	5.000	9.3	8.000	11.7
0.400	5.2	1.400	5.1	2.600	6.8	5.500	9.8	8.500	12.0
0.500	5.2	1.600	5.5	3.000	7.3	6.000	10.2	9.000	12.3
0.600	5.2	1.800	5.8	3.500	7.9	6.500	10.6	9.500	12.7

Price & Myers		Page 1
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole SItE-5.3ls-30yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Summary of Results for 30 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	13.821	0.321	5.2	377.0	O K
30 min Summer	13.931	0.431	5.3	506.3	O K
60 min Summer	14.052	0.552	5.3	648.6	O K
120 min Summer	14.188	0.688	5.3	808.7	O K
180 min Summer	14.269	0.769	5.3	903.1	O K
240 min Summer	14.324	0.824	5.3	967.6	O K
360 min Summer	14.394	0.894	5.3	1050.4	O K
480 min Summer	14.435	0.935	5.3	1099.1	O K
600 min Summer	14.462	0.962	5.3	1129.8	O K
720 min Summer	14.478	0.978	5.3	1149.5	O K
960 min Summer	14.496	0.996	5.3	1170.1	O K
1440 min Summer	14.497	0.997	5.3	1171.0	O K
2160 min Summer	14.470	0.970	5.3	1139.3	O K
2880 min Summer	14.444	0.944	5.3	1109.6	O K
4320 min Summer	14.410	0.910	5.3	1068.7	O K
5760 min Summer	14.383	0.883	5.3	1037.2	O K
15 min Winter	13.860	0.360	5.2	422.8	O K
30 min Winter	13.983	0.483	5.3	567.9	O K
60 min Winter	14.120	0.620	5.3	728.1	O K
120 min Winter	14.274	0.774	5.3	909.1	O K
180 min Winter	14.366	0.866	5.3	1017.1	O K
240 min Winter	14.429	0.929	5.3	1091.7	O K
360 min Winter	14.510	1.010	5.3	1186.8	O K
480 min Winter	14.558	1.058	5.3	1242.6	O K
600 min Winter	14.588	1.088	5.3	1278.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	112.288	0.0	324.9	27
30 min Summer	75.603	0.0	407.0	41
60 min Summer	48.749	0.0	629.5	70
120 min Summer	30.755	0.0	776.5	130
180 min Summer	23.152	0.0	837.8	190
240 min Summer	18.796	0.0	849.8	250
360 min Summer	13.864	0.0	837.3	368
480 min Summer	11.083	0.0	816.7	488
600 min Summer	9.287	0.0	799.1	608
720 min Summer	8.025	0.0	784.0	726
960 min Summer	6.360	0.0	758.5	966
1440 min Summer	4.571	0.0	717.4	1442
2160 min Summer	3.302	0.0	1515.1	2056
2880 min Summer	2.640	0.0	1489.5	2392
4320 min Summer	1.958	0.0	1374.4	3160
5760 min Summer	1.604	0.0	2085.1	3976
15 min Winter	112.288	0.0	358.7	26
30 min Winter	75.603	0.0	426.3	41
60 min Winter	48.749	0.0	700.7	70
120 min Winter	30.755	0.0	837.3	128
180 min Winter	23.152	0.0	853.0	188
240 min Winter	18.796	0.0	839.1	246
360 min Winter	13.864	0.0	811.2	364
480 min Winter	11.083	0.0	791.7	480
600 min Winter	9.287	0.0	776.9	598

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Innovyze	Source Control 2018.1	

Summary of Results for 30 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
720 min Winter	14.609	1.109	5.3	1303.0	O K
960 min Winter	14.632	1.132	5.3	1330.4	O K
1440 min Winter	14.641	1.141	5.3	1341.0	O K
2160 min Winter	14.623	1.123	5.3	1319.4	O K
2880 min Winter	14.592	1.092	5.3	1283.6	O K
4320 min Winter	14.547	1.047	5.3	1230.4	O K
5760 min Winter	14.510	1.010	5.3	1187.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
720 min Winter	8.025	0.0	764.9	714
960 min Winter	6.360	0.0	745.9	946
1440 min Winter	4.571	0.0	718.8	1402
2160 min Winter	3.302	0.0	1550.5	2060
2880 min Winter	2.640	0.0	1500.8	2680
4320 min Winter	1.958	0.0	1387.3	3336
5760 min Winter	1.604	0.0	2333.2	4280

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 520350 115600 TQ 20350 15600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.815

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
	(ha)		(ha)		(ha)
0	4 0.605	4	8 0.605	8	12 0.605

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Model Details

Storage is Online Cover Level (m) 15.000

Tank or Pond Structure

Invert Level (m) 13.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1175.0	1.500	1175.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0101-5300-1500-5300	
Design Head (m)	1.500
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	13.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.3	Kick-Flo®	0.903	4.2
Flush-Flo™	0.442	5.3	Mean Flow over Head Range	-	4.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.7	2.000	6.1	4.000	8.4	7.000	10.9
0.200	4.7	1.000	4.4	2.200	6.3	4.500	8.9	7.500	11.3
0.300	5.1	1.200	4.8	2.400	6.6	5.000	9.3	8.000	11.7
0.400	5.2	1.400	5.1	2.600	6.8	5.500	9.8	8.500	12.0
0.500	5.2	1.600	5.5	3.000	7.3	6.000	10.2	9.000	12.3
0.600	5.2	1.800	5.8	3.500	7.9	6.500	10.6	9.500	12.7

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Innovyze Source Control 2018.1		

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	13.906	0.406	5.2	476.6	O K
30 min Summer	14.050	0.550	5.3	645.8	O K
60 min Summer	14.209	0.709	5.3	832.7	O K
120 min Summer	14.368	0.868	5.3	1020.2	O K
180 min Summer	14.465	0.965	5.3	1134.1	O K
240 min Summer	14.534	1.034	5.3	1214.5	O K
360 min Summer	14.626	1.126	5.3	1322.9	O K
480 min Summer	14.685	1.185	5.3	1392.1	O K
600 min Summer	14.725	1.225	5.3	1439.3	Flood Risk
720 min Summer	14.753	1.253	5.3	1472.7	Flood Risk
960 min Summer	14.788	1.288	5.3	1513.4	Flood Risk
1440 min Summer	14.805	1.305	5.3	1533.3	Flood Risk
2160 min Summer	14.785	1.285	5.3	1509.6	Flood Risk
2880 min Summer	14.754	1.254	5.3	1473.0	Flood Risk
4320 min Summer	14.707	1.207	5.3	1418.0	Flood Risk
5760 min Summer	14.673	1.173	5.3	1378.0	O K
15 min Winter	13.955	0.455	5.3	534.3	O K
30 min Winter	14.116	0.616	5.3	724.3	O K
60 min Winter	14.295	0.795	5.3	934.5	O K
120 min Winter	14.476	0.976	5.3	1146.5	O K
180 min Winter	14.585	1.085	5.3	1274.5	O K
240 min Winter	14.662	1.162	5.3	1365.4	O K
360 min Winter	14.768	1.268	5.3	1489.5	Flood Risk
480 min Winter	14.836	1.336	5.3	1569.7	Flood Risk
600 min Winter	14.883	1.383	5.3	1625.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	141.636	0.0	392.3	27
30 min Summer	96.164	0.0	438.5	41
60 min Summer	62.307	0.0	785.7	72
120 min Summer	38.527	0.0	855.3	130
180 min Summer	28.787	0.0	835.5	190
240 min Summer	23.320	0.0	816.2	250
360 min Summer	17.228	0.0	790.6	370
480 min Summer	13.828	0.0	775.6	488
600 min Summer	11.628	0.0	766.0	608
720 min Summer	10.078	0.0	759.8	728
960 min Summer	8.020	0.0	753.7	966
1440 min Summer	5.772	0.0	751.4	1444
2160 min Summer	4.156	0.0	1557.2	2160
2880 min Summer	3.306	0.0	1504.6	2504
4320 min Summer	2.417	0.0	1403.3	3248
5760 min Summer	1.953	0.0	2532.6	4088
15 min Winter	141.636	0.0	417.8	27
30 min Winter	96.164	0.0	444.3	41
60 min Winter	62.307	0.0	844.2	70
120 min Winter	38.527	0.0	838.6	130
180 min Winter	28.787	0.0	812.6	188
240 min Winter	23.320	0.0	796.5	246
360 min Winter	17.228	0.0	780.7	364
480 min Winter	13.828	0.0	776.2	482
600 min Winter	11.628	0.0	777.9	598

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Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
720 min Winter	14.918	1.418	5.3	1665.7	Flood Risk
960 min Winter	14.961	1.461	5.3	1716.9	Flood Risk
1440 min Winter	14.990	1.490	5.3	1750.7	Flood Risk
2160 min Winter	14.982	1.482	5.3	1741.9	Flood Risk
2880 min Winter	14.953	1.453	5.3	1707.8	Flood Risk
4320 min Winter	14.891	1.391	5.3	1633.9	Flood Risk
5760 min Winter	14.844	1.344	5.3	1578.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
720 min Winter	10.078	0.0	783.6	716
960 min Winter	8.020	0.0	793.5	948
1440 min Winter	5.772	0.0	793.2	1408
2160 min Winter	4.156	0.0	1576.0	2080
2880 min Winter	3.306	0.0	1538.3	2716
4320 min Winter	2.417	0.0	1488.3	3420
5760 min Winter	1.953	0.0	2827.6	4336

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 520350 115600 TQ 20350 15600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.815

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.605	4 8	0.605	8 12	0.605

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Model Details

Storage is Online Cover Level (m) 15.000

Tank or Pond Structure

Invert Level (m) 13.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1175.0	1.500	1175.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0101-5300-1500-5300	
Design Head (m)	1.500
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	13.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.3	Kick-Flo®	0.903	4.2
Flush-Flo™	0.442	5.3	Mean Flow over Head Range	-	4.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.7	2.000	6.1	4.000	8.4	7.000	10.9
0.200	4.7	1.000	4.4	2.200	6.3	4.500	8.9	7.500	11.3
0.300	5.1	1.200	4.8	2.400	6.6	5.000	9.3	8.000	11.7
0.400	5.2	1.400	5.1	2.600	6.8	5.500	9.8	8.500	12.0
0.500	5.2	1.600	5.5	3.000	7.3	6.000	10.2	9.000	12.3
0.600	5.2	1.800	5.8	3.500	7.9	6.500	10.6	9.500	12.7