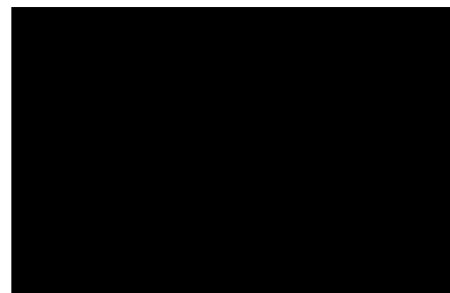


Technical Note - Discharge of Surface Water Management Planning Conditions



Project	The Laurels, Dappers Lane, Angmering
Project Number	23260

By Martin Kempshall C Eng MICE

Date 6 November 2019

1 Introduction

- 1.1 This Technical Note has been produced in support of the Reserved Matters / Discharge of Condition Application for discharging of Conditions 14, 15, 16 and 18 of Outline Planning Permission A/74/18/OUT comprising 9 two-storey dwellings at The Laurels, Dappers Lane, Angmering, BN16 4EN.
- 1.2 This Technical Note is to be read in conjunction with all planning, architectural and other reports that accompany the Planning Application for the proposed development.
- 1.3 The proposed development will incorporate a sustainable drainage system which will discharge all surface water via infiltration to ground using permeable paving with subbase attenuation.



2 Condition 14

2.1 Condition 14 of Outline Planning Application A/74/18/OUT states:

Development shall not commence, other than works of site survey and investigation, 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, and 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 adhered to and maintained in good working order in perpetuity.

Reason: To ensure that the proposed development is satisfactory drained in accordance with policies WSP1, WDM1, WDM2 and WDM3 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition to ensure that the surface water disposal scheme is agreed before construction commences.

3 Design Parameters for Discharge of Condition 14

3.1 Summary of Surface Water Management and Design

- 3.1.1 The following design criteria has been set to ensure compliance with the principles of the design will be based upon Arun District Council Supplementary Requirements for Surface Water Drainage Proposals and West Sussex County Council LLFA Policy for the Management of Surface Water and recognised best practice.
- 3.1.2 Infiltration to ground is proposed in accordance with the Drainage Hierarchy preference and CIRIA C 753.
- 3.1.3 The system is designed to attenuate all storm water events up to and including the critical 1 in 100 year storm with a 40% allowance for Climate Change. The designing for exceedance event has been accommodated within the attenuation system to ensure that all surface water is retained on site during the exceedance event.
- 3.1.4 Requirements of Table 26.2 of CIRIA SuDS Manual have been achieved to ensure water quality requirements are achieved throughout the site.
- 3.1.5 The design has been based upon tested infiltration rates completed by Ashdown Site Investigation based upon the principles of BRE365. The lowest recorded rates of infiltration have been used at the proposed point of discharge to ground.

3.2 Detailed Surface Water Drainage Design

- 3.2.1 All surface water is to be collected and discharged via an infiltration blanket beneath a permeable paved surface.
- 3.2.2 The infiltration rates in the eastern areas of the site were moderate to poor and therefore the design of the infiltration system is predominantly in the western area of the site where moderate to good infiltration rates were identified within the site investigation.
- 3.2.3 The drainage has been separated into two areas:
 - ¿ Area A comprises unlined permeable paving and is based upon a System B permeable paved system (Interpave, 2010). Drainage Area A acts as a conveyance system to Drainage Area B, with conveyance through the voided subbase. The system will be unlined allowing some infiltration to ground to occur where available. This area has not been used for attenuation storage within the calculations and has been assessed as an impermeable area for surface water storage requirements.
 - ¿ Drainage Area B has been designed to accommodate and discharge all surface water to ground for all the impermeable areas of the site. The infiltration blankets for Area B comprise permeable paving with storage within 300mm depth of permavoid subbase replacement system (Or similar agreed) beneath the permeable paving of Drainage Area B.
- 3.2.4 A freeboard of 1 metre from the highest recorded groundwater level has been maintained as per best practice guidance.
- 3.2.5 A copy of Drawing 101 showing the proposed drainage layout is located at the rear of this Technical Note.
- 3.2.6 A copy of the Microdrainage Calculations for the surface water network and attenuation systems is located at the rear of this Technical Note.

3.3 General Site Ground Conditions

- 3.3.1 The Ashdown Site Investigation report of November 2018 identifies made ground generally comprising gravelly clay, was encountered to a depth of 0.20m and 0.65m. The gravel fraction comprised variable quantities of flint, brick, concrete, plastic, asphalt, chalk, nylon string, glass, clinker-like material and charcoal-like material.
- 3.3.2 Beneath the made ground, the investigation encountered slightly gravelly clay soils persisting to the full depths of the trial pits, and to depths of between 0.70m and 1.20m below ground level in the boreholes. Soils in this zone within the western areas of the site were determined as being suitable for infiltration to ground.

3.4 Winter Groundwater Monitoring

3.4.1 Groundwater monitoring was undertaken throughout the Winter of 2018-19 and identified a maximum groundwater level of approximately 2 metres below existing ground levels.

3.4.2 A full copy of the winter groundwater monitoring data is located at the rear of this Technical Note.

3.5 Soakage Testing

3.5.1 A full copy of the infiltration test locations and data are located at the rear of this report. Winter infiltration testing was completed on 17 October 2018 and are summarised in Table 1.

Exploratory Hole	Test Response Zone Depth (m)		Stratum	Calculated Infiltration Rate (f) (m/sec)	Driving Head of Water (m)
	Top	Bottom			
TP01 Test 1	0.57	1.00	Head (slightly gravelly clay over gravelly clay)	1.1×10^{-4}	-
TP01 Test 2	0.55	1.00	Head (slightly gravelly clay over gravelly clay)	1.3×10^{-4}	-
TP01 Test 3	0.57	1.00	Head (slightly gravelly clay over gravelly clay)	2.6×10^{-5}	-
TP02 Test 1	0.70	1.00	Head (slightly gravelly clay)	4.2×10^{-6}	-
WS01 Tests 1, 2 & 3	2.00	3.00	Head (clayey gravel)	2.9×10^{-3}	1.0
WS05 Tests 1, 2 & 3	1.00	2.00	Head (clayey gravel)	2.5×10^{-3}	1.0

Table 1 Summary of Infiltration Test Results

3.5.2 TP01 was completed on the west of the site and yielded moderate to good rates of infiltration and will therefore infiltration of surface water to ground will is proposed in this area of the site.

3.5.3 TP02 yielded poor infiltration test results and therefore whilst some infiltration may occur within this area of the site this is insufficient to be able to demonstrate a viable design.

3.5.4 The lowest recorded infiltration test result from TP01 of 2.6×10^{-5} m/s as identified in Table 1 has been used for the design of infiltration blanket.

3.5.5 A copy of Drawing 101 showing the proposed drainage layout is located at the rear of this Technical Note.

3.5.6 Extracts from the Ashdown Site Investigation Report is located at the rear of this Technical Note.

3.6 Surface Water Quality

3.6.1 The proposed development is for open storage. In accordance with CIRIA SuDS Manual 2015 (Report C753), the pollution hazard level for this type of development is high.

3.6.2 The surface water scheme will include mitigation to ensure that surface water is suitably treated and any pollution risk adequately managed prior to discharge.

3.6.3 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types. Those determined as of most relevance to the development proposals are as follows:

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very Low	0.2	0.2	0.05
Commercial / Industrial roofs	Low	0.3	0.2	0.05
Individual property driveways, residential car park, low-traffic roads	Low	0.5	0.4	0.4

Table 2: Pollution Hazard Indices

3.6.4 Where multiple drainage components are used in series the individual mitigation index of secondary and tertiary components is lowered by 50% due to reduced performance associated with primary treatment.

SuDS Type	Total suspended solids (TSS)	Metals	Hydro-carbons
Permeable pavement	0.7	0.6	0.7

Table 3: Pollution Mitigation Indices

3.6.5 The proposed use of permeable paving will meet the target treatment level required for runoff with very low to low risk of pollution hazard thus demonstrating that the surface water drainage system for the site can be designed to adequately mitigate against the risk of pollution.

4 Condition 15

4.1 Condition 15 of Outline Planning Application A/74/18/OUT states:

The development shall not proceed until formal consent has been approved in writing from the Lead Local Flood Authority (WSCC) or its agent (ADC) for the discharge of any flows to watercourses, or the culverting, diversion, infilling or obstruction of any watercourse on the

site. Any discharge to a watercourse must be at a rate no greater than the predevelopment run off values.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with policies WSP1, WDM1, WDM2 and WDM3 of the Arun Local Plan. This is required to be a pre-commencement condition because it is necessary to implement the surface water drainage system prior to commencing any building works.

4.2 Statement on Ordinary Watercourse / culvert

- 4.2.1 There is no evidence of an ordinary watercourse or culvert on, or immediately adjacent to the site. All surface water is to be discharged to ground in accordance with the Drainage Hierarchy.

5 Condition 16

5.1 Condition 16 of Outline Planning Application A/74/18/OUT states:

Development shall not commence until full details of the maintenance and management of the SuDS system is set out in a site-specific maintenance manual and submitted to, and approved in writing, by the Local Planning Authority. The manual is to include (a) details of financial management of the site including arrangements made in the event that the management company (or any subsequent management company) is no longer able to fulfil its duties; and (b) arrangements for the replacement of major components at the end of the manufacturers recommended design life.

Reason: To ensure the efficient maintenance and on-going operation of the SuDS system and to ensure the best practice in line with guidance set out in 'The SuDS Manual' CIRIA publication ref: C753 Chapter 32. This is required to be a pre-commencement condition because it is necessary to implement the surface water drainage system prior to commencing any building works in accordance with policies WSP1, WDM1, WDM2 and WDM3 of Arun Local Plan.

5.2 Management and Maintenance of Proposed SuDS Drainage System

- 5.2.1 Upon completion management of the shared drainage facilities will be passed on to an Estates Management Company appointed by the developer on behalf of the new Residents.
- 5.2.2 The regular and corrective maintenance of all shared elements of the drainage system beneath the road, including all part of the infiltration blanket will be managed and funded through the Estates Management Company on behalf of the Residents.
- 5.2.3 In the event that the Estates Management Company becomes unable to discharge its duties within two years of first appointment the developer will endeavour to appoint an alternative on behalf of the residents.

- 5.2.4 The regular maintenance of all private drainage, channels, gutters, rainwater pipes and connections will be the responsibility of the individual homeowner.
- 5.2.5 The proposed permeable paving system with subbase attenuation is low maintenance and does not contain any control devices which will require replacement.
- 5.2.6 The design life of permeable paving is approximately 25 years with adequate maintenance as outlined within the table shown in Drawing 102.
- 5.2.7 At the end of the design life the permeable paving and subbase system will be replaced where it is determined to be performing inadequately by a suitably qualified person.
- 5.2.8 In accordance with manufacturer's instructions provisions will be made to replace any infrastructure that has reached the end of its design life. They will be replaced on a like for like basis as far as reasonably practicable.
- 5.2.9 Upon completion of the development specific details of the elements of the drainage system shall be provided to the Local Planning Authority and shall be provided as part of Condition 17 of the approved outline planning permission.
- 5.2.10 A copy of Drawing 102 showing the proposed drainage maintenance requirements and ownership responsibilities is located at the rear of this Technical Note.

5.3 Maintenance during construction

- 5.3.1 Once appointed the Contractor will prepare a site specific method statement for the control of silt and other pollutants during construction. CIRIA Report C532, Control of water pollution from construction sites, provides further guidance on this.
- 5.3.2 During the construction phase should hardstanding areas be constructed prior to the completion of the proposed surface water scheme surface water flow will be temporarily channelled into localised soakaways wherever viable. Appropriate water quality mitigation in accordance with CIRIA Report C532 will be provided. This approach allows for surface water to be attenuated and sediments captured during the construction phase.
- 5.3.3 The Contractor will maintain the proposed drainage system during construction and until the handing over of the site.

6 Condition 18

6.1 Condition 18 of Outline Planning Application A/74/18/OUT states:

The development layout shall not be agreed until such time that arrangements for the future access and maintenance of any watercourse or culvert (piped watercourse) crossing or abutting the site has been submitted and approved in writing by the Local Planning Authority. The details thereby agreed shall be adhered to at all times thereafter.

No construction is permitted, which will restrict current and future land owners from undertaking their riparian maintenance responsibilities of any watercourse on or adjacent to the site.

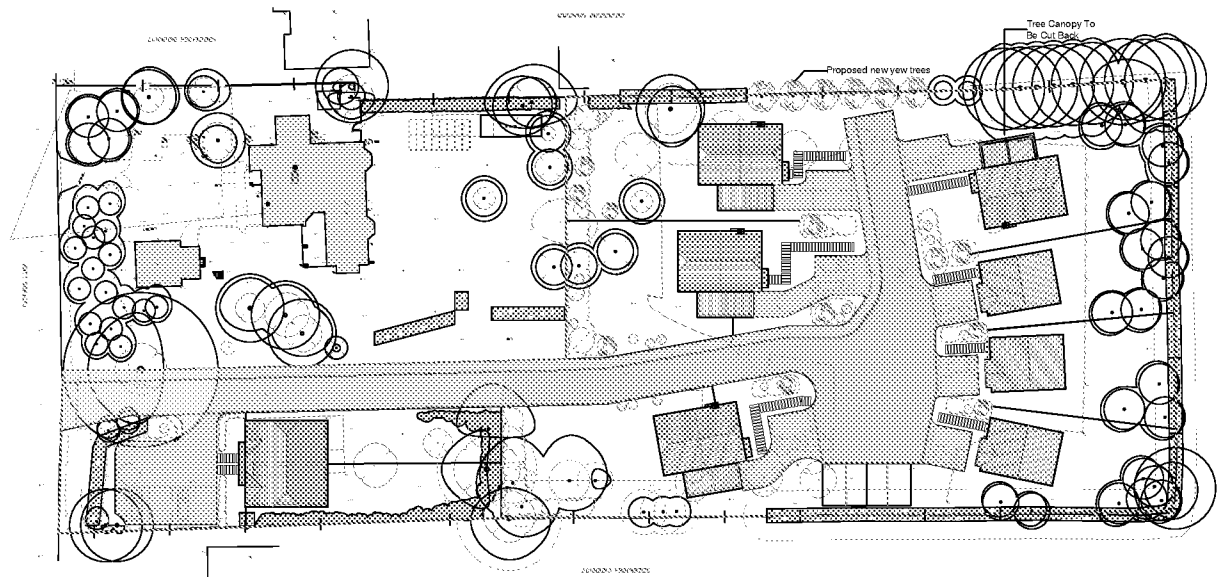
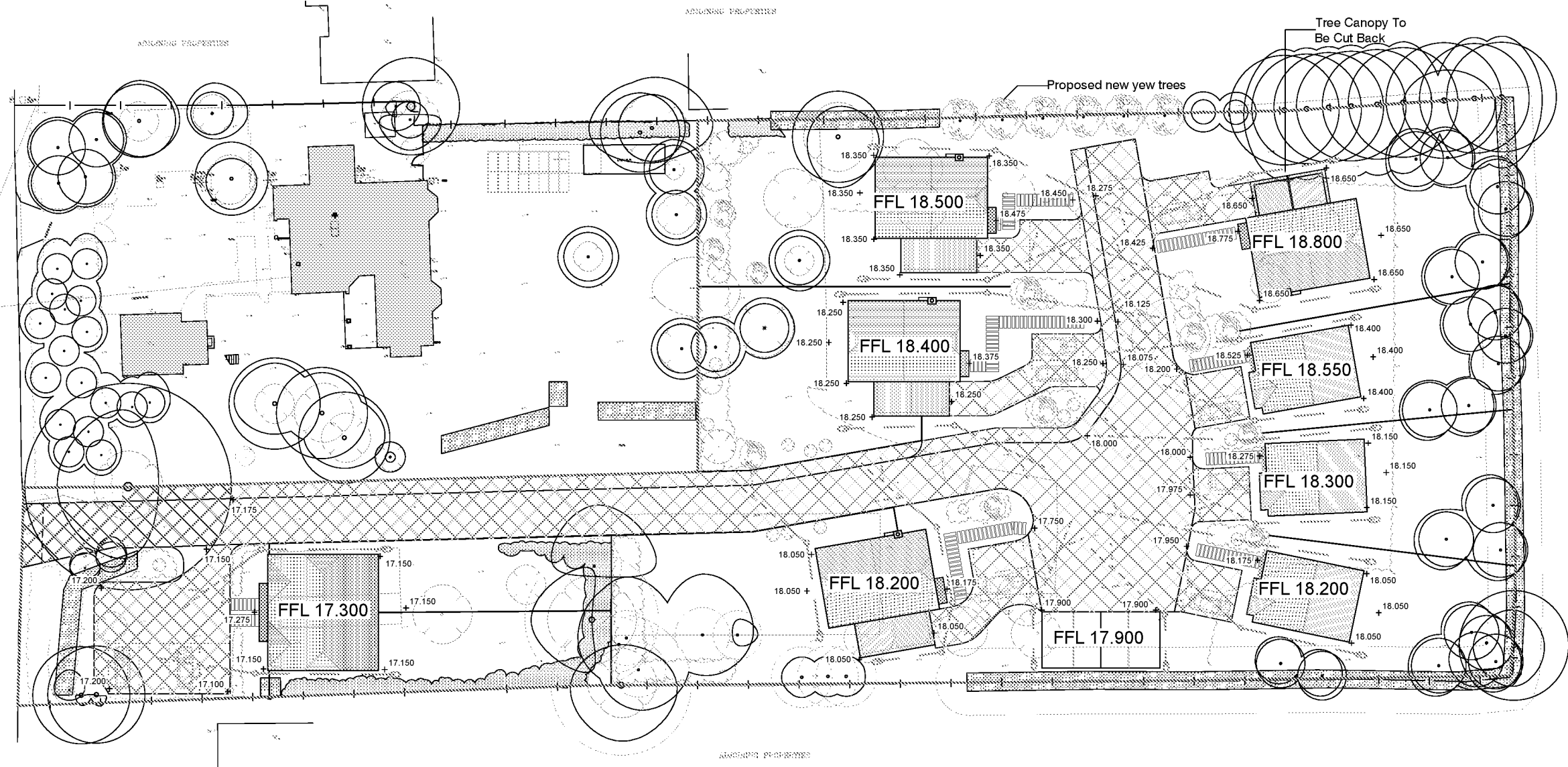
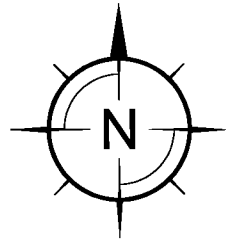
Reason: To ensure that the duties and responsibilities, as required under the Land Drainage Act 1991, and amended by the Flood and Water Management Act 2010, can be fulfilled without additional impediment following the development completion and in accordance with policy WDM1 of the Arun Local Plan.

6.2 Statement on Ordinary Watercourse / Culvert

- 6.2.1 There is no evidence of an ordinary watercourse or culvert on, or immediately adjacent to the site for which the landowner would have Riparian Ownership Responsibilities.
- 6.2.2 Should an ordinary watercourse or culvert be identified at any stage during the construction process then the Landowner will fulfil their duties as Riparian owner under the Land Drainage Act 1991, as amended by the Flood and Water Management Act 2010. In such a case land drainage consent would be applied for under the Act with West Sussex County Council as Lead Local Flood Authority and is therefore already covered by this legislation.

7 Documents appended

- ¿ Drawing 101 - Proposed Drainage Strategy Plan
- ¿ Drawing 102 - Proposed Maintenance Ownership Plan
- ¿ Drawing 103 - Proposed Impermeable Area Plan
- ¿ Drawing 104 - Construction Details
- ¿ Microdrainage Calculations for Climate Change adjusted 1 in 100 year event
- ¿ Extracts from Ashdown Site Investigation Report



Surface Finishes Legend:

- PV1 Permeable Block Paving Carriageway - Voided Subbase
- PV2 Permeable Block Paving Carriageway - Permavoid
- PV3 Permeable Block Paving Carriageway - No-dig construction
- PV4 Permeable Block Paving Footway
- PV5 Permeable Block Paving Drive
- PV6 Proposed paving flags
- To West Sussex standard details

Drainage Legend:

- Area A Voided subbase with infiltration to ground
- Area B 300mm thick permavoid with infiltration to ground 386m²
- Area of no-dig permeable construction to existing ground levels Infiltration to ground
- Impermeable full depth construction and tie in to WSCC standard details Subject to Section 278 agreement
- Private Type 4 Storm Water Inspection Chamber
- Private Storm Water Rodding Eye
- Perforated pipework to subbase

GENERAL NOTES:

- All dimensions to be checked on site. All details and dimensions relating to sub-Contractors work must be checked and agreed between the sub-Contractor or supplier and the general Contractor.
- This drawing is to be read in conjunction with all relevant Architect's and Engineer's drawings and specification.
- The main Contractor is responsible for ensuring the stability of the structure whilst the works are in progress.
- Any information given regarding existing underground services is given in good faith after consultation with the relevant authority. No liability is accepted by the Consultant and the main Contractor is responsible for obtaining and checking all information and taking due care and attention whilst undertaking the works.

A	06.11.19	MJP	Drainage updated	MK
REV	DATE	INT	DESCRIPTION	CHK

Issue Status **FOR PLANNING**

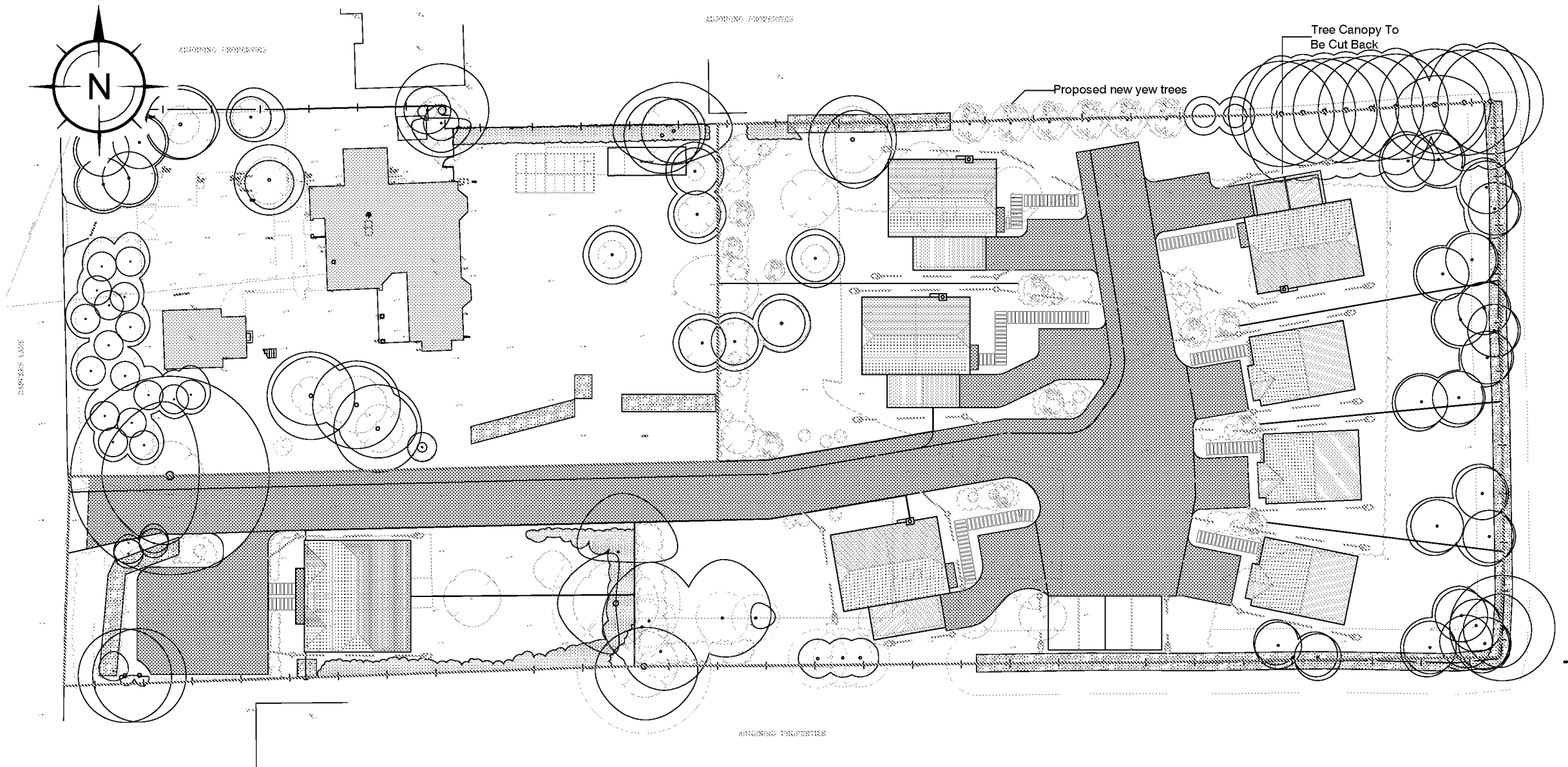
 The First Engineering Practice
11 Tungsten Building
George Street
Fishergate
Sussex
BN41 1RA
01273 436416
info@firsteng.co.uk
www.firsteng.co.uk

CLIENT Oceanview Developments

PROJECT The Laurels
Dappers Lane
Angmering

TITLE Proposed Drainage Strategy Plan

DRAWN	DATE	PROJECT NO	2326
M Pacifico	Oct 2019		
ENGINEER	CHECKED	DRG NO	101
M Kempshall	SRM	REV	A
SCALE	1:500 @ A3		



Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove sediment and debris from silt trap chambers, channel drains and inlet chambers	6 monthly
	Litter and debris removal – catch pots	Monthly or as required
	Surface and foul water pipework – jetting / rodding	Every 2 years or as required
	Manage other vegetation and remove nuisance plants – aesthetics	As required
	Visual inspection of permeable paving for defects and settlement	Annually
	Sweeping / brushing of permeable paving	Every 2 years

Inspection / Action Required	Gullies, Channels and Gutters	Catchpits	Permeable Surface	Surface Water Pipework
After leaf fall in Autumn	✓	✓		
6 Months	✓	✓	✓	
1 Year			✓	
2 Years				✓
When alarm indicates				

Drainage System Maintenance Summary

Maintenance Schedule	Required Action	Frequency
Corrective Maintenance	Remove debris / blockages to silt traps / channel drains	As required
	Repairs to access chambers / manhole covers	As required
	Replace any broken permeable blocks / surface, remedial works to any depressions or rutting. Performance to be monitored through visual observations.	As required
	Exploratory investigations every 5 to 7 years where the need is identified by a suitably qualified person.	
	Inspect inlet, outlet from downpipe and gullies for blockages, standing water and clear	As required

Storm Drainage Maintenance Legend:

To be maintained by the homeowner

Private Type 4 Storm Water Inspection Chamber

Private Storm Water Rodding Eye

To be maintained by estates management Company

Perforated pipework to subbase

Hard paved areas including no dig area at site boundary

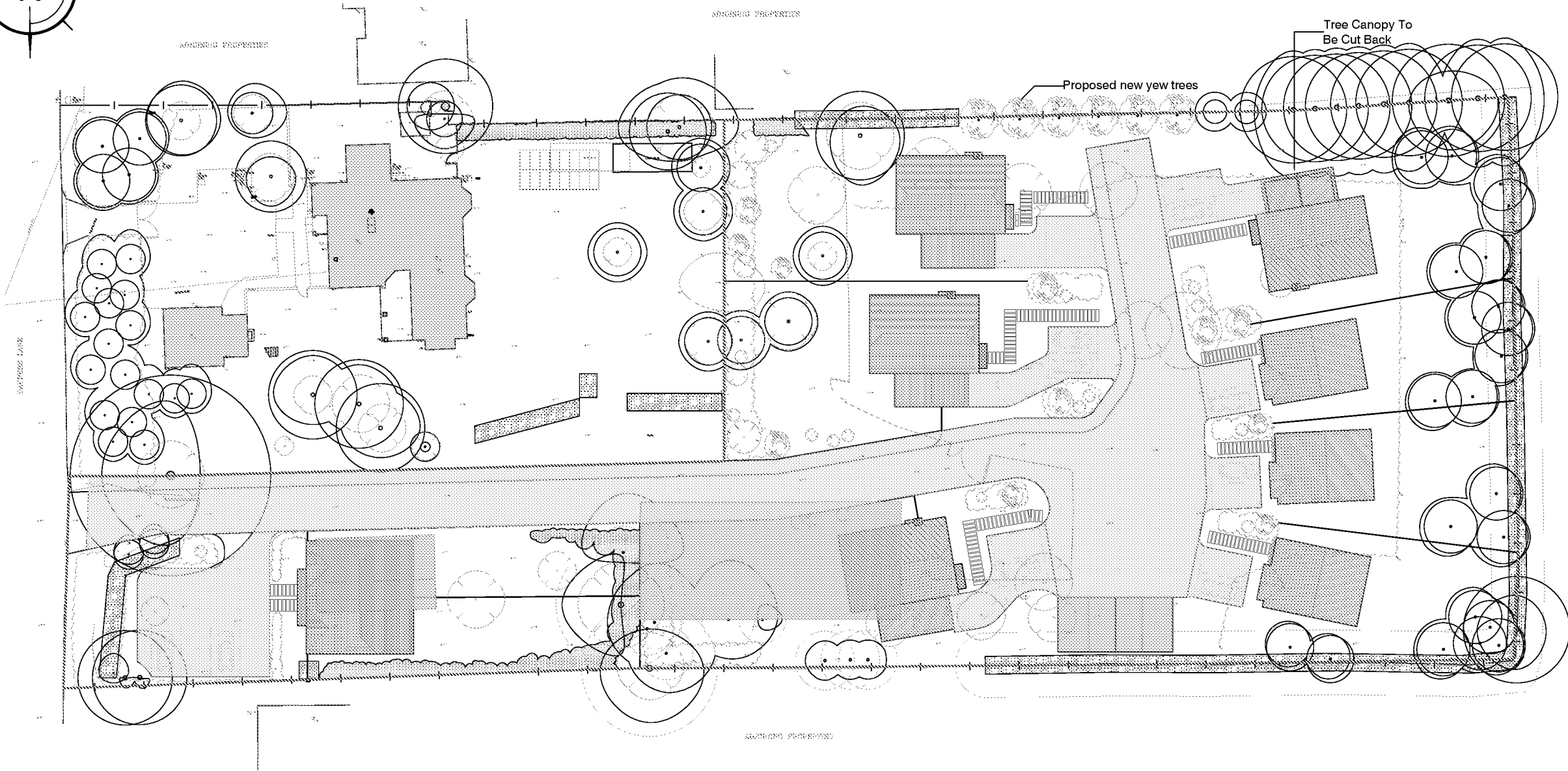
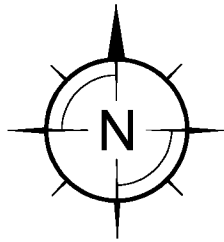
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 3. The main Contractor is responsible for ensuring the stability of the structure whilst the works are in progress.
 4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority. No liability is accepted by the Consultant and the main Contractor is responsible for obtaining and checking all information and taking due care and attention whilst undertaking the works.

REV	DATE	INT	DESCRIPTION	CHK
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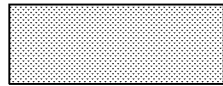
Issue Status FOR PLANNING

The Civil Engineering Practice
11 Tungsten Building
George Street
Fishergate
Sussex
BN41 1RA
01273 434424
reception@civil.co.uk
www.civil.co.uk

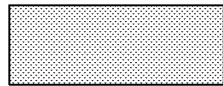
CLIENT	Oceanview Developments		
PROJECT	The Laurels Dappers Lane Angmering		
TITLE	Proposed Ownership Plan		
DRAWN	M Pacifico	DATE	Oct 2019
ENGINEER	M Kempshall	CHECKED	SHM
SCALE	1:500 @ A3		
PROJECT NO	2326	DWG NO	102



Impermeable Areas Legend:



Existing Impermeable Areas 407m²



Proposed Roofs 870m²



Proposed hard paved areas
with permeable surface 1543m²

GENERAL NOTES:

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REV	DATE	INT	DESCRIPTION	CHK
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The Civil Engineering Practice
11 Tungsten Building
George Street
Fishergate
Sussex
BN41 1RA
01273 434424
reception@civil.co.uk
www.civil.co.uk

CUSTOMER Oceanview Developments
PROJECT The Laurels
Dappers Lane
Angmering
TITLE Proposed Impermeable Areas Plan

DRAWN M Pacifico	DATE Nov 2019	PROJECT NO 2326
ENGINEER M Kempshall	CHECKED SFM	DWG NO 103
SCALE 1:500 @ A3		

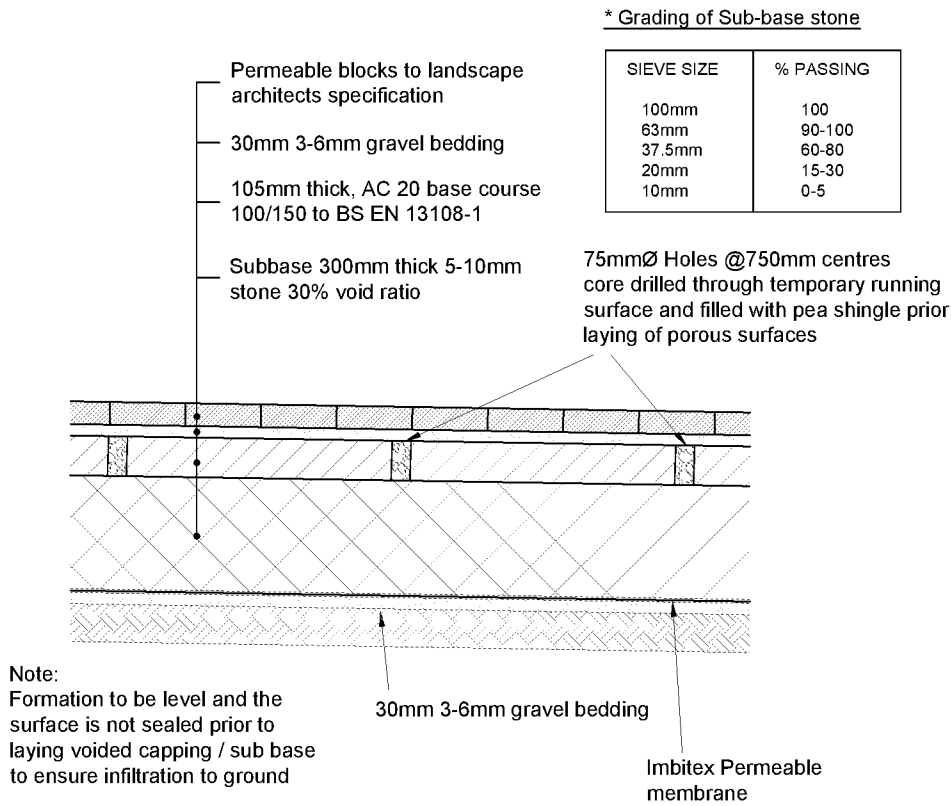
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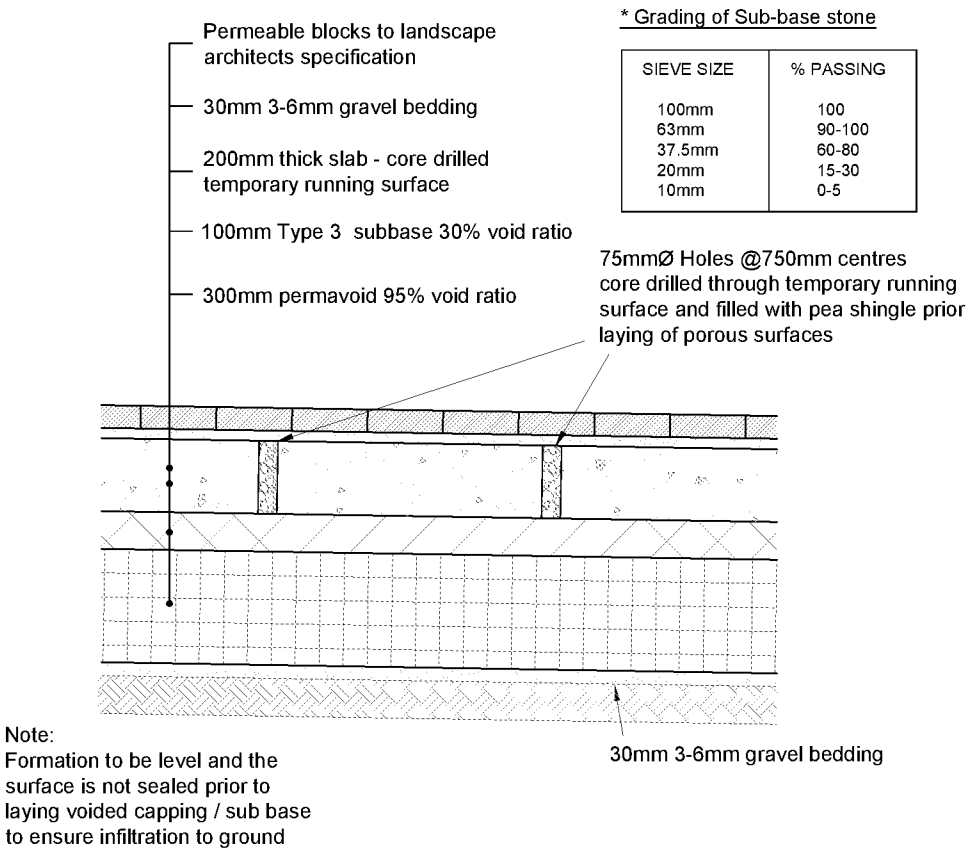
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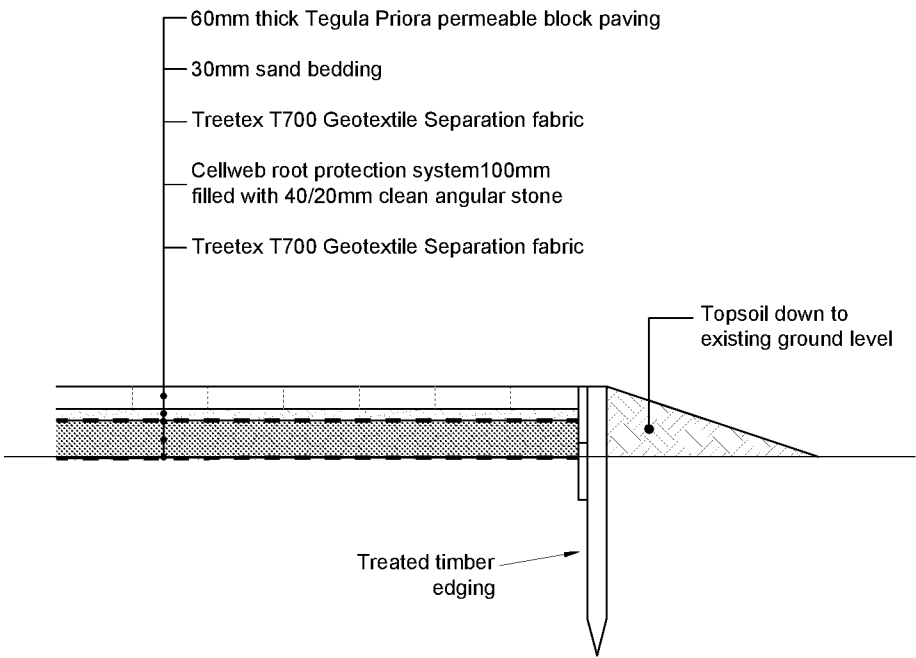
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PV1 - BLOCK CARRIAGEWAY CONSTRUCTION
VOIDED SUBBASE INFILTRATION SYSTEM
(Scale 1:20)



PV2 - BLOCK CARRIAGEWAY CONSTRUCTION
PERMAVOID INFILTRATION SYSTEM
(Scale 1:20)



PV3 - NO DIG CONSTRUCTION
(Scale 1:20)

REV	DATE	INT	DESCRIPTION	CHK
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Issue Status FOR PLANNING

 The Civil Engineering Practice
11 Tungsten Building
George Street
Fishergate
Sussex
BN41 1RA
01323 434424
info@the-civil.co.uk
www.the-civil.co.uk

CUSTOMER Oceanview Developments

PROJECT The Laurels
Dappers Lane
Angmering

TITLE Construction Details

DRAWN	DATE	PROJECT NO.
M Pacifico	Nov 2019	2326
ENGINEER	CHECKED	DRG NO.
M Kempshall	SFM	104
SCALE		REV
As Shown @ A3		

The Civil Engineering Practice					Page 1																																																																																																																																																																																																																			
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Summary of Results for 100 year Return Period (+40%) Half Drain Time : 126 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (mE)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>16.840</td><td>0.150</td><td>6.7</td><td>55.3</td><td>O K</td></tr><tr><td>30 min Summer</td><td>16.882</td><td>0.192</td><td>6.7</td><td>70.8</td><td>O K</td></tr><tr><td>60 min Summer</td><td>16.914</td><td>0.224</td><td>6.7</td><td>82.8</td><td>O K</td></tr><tr><td>120 min Summer</td><td>16.926</td><td>0.236</td><td>6.7</td><td>87.0</td><td>O K</td></tr><tr><td>180 min Summer</td><td>16.922</td><td>0.232</td><td>6.7</td><td>85.6</td><td>O K</td></tr><tr><td>240 min Summer</td><td>16.914</td><td>0.224</td><td>6.7</td><td>82.8</td><td>O K</td></tr><tr><td>360 min Summer</td><td>16.898</td><td>0.208</td><td>6.7</td><td>76.8</td><td>O K</td></tr><tr><td>480 min Summer</td><td>16.883</td><td>0.193</td><td>6.7</td><td>71.2</td><td>O K</td></tr><tr><td>600 min Summer</td><td>16.869</td><td>0.179</td><td>6.7</td><td>65.9</td><td>O K</td></tr><tr><td>720 min Summer</td><td>16.856</td><td>0.166</td><td>6.7</td><td>61.2</td><td>O K</td></tr><tr><td>960 min Summer</td><td>16.834</td><td>0.144</td><td>6.7</td><td>53.1</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>16.803</td><td>0.113</td><td>6.7</td><td>41.5</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>16.773</td><td>0.083</td><td>6.7</td><td>30.5</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>16.746</td><td>0.056</td><td>6.7</td><td>20.6</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>16.733</td><td>0.043</td><td>5.8</td><td>15.9</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>16.728</td><td>0.038</td><td>5.1</td><td>13.8</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>16.724</td><td>0.034</td><td>4.5</td><td>12.5</td><td>O K</td></tr><tr><td>8640 min 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Date 04/11/2019 File WHOLE SITE PERMAVOID.SRCX		Designed by MK Checked by			
Innovyze		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (mE)	Status
30 min Winter	16.908	0.218	6.7	80.4	O K
60 min Winter	16.946	0.256	6.7	94.6	O K
120 min Winter	16.964	0.274	6.7	101.0	O K
180 min Winter	16.957	0.267	6.7	98.6	O K
240 min Winter	16.947	0.257	6.7	94.8	O K
360 min Winter	16.923	0.233	6.7	86.1	O K
480 min Winter	16.900	0.210	6.7	77.3	O K
600 min Winter	16.877	0.187	6.7	69.1	O K
720 min Winter	16.857	0.167	6.7	61.6	O K
960 min Winter	16.823	0.133	6.7	48.9	O K
1440 min Winter	16.776	0.086	6.7	31.8	O K
2160 min Winter	16.742	0.052	6.7	19.0	O K
2880 min Winter	16.734	0.044	5.9	16.1	O K
4320 min Winter	16.726	0.036	4.8	13.1	O K
5760 min Winter	16.721	0.031	4.2	11.6	O K
7200 min Winter	16.719	0.029	3.9	10.5	O K
8640 min Winter	16.717	0.027	3.6	9.8	O K
10080 min Winter	16.715	0.025	3.4	9.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (mE)	Time-Peak (mins)		
30 min Winter	90.705	0.0	37		
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240 min Winter	20.078	0.0	190		
360 min Winter	14.585	0.0	266		
480 min Winter	11.622	0.0	342		
600 min Winter	9.738	0.0	414		
720 min Winter	8.424	0.0	484		
960 min Winter	6.697	0.0	616		
1440 min Winter	4.839	0.0	868		
2160 min Winter	3.490	0.0	1148		
2880 min Winter	2.766	0.0	1476		
4320 min Winter	1.989	0.0	2204		
5760 min Winter	1.573	0.0	2944		
7200 min Winter	1.311	0.0	3672		
8640 min Winter	1.129	0.0	4360		
10080 min Winter	0.994	0.0	5144		
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4. STORMWATER INFILTRATION SYSTEMS

In-situ infiltration testing¹ was carried out in both trial pits. For each test undertaken in TP01 the soil infiltration rate (f) was calculated by dividing the volume of water lost between 75% and 25% of the initial test depth by the sum of the average surface area of the sides of the trial pit in contact with the water during the test monitoring period, and its base area. This figure was then divided by the test duration (time taken for the water level to fall between 75% and 25% of the initial test depth) to give the soil infiltration rate in metres per second.

During the test performed within trial pit TP02, the water level within the test pit did not fall below 25% of the initial test depth and calculation of the soil infiltration rate in accordance with the BRE digest was not possible. For this test, the soil infiltration rate has therefore been calculated by dividing the volume of water lost during the test by the product of the average surface area of the trial pit in contact with water during the test period and the test duration in seconds.

In-situ infiltration testing² was also undertaken in boreholes WS01 and WS05. From the test results, calculations were made to estimate the infiltration rate that could be expected for soakaways constructed to discharge into the underlying soils within the test zone.

The infiltration rates derived from the tests are summarised in the following table.

Table 1. Calculated Infiltration Rates

Exploratory Hole	Test Response Zone Depth (m)		Stratum	Calculated Infiltration Rate (f) (m/sec)	Driving Head of Water (m)
	Top	Bottom			
TP01 Test 1	0.57	1.00	Head (slightly gravelly clay over gravelly clay)	1.1×10^{-4}	-
TP01 Test 2	0.55	1.00	Head (slightly gravelly clay over gravelly clay)	1.3×10^{-4}	-
TP01 Test 3	0.57	1.00	Head (slightly gravelly clay over gravelly clay)	2.6×10^{-5}	-
TP02 Test 1	0.70	1.00	Head (slightly gravelly clay)	4.2×10^{-6}	-
WS01 Tests 1, 2 & 3	2.00	3.00	Head (clayey gravel)	2.9×10^{-3}	1.0
WS05 Tests 1, 2 & 3	1.00	2.00	Head (clayey gravel)	2.5×10^{-3}	1.0

The value 'f' is equivalent to the soil infiltration coefficient 'q' quoted in the Construction Industry Research and Information Association (CIRIA) Report 156.

The results from the infiltration tests undertaken at the site indicate that the Head deposits possess moderate to good infiltration characteristics with the higher infiltration rates being recorded in the coarser grained soils encountered at depth. The results from the infiltration tests should be provided to engineers responsible for the design of the drainage system.

¹ Conducted in general accordance with the requirements of BRE 365, Soakaway Design.

² Conducted in accordance with The Soakaway Design Guide, published by Kent County Council, July 2000.

To comply with building regulations³, point discharging infiltration systems (conventional ring or trench soakaways) are required to be constructed a minimum of 5.0m away from proposed or existing buildings.

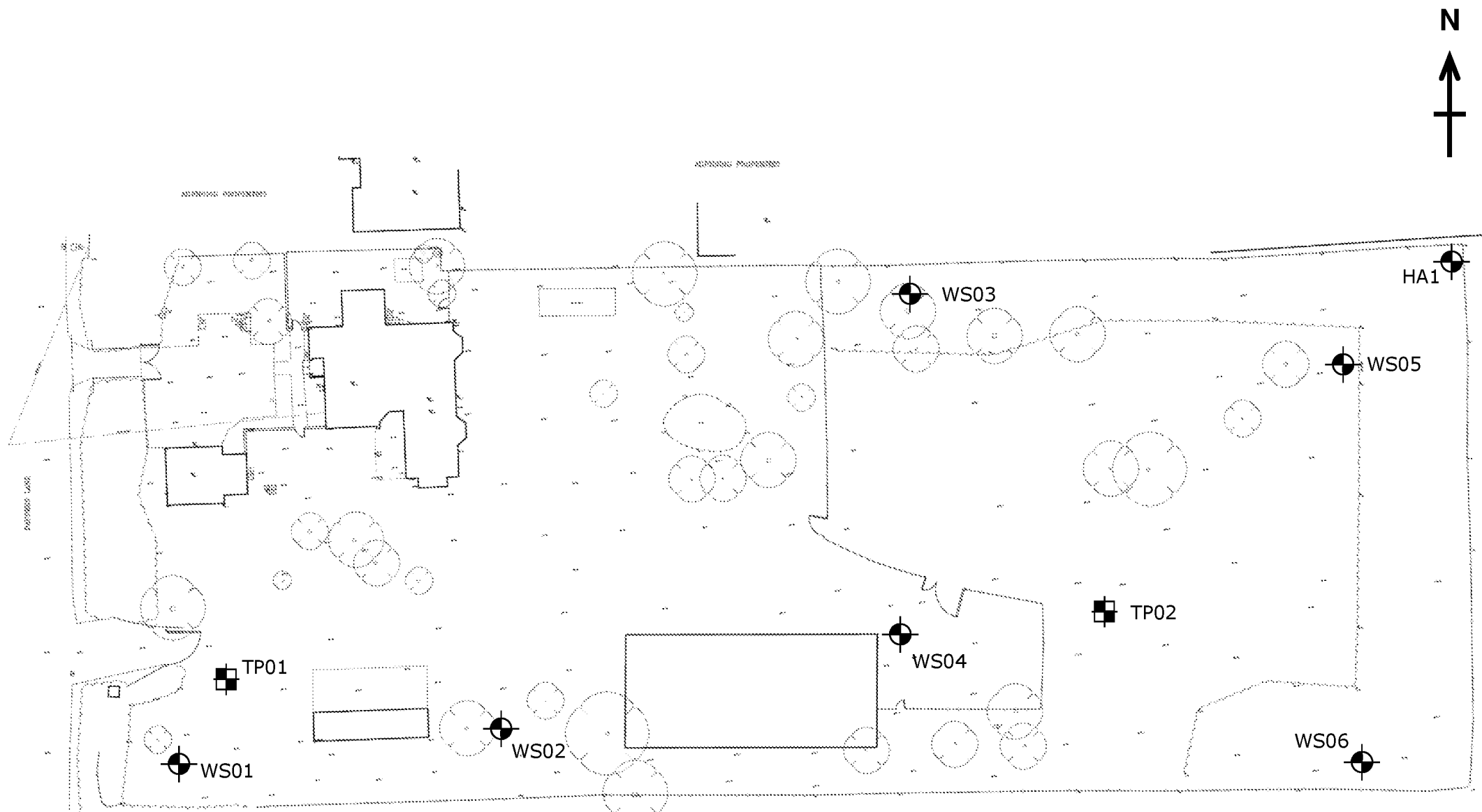
Groundwater monitoring over the winter period is currently underway, as requested by the Local Authority and as suggested by the BRE365 guidance (prior to designing the proposed infiltration systems). The results of the monitoring will follow under separate cover.

Given that discharge to ground via infiltration systems is proposed, it is recommended that designers of the system provide for the prevention of pollution of groundwater. In this regard due consideration should be given to guidance provided within BRE 365 and by the Environment Agency.

Appropriate consideration should also be given to whether there is a need for inclusion of interceptors and oil separators. The Local Authority and/or relevant water company should be consulted in relation to consent for discharge of water from rooftops, areas of hardstanding and roadways to drains.

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³ The Building Regulations 2010; Part H; Drainage and Waste Disposal
The Laurels, Dappers Lane, Angmering, West Sussex



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SUMMARY OF TRIAL PIT FALLING HEAD SOAKAGE TEST RESULTS

TP01 (Test 1)		TP01 (Test 2)		TP01 (Test 3)	
Time (mins)	Depth to water (m bgl)	Time (mins)	Depth to water (m bgl)	Time (mins)	Depth to water (m bgl)
0	0.57	0	0.55	0	0.57
1	0.59	1	0.56	1	0.60
3	0.64	3	0.59	2	0.61
7	0.72	8	0.67	5	0.62
11	0.80	19	0.92	8	0.65
19	0.95	25	Dry	17	0.73
24	Dry			28	0.78
				51	0.87
				98	Dry
Pit Length - 1.00m Pit Width - 0.30m Pit Depth - 1.00m bgl		Pit Length - 1.00m Pit Width - 0.30m Pit Depth - 1.00m bgl		Pit Length - 1.00m Pit Width - 0.30m Pit Depth - 1.00m bgl	

Remarks: bgl - below ground level.

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Groundwater Monitoring Results - WS04

