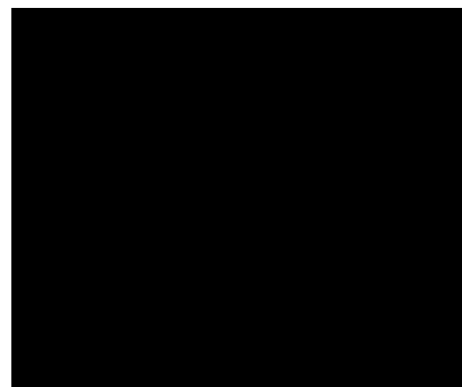




Flood Risk Assessment

Proposed Residential Development

Land West of North End Road, Yapton

On behalf of

Pibworth Holdings Ltd

April 2019

Document History and Status

Project Number 23110

Date	Version	Prepared By	Reviewed By	Approved By
12 November 2018	Draft 1.0	Tom Zajac BE ng GradICE	Stuart Magowan IE ng MIC E	Stuart Magowan IE ng MIC E
30 April 2019	1.0	Nathan Shields	Stuart Magowan IE ng MIC E	Stuart Magowan IE ng MIC E

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1 Non Technical Summary

- 1.1 This Flood Risk Assessment has been undertaken in accordance with the National Planning Policy Framework on behalf of Pipworth Holding Ltd in support of an Outline Planning Application for the construction of up to 38 residential dwellings with associated access roads, car parking and landscaping on land west of North End Road, Yapton.
- 1.2 This Assessment is to be read in conjunction with all planning, architectural and other reports that accompany the Outline Planning Application for the proposed development.
- 1.3 The site is located in Flood Zone 1.
- 1.4 The proposed development will incorporate a sustainable drainage system which will discharge surface water via infiltration to ground and provide storage for all storm return periods up to and including the 1:100 year rainfall event with an allowance for climate change.
- 1.5 Foul will be discharged by gravity to the existing public foul sewer located beneath North End Road.
- 1.6 The site is within the Lidsey Foul Water Treatment Catchment Area but with proposed foul discharge into the public sewers. There is no requirement for an Environmental Assessment to justify the proposed foul discharge into the public sewer network.
- 1.7 This report concludes that the site is not at risk of flooding from tidal or fluvial sources, overland flows or flooding risk from groundwater and that the proposed development is suitable at this location.

2 Planning Policy Context

2.1 National Planning Policy Framework

2.1.1 The National Planning Policy Framework was updated in July 2018.

2.1.2 With regard to planning and flood risk the policy framework states that when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment.

Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- b) the development is appropriately flood resistant and resilient;
- c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- d) any residual risk can be safely managed; and
- e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

2.1.3 With regard to minor developments the NPPF states that applications for some minor development and changes of use (reference footnote 51) should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 50.

2.1.4 Footnote 50 reads: a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.)

2.1.5 Footnote 51 reads :this includes householder development, small non-residential extensions (with a footprint of less than 250m²) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate.~

2.1.6 With regard to major developments the NPPF states that :major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

- a) take account of advice from the lead local flood authority;
- b) have appropriate proposed minimum operational standards;
- c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- d) where possible, provide multifunctional benefits~

2.1.7 Major development is defined as follows:

:For housing, development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more. For non-residential development it means additional floorspace of 1,000m² or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management Procedure) (England) Order 2015.~

2.2 Lead Local Flood Authority

2.2.1 West Sussex County Council became a Lead Local Flood Authority under the Flood and Water Management Act 2010 and was given a series of new responsibilities to coordinate the management of local flood risk.

2.2.2 As part of their role West Sussex County Council have commissioned and produced the following documents:

- ¿ Strategic Flood Risk Assessment - J anuary 2010
- ¿ Preliminary Flood Risk Assessment - May 2011
- ¿ Local Flood Risk Management Strategy - May 2014

2.2.3 The above documents have been reviewed in the preparation of this report.

2.3 Arun District Council

2.3.1 Arun District Council have commissioned and produced the following documents:

- Combined Level 1 and Level 2 Strategic Flood Risk Assessment - Final Report - November 2016

2.3.2 The above document has been reviewed in the preparation of this report.

2.4 Local Planning Policy

2.4.1 The Arun Local Plan 2011-2031 was adopted on 18 July 2018

2.4.2 The following policies are of specific relevance to this Flood Risk Assessment

2.4.3 Policy W DM2 Flood Risk states that development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Council's Strategic Flood Risk Assessment (SFRA), will only be permitted where all of the following criteria have been satisfied:

- a. The sequential test in accordance with the National Planning Policy Guidance has been met.
- b. A site specific Flood Risk Assessment demonstrates that the development will be safe, including access and egress, without increasing flood risk elsewhere and reduce flood risk overall.
- c. The sustainability benefits to the wider community are clearly identified.
- d. The scheme identifies adaptation and mitigation measures.
- e. Appropriate flood warning and evacuation plans are in place; and
- f. New site drainage systems are designed to take account of events which exceed the normal design standard i.e. consideration of flood flow routing and utilising temporary storage areas.

The reports prepared as part of the criteria above must take into account contingency allowances, taking climate change into account as set out in Flood Risk Assessments: climate change allowances section of the NPPG.

In locations where strategic flood defence or resilient and resistant construction measures are necessary within the site itself, proposals will be required to demonstrate how measures have been incorporated as an

intrinsic part of the scheme in a manner which is compatible with the latest Strategic Flood Risk Assessment.

All development proposals must take account of relevant Surface Water Management Plans, Catchment Flood Management Plans and related Flood Defence Plans and strategies such as the Lower Tidal River Arun Strategy

The council may require financial contributions from development on sites where measures to address flood risk or to improve the environmental quality of watercourses have been identified by these Plans and Strategies.

2.4.4 Policy W DM3 Sustainable Urban Drainage Systems states that to increase the levels of water capture and storage and improve water quality, all development must identify opportunities to incorporate a range of Sustainable Urban Drainage Systems (SUDS), appropriate to the size of development, at an early stage of the design process.

Proposals for both major and minor development proposals must incorporate SUDS within the private areas of the development in order to provide source control features to the overall SUDS design.

These features include:

- ¿ Green roofs
- ¿ Permeable driveways and parking
- ¿ Soakaways
- ¿ Water harvesting and storage features including water butts

Proposals for major development must also integrate SUDS within public open spaces and roads, reflecting discussion with the appropriate bodies. SUDS must therefore be integrated into the overall design of a development and must:

- a. Contribute positively to the appearance of the area, integrating access to allow maintenance of existing watercourses and the system.
- b. Effectively manage water (including its quality)
- c. Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets
- d. Provide amenity for local residents (ensuring a safe environment)

- e. Retain the existing drainage network of the site and the wider area,
- f. Be maintained in perpetuity, supported through a Maintenance and Management Plan/Regime, including its financing, agreed with the Local Planning Authority.

In order to ensure that SUDS discharge water from the development at the same or lesser rate, as prior to construction, developers must:

- f. (sic) 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 SUDS manual produced by CIRIA.
- g. Undertake up to six months groundwater monitoring within the winter period.
- h. Undertake winter percolation testing in accordance with BRE365.
- i. The proposed drainage system must be designed to ensure that there is no flooding on a 1 in 30 year storm event.
- j. The design must also take account of the 1 in 100 year storm event plus 30% allowance for climate change, on stored volumes, to ensure that there is no flooding of properties or the public highway or inundation of the foul sewerage system.

Any excess flows must be contained within the site boundary, and within designated storage areas.~

3 Existing Site

3.1 Site Location

- 3.1.1 The development site is located on the land west of B2132 North End Road, Yapton at Ordnance Survey reference SU 977 037. The nearest postcode is BN18 0DU.



Image 1: Site Location

- 3.1.2 The site is bounded to the north by residential properties, the east by B2132 North End Road, the south by Yapton C of E Primary School and agricultural land to the west.

- 3.1.3 A copy of the site location plan is located in Appendix 1 at the rear of this report.

3.2 Site Description

- 3.2.1 The site is approximately 1.6ha in area and currently undeveloped open land historically used to keep livestock, and more recently for horse grazing.

3.2.2 Existing ground levels are highest at the south east corner of the site at approximately 7.2m AOD. The site falls towards its south west boundary to a level of approximately 5.8m AOD.

3.2.3 A copy of the existing site layout plan is located in Appendix 2 at the rear of this report.

3.3 Existing Drainage

3.3.1 The site currently has no positive surface water or foul water drainage infrastructure.

3.3.2 Surface water runoff from the site discharge into the ground and disperses over the fields.

3.3.3 There are no apparent watercourses adjoining the site boundaries.

3.3.4 Details from the Environmental Agency note a Ryebank Rife south of the B2233 Main Road and approximately 300m to the south western corner of the site.

3.3.5 The existing greenfield runoff rate has been established using XP Solutions Microdrainage.

3.3.6 Q_{bar} has been established at 5.9l/s and the 1:100 year peak runoff 18.9l/s

3.3.7 The equivalent greenfield runoff rates are 3.68l/s/ha and 11.6l/s/ha respectively.

RURCAL INPUTS

Return Period (Years): 100

Area (ha): 1.60

Soil: 750

Catchment Curve: None

Map

Calculate

Results

QBAR rural (l/s): 8.3

QBAR urban (l/s): 8.3

Return Period Load

Region	QBAR (l/s)	Q (100 yrs) (l/s)	Q (10 yrs) (l/s)	Q (30 yrs) (l/s)	Q (500 yrs) (l/s)
Region 1	5.9	14.8	5.3	11.3	15.8
Region 2	5.9	15.3	5.3	11.2	15.5
Region 3	5.9	12.3	5.3	10.4	12.3
Region 4	5.9	15.2	4.9	11.6	15.2
Region 5	5.9	21.3	5.1	14.2	21.3
Region 6/Region 7	5.9	18.8	5.8	13.4	18.8
Region 8	5.9	14.3	4.8	11.2	14.3
Region 9	5.9	12.8	5.2	10.4	12.8
Region 10	5.9	12.3	5.1	10.8	12.3
Ireland National	5.9	18.9	5.8	9.4	18.9
Ireland East	5.9	11.2	5.8	8.8	11.2
Ireland South	5.9	18.8	5.8	9.4	18.8
Ireland West	5.9	18.3	5.8	9.4	18.3
Ireland Greater Dublin	5.9	15.4	5.8	12.5	15.4

OK Cancel Help

Enter Return Periods between 1 and 1000

Image 2: Greenfield Runoff Calculation

3.3.8 There are public foul water sewers located beneath the B2132 North End Road to the south east of the site.

3.3.9 A copy of the sewer records is located in Appendix 3 at rear of this report.

3.4 Geology and Groundwater

3.4.1 British Geological Survey maps and borehole information identify the site being located within an area underlain Superficial River Terrace Deposits (a clayey Sand layer) overlying Lewes Nodular Chalk.

3.4.2 The ground investigation reports for adjoining sites, available on the public access planning portal also confirm the area of the site to be underlain by made ground and River Terrace deposits to a depth of approximately 3.0m overlying Lewes Nodular Chalk.

3.4.3 The available borehole log information confirms groundwater was encountered at a depth of 2.6m below ground level within the River Terrace deposits.

3.4.4 Groundwater monitoring will be required to confirm the groundwater level within the proposed development land.

3.4.5 Proposed development is located within the area located beyond the Source Protection Zone.

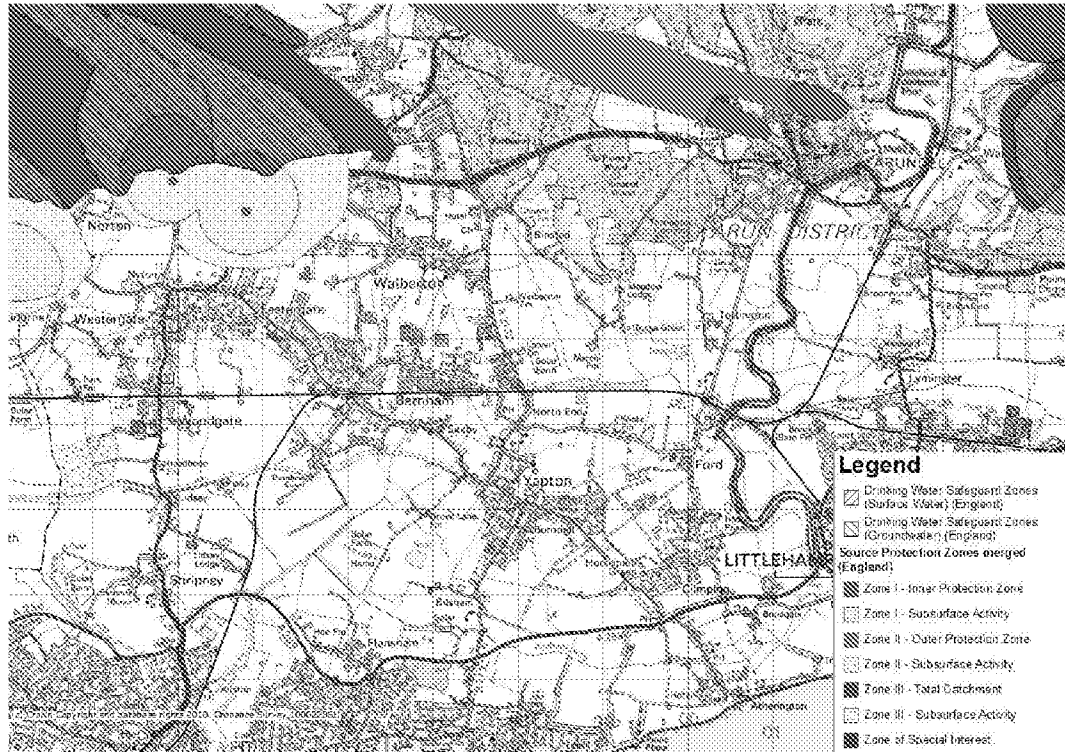


Image 3: Source Protection Zone Map

3.4.6 The online 'Magic Map' available from Defra confirms that the site is located above a major aquifer classified as having an intermediate vulnerability.

3.4.7 A copy of the BGS Geological Borehole Data, 'Magic Map' Aquifer Classification and Source Protection Zone Map extract are located in Appendix 4 at the rear of this report.

4 Flood Zone and Flood History

4.1 Flood Zone

- 4.1.1 The Environment Agency's online mapping confirms that the site is located in Flood Zone 1 and is not at risk of flooding from rivers or the sea from anything less extreme than a 1:1000 year flood event.

4.2 Flood History

4.2.1 Environment Agency

- 4.2.1.1 The Environment Agency maps of historic flood incidents do not identify any historic incidents of flooding in the locality of the site.

4.2.1 West Sussex County Council

- 4.2.1.1 Neither the Strategic Flood Risk Assessment dated December 2010, the Preliminary Flood Risk Assessment dated July 2011 nor the Local Flood Risk Management Strategy dated August 2014 identify any specific flood incidents in the immediate vicinity of the site.

4.2.2 Arun District Council

- 4.2.2.1 The Level 1 and Level 2 Strategic Flood Risk Assessment dated November 2016 does not identify any specific flood incidents in the immediate vicinity of the site.
- 4.2.2.2 Correspondence received from Arun District Council confirms that the District Council hold no records of historic flooding at the site.
- 4.2.2.3 Copies of the available flood maps and correspondence are located in Appendix 5 at the rear of this report.

5 Flooding Potential

5.1 Tidal Flooding

5.1.1 The site is located 4km from the coast and is not at risk of tidal flooding.

5.2 Fluvial Flooding

5.2.1 The area of the proposed site is within Flood Zone 1 and is not at risk of fluvial flooding from anything less extreme than a 1:1000 year flood event.

5.3 Groundwater Flooding

5.3.1 The British Geological Survey borehole log information identify the recorded groundwater at a depth of 2.6m below ground level.

5.3.2 There are no records identified within West Sussex County Council's Strategic Flood Risk Assessment, Preliminary Flood Risk Assessment or Local Flood Risk Management Strategy nor in Horsham District Council's Strategic Flood Risk Assessment of groundwater flooding affecting the site.

5.3.3 There is no indication in the Preliminary Flood Risk Assessment or other available flood maps of groundwater flooding affecting the site.

5.4 Overland Flow

5.4.1 The Environment Agency's maps confirm the site is not at risk of flooding from overland flows.

5.4.2 The flood mapping contained within the various flood documents produced by West Sussex County Council and Arun District Council does not identify any flood risk associated with overland flow routes.

5.5 Flood Routing

5.5.1 The natural route for flood waters to dissipate, should any ever occur on the site, is towards the south west corner of the site boundary. The potential flood route will follow the natural topography of the site. From the available soil information and evidence of the Greenfield runoff calculations it is not anticipated that there would be significant runoff from the site.

6 Development Proposals

6.1 Description

6.1.1 The development proposals are for the construction of up to 38 residential dwellings with associated access roads, car parking and landscaping area.

6.1.2 A copy of the proposed indicative site layout plan is located in Appendix 6 at the rear of this report.

6.2 Drainage Strategy

6.2.1 Based upon the available information it is anticipated that discharge of surface water runoff by infiltration will be feasible.

6.2.2 The surface water system will be designed to comply with the National Planning Policy Framework and its supporting guidance documents including the Non-Statutory Technical Standards for SuDS.

6.2.3 Storage will be provided to accommodate a 1:100 year storm event with an additional 40% to account for the predicted effects of increased rainfall intensity due to future climate change.

6.2.4 The impermeable areas for various elements of the site are as follows.

¿ Residential Dwellings

- o 2,600m² Roof Area
- o 1,850m² Parking and private drives

¿ Highways

- o 2,450m² Total

6.2.5 The total impermeable area of the site is anticipated to be approximately 6,900m².

6.2.6 Based upon the proposed development of 38 residential units the average impermeable roof area per residential unit is 100m².

6.2.7 Preliminary calculations have been prepared based on an assumed infiltration rate of 3.5×10^{-6} m/s which is conservative infiltration rate for River Terrace deposits. Further investigation will be undertaken including infiltration testing to BRE Digest 365 requirements to inform the detailed design.

6.2.8 From the preliminary calculations individual cellular crate soakaways with total surface area of 9m² and three crates deep will be sufficient for the

residential units to drain up to the 1 in 100 year rainfall event including an allowance for climate change.

6.2.9 In accordance with Building Regulation and BRE Digest 365 method private cellular crates soakaways have been designed for 1 in 10 year storm to half drain within thus providing storage for the 1 in 100 year storm including 40% for climate change.

6.2.10 Surface water runoff from the private access roads, driveways and parking areas will be discharged into the ground via permeable block paving.

6.2.11 A minimum 300mm deep voided subbase will be required which will be sufficient to provide storage for up to 1 in 100 year rainfall event.

6.2.12 Surface water runoff from highways can be accommodated within a trench soakaway 2m wide, 1.2m deep located within the proposed open space area. From the preliminary calculations 200m of trench soakaway will be required to cater for the 1 in 100 year rainfall event including climate change allowance.

6.2.13 The drainage proposals will be confirmed at detailed design stage subject to further site investigations and testing and if infiltration is found to be higher than assumed, the storage requirement will be reduced.

6.3 Foul Water

6.3.1 The anticipated peak foul sewer discharge from the proposed development is 1.8l/s based upon Sewers for Adoption 7th Edition.

6.3.2 An onsite pumping station may be required to lift the foul drainage from the south west areas of the site.

6.3.3 Foul drainage will be discharged from the onsite pumping station to a new manhole at the eastern site boundary which will discharge by gravity to the existing public foul sewer beneath the B2132 North End Road to the east of the site.

6.3.4 The proposed location for a new pumping station will be confirmed if required at detailed design.

6.3.5 Southern Water has been contacted to undertake an initial Level 1 Foul Capacity Check. At the time of writing this statement Southern Water's response was not yet available.

- 6.3.6 From 1 April 2018 Southern Water can no longer charge for improving offsite infrastructure to provide capacity. If the new development is to be connected via a new pipe with the same diameter or less than the existing public sewer.
- 6.3.7 Any existing network reinforcement if required will be undertaken by Southern Water and the developer will be charged based on the new infrastructure charges. For this development of > 20 units the charge is £765 per property.
- 6.3.8 The proposed foul sewer discharge system sits outside the requirements for an Environmental Assessment with regards to foul drainage discharge.
- 6.3.9 A copy of the proposed impermeable areas, preliminary drainage strategy plan together with the preliminary surface water calculations are located in Appendix 7 at the rear of this report.
- 6.4 Water Quality
- 6.4.1 The proposed development is for residential use. In accordance with CIRIA SuDS Manual 2015 (Report C753), the pollution hazard level for this type of development is between very low and low depending on the use/area of the site. Where surface water runoff is to be discharged to ground within a groundwater protection zone, the SuDS components are only required to control potential contaminants for the frequent low intensity rainfall events as the natural high volume of flows within the receiving water body during a high intensity rainfall event is likely to dilute any contaminants within the water body.
- 6.4.2 The surface water scheme will include mitigation to ensure that surface water is suitably treated and any pollution risk mitigated prior to discharge.
- 6.4.3 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types and uses and defines runoff from residential roofs to be at very low risk potential for pollution. Runoff from individual property driveways, residential car parks is considered to be at low risk potential for pollution.

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very Low	0.20	0.20	0.05
Individual property driveways, residential car park, low traffic roads	Low	0.50	0.40	0.40

Table 1: Pollution Hazard Indices

6.4.4 Where multiple drainage components are used in series the individual mitigation index of secondary and tertiary components is halved due to reduced performance associated with primary treatment.

SuDS Type	Total suspended solids (TSS)	Metals	Hydro-carbons
Permeable paving	0.7	0.6	0.7
Swale	0.5	0.6	0.6
Soakaway with 300mm minimum depth underlying soil drainage media	0.4	0.4	0.4

Table 2: Pollution Mitigation Indices

6.4.5 The proposed use of combination of swale and gravel trench soakaway will meet the target mitigation level required for runoff with low risk of pollution potential thus demonstrating that the surface water drainage system for the site can be designed to adequately mitigate against the risk of pollution.

6.4.6 An outline drainage maintenance schedule is located in Appendix 8 at the rear of this report.

7 Safe Development

7.1 Flood Zone Compatibility

7.1.1 The site and its wider area are in Flood Zone 1 and will remain so into the foreseeable future.

7.1.2 With reference to the Technical Guidance to the National Planning Policy Framework:

¿ Table 2: Flood Risk Vulnerability Classification.

The type of development proposed is classified as More Vulnerable.

¿ Table 3: Flood Risk Vulnerability and Flood Zone Compatibility.

More Vulnerable development is appropriate in Flood Zones 1 and 2.

7.2 Risk to Others

7.2.1 The proposed surface water drainage system will be designed to current standards incorporating SuDS elements providing treatment, attenuation and storage which will minimise runoff leaving the site during times of heavy rain.

7.2.2 Allowance has been made for 40% increase in rainfall intensities which accords with the latest figures published by the Environment Agency and in accordance with the requirements under the National Planning Policy Framework.

7.2.3 The proposed drainage system will incorporate sufficient treatment prior to final discharge destination thus mitigating the risk of pollution from the site.

7.2.4 The risk of surface water flooding to others due to the development proposals is reduced and the resultant risk is negligible.

7.2.5 Given the obligation of sewerage undertakers to upgrade the existing networks if a connection to an equivalent sized public sewer is available the risk of sewer flooding from this development in the foreseeable future is negligible.

8 Conclusions

- 8.1 The site is located within Flood Zone 1 and is not at risk from any source of flooding.
- 8.2 There are no historic records of flooding from any source affecting the site or its immediate area.
- 8.3 The geology of the area is predominantly River Terrace Deposit over Chalk with anticipated good infiltration characteristics.
- 8.4 Preliminary calculations indicate that surface water runoff generated by the proposed development can be attenuated on site for all rainfall events up to the 1:100 year event including an allowance for climate change.
- 8.5 Water quality improvement will be provided to mitigate against any risk to any receiving waterbody.
- 8.6 An on site pumping station will be required to lift the foul drainage from the south west areas of the site and discharge it to the existing public foul sewers beneath the B2132 North End Road to the east of the site.
- 8.7 In terms of flood risk planning the proposed development is safe, will not increase flood risk elsewhere and will provide improvement to immediately adjacent sites by managing surface water from all rainfall events up to the 100 year plus climate change event.
- 8.8 The development proposals are suitable at this location.

9 List of Appendices, Images and Tables

Appendix 1	Site Location Plan
Appendix 2	Existing Site Layout Plan
Appendix 3	Sewer Records
Appendix 4	BGS Geological Borehole Data
Appendix 5	Flood Maps and Correspondence
Appendix 6	Proposed Site Layout Plan
Appendix 7	Proposed Impermeable Areas Plan Preliminary Drainage Strategy Plan Preliminary Surface Water Calculations
Appendix 8	Outline Drainage Maintenance Schedule
Image 1	Site Location
Image 2	Greenfield Runoff Calculation
Image 3	Source Protection Zone Map
Table 1	Pollution Hazard Indices
Table 2	Pollution Mitigation Indices

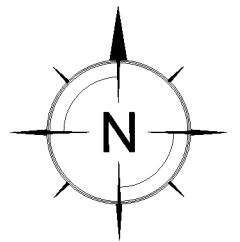
Appendix 1

Site Location Plan



Appendix 2

Existing Site Layout Plan

02

Appendix 3

Sewer Records

SEWER RECORDS PAGE 1 OF 2

104080



103502

O.S. REF.

SU9703NE

Title: 313559_Land at North End Road,

Drawn by: yadavsa

Scale: 1:2500

Date: 26/10/2018

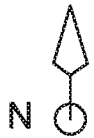
The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy.

The actual positions should be determined on site.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

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

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498244

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape
0001X	5.9	4.02	175	VC	CIRC																		
0501X	5.69	4.78	175	VC	CIRC																		
0502X	5.86	4.41	175	VC	CIRC																		
0503X	5.99		175	VC	CIRC																		
0504X	6.05	4.53	175	VC	CIRC																		
1501X	6.45	4.85	175	VC	CIRC																		
1502X	6.39	4.58	175	VC	CIRC																		
3501X	3.02	1.08	350	PF	CIRC																		
3502X	2.58	0.9	350	PF	CIRC																		
3601X	3.96	2.11	175	VC	CIRC																		
3602X	3.14	0.74	350	PF	CIRC																		
3604X	3.19	0.86	150	VC	CIRC																		
3605Y	3.15		225	VC	CIRC	*																	
3605X	3.15		225	VC	CIRC	*																	
3606X	3.42		150	VC	CIRC																		
360PX	3.42	3.41	300	BAC	CIRC																		
3701X	5	3.44	150	VC	CIRC																		
4601X	4.46	2.99	150	VC	CIRC																		
7501X	5.75	3.23	175	VC	CIRC																		
7502X	5.56	3.22	175	VC	CIRC																		
7503X	5.47	3.02	175	VC	CIRC																		
7601X			100	VC	CIRC																		
8501X	5.8	3.32	175	VC	CIRC																		
8502X	6.989	5.167	150	VC	CIRC																		
8503X	6.83	5.47	150	PVC	CIRC																		
8602X	5.57	3.56	175	VC	CIRC																		
8603X	6.03	3.67	175	VC	CIRC																		
861DX			175	VC	CIRC																		
8701X	5.96	4.12	175	VC	CIRC																		
8702X	5.78	3.83	175	VC	CIRC																		
8801X	6.04	4.48	175	VC	CIRC																		
9502X	6.938	5.057	150	VC	CIRC																		
9505X	7.037		150	VC	CIRC																		
9601X	6.25	3.98	175	VC	CIRC																		
9603X	6.298		175	VC	CIRC																		
9801X	6.27	4.77	175	VC	CIRC																		
9901X	6.27	4.85	175	VC	CIRC																		
9902X	6.13	4.56	175	VC	CIRC																		

LINE STYLES / COLOURS

Brown	-----	Full
	-----	Full System Sewer
	-----	Full Vacuum Main
	-----	Full Rising Main
Red	-----	Combined
	-----	Combined System Sewer
	-----	Combined Rising Main
Orange	-----	Lateral Onin
	-----	Building Over Agreement Area
Dark Blue	-----	Trusted Effluent
Purple	-----	Seepage
	-----	Sewer Catchment
	-----	Section 104 Area
Light Blue	-----	Surface Water
	-----	Surface Water Rising Main
Yellow	-----	Private
Green	-----	Access Shaft
	-----	Decommissioned

MATERIALS

AK	Alkaline
BAC	Reinforced Asbestos Cement
BRD	Block (Common)
BRE	Block (Engineering)
CC	Concrete Box Culvert
CI	Cast Iron
CG	Concrete (In-Situ)
CP	Concrete (Pre-Cast)
CSB	Concrete Segments (boxed)
CSU	Concrete Segments (unboxed)
DI	Ductile Iron
GRP	Glass Reinforced Concrete
GRP	Glass Reinforced Plastic
MAN	Masonry in regular Courses
MAN	Masonry in random Courses
PE	Polyethylene
PF	Plastic Fibre
PP	Polypropylene
PVC	Polyvinyl Chloride
RFM	Reinforced Plastic Matrix
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
XX	Other
ZZ	Unknown

Manhole (SW)
Manhole (F&C)
Lamp hole (SW)
Lamp hole (F&C)
Pumping Station (SW)
Pumping Station (F&C)
Side entry manhole (SW)
Side entry manhole (F&C)
Blind shaft (SW)
Blind shaft (F&C)
Ejector station (SW)
Ejector station (F&C)
Watertight door (SW)
Watertight door (F&C)
Flushing ch. Man (SW)
Flushing ch. Man (F&C)
Flushing ch. Non (SW)
Flushing ch. Non (F&C)
Domestic Chamber

LEGEND - SEWERS

Washout (SW)
Washout (F&C)
Redding Eye (SW)
Redding Eye (F&C)
Gauging point (SW)
Gauging point (F&C)
Intercept chamber (SW)
Intercept chamber (F&C)
Storm Tank (SW)
Storm Tank (F&C)
Vortex chamber (SW)
Vortex chamber (F&C)
Label ellipse
Diameter/524 nozzle
Outlet
Pemecok chamber
Demiboard
Storm Overflow
Backcrop manhole

Other (s)
Other
Change in sewer (s)
Change in sewer
Reflex valve
Flap valve
Cascade
Anode
Valve
Closed Valve
Air Valve
Hatch box (SW)
Hatch box (F&C)
Direction arrow
Emptying valve
Catchpit
Scallopway
Isol
Branching Pond

Wastewater treatment works
Wastewater treatment works
Outlet headworks
Valve
Valve column
Tidal storage tank
Blank end
Head of Public Sewer
Storm Pumping Station
SHAPES (S)
A Archhead
B Semi
C Circular
E Egg
H Horseshoe
R Rectangular
S Square
T Triangular
U U Shape
X Other
NODE REFERENCING SYSTEM
1st digit: hundred metre ending identifier
2nd digit: hundred metre starting identifier
sewer type identifier
0-4 = Invert Combined
5-9 = Surface Water
4th digit: next sequential node

Drawn by: yadavsa	
Title: 313559_Land at North End Road,	
Date: 26/10/2018	

Appendix 4
BGS Geological Borehole Data
Magic Map Aquifer Classification
and Source Protection Zone Map Extract



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 434407 : BGS Reference: SU90SE29

British National Grid (27700) : 497380,103350

Report an issue with this borehole

<<

< Prev

Page 1 of 1

Next >

>>

SU 90 SE 29

9738 8335

North-east end of Drove Lane, Yapton

Surface level +6.6 m
Water struck at +1.9 m
October 1981

Block H

Overburden 2.9 m
Mineral 1.0 m
Bedrock 2.3 m+

LOG

Geological classification

Lithology

**Thickness
m**

**Depth
m**

		m	m
	Soil	0.5	0.5
Brickearth	Clay, brown, silty	1.4	1.9
Raised Beach Deposits (younger)	Silt, chalky, with chalk pebbles	1.0	2.9
	'Very clayey' sandy gravel	1.0	3.9
	Gravel: coarse with flint dominant, and fine with chalk dominant; some cobbles		
	Sand: fine with some medium and coarse; coarse mostly chalk		
	Fines: silt and clay, chalky		
Upper Chalk	Chalk, rubbly, soft, silty and sandy to 6.0 m	2.3+	6.2

GRADING

Mean for deposit
percentages

Depth below
surface (m)

Percentages

Fines Sand Gravel

Fines

Sand

Gravel

-1

+1 -1

+1 -1

+1 -4

+4 -16

+16 -64

+64 mm

35

38

27

2.9-3.9

35

28

4

6

10

14

3

96



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 434410 : BGS Reference: SU90SE32

British National Grid (27700) : 498220,104300

[Report an issue with this borehole](#)

<<

< Prev

Page 1 of 1

Next >

>>

SU 90 SE 32

9822 0430

North End, Yapton

Surface level +6.0 m
Water not stuck
August 1981

Block H

Waste 3.3 m
Bedrock 1.2 m+

LOG

Geological classification

Lithology

Thickness Depth
m m

	Soil	0.3	0.3
Brickearth	Clay, brown, silty, with a few subangular flint pebbles. Very sandy near base	2.7	3.0
Raised Beach Deposits (younger)	Sand, mid to dark brown; fine to coarse; quartz with flint; silty and with angular to well rounded flint pebbles	0.3	3.3
Upper Chalk	Chalk, soft, rubbly	1.2+	4.5



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 434411 : BGS Reference: SU90SE33
British National Grid (27700) : 498270,103490
[Report an issue with this borehole](#)

<< < Prev Page 1 of 1 Next > >>

SU 90 SE 33 9827 0349

Yapton Church

Block H

Surface level +6.4 m
Water not struck
September 1981

Waste 1.4 m
Bedrock 1.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and made ground	0.3	0.3
Brickearth	Clay, very sandy, mottled brown and grey-brown; some small flint pebbles	1.1	1.4
Upper Chalk	Chalk, soft, weathered, pale yellowish brown; nodular flints	1.6+	3.0



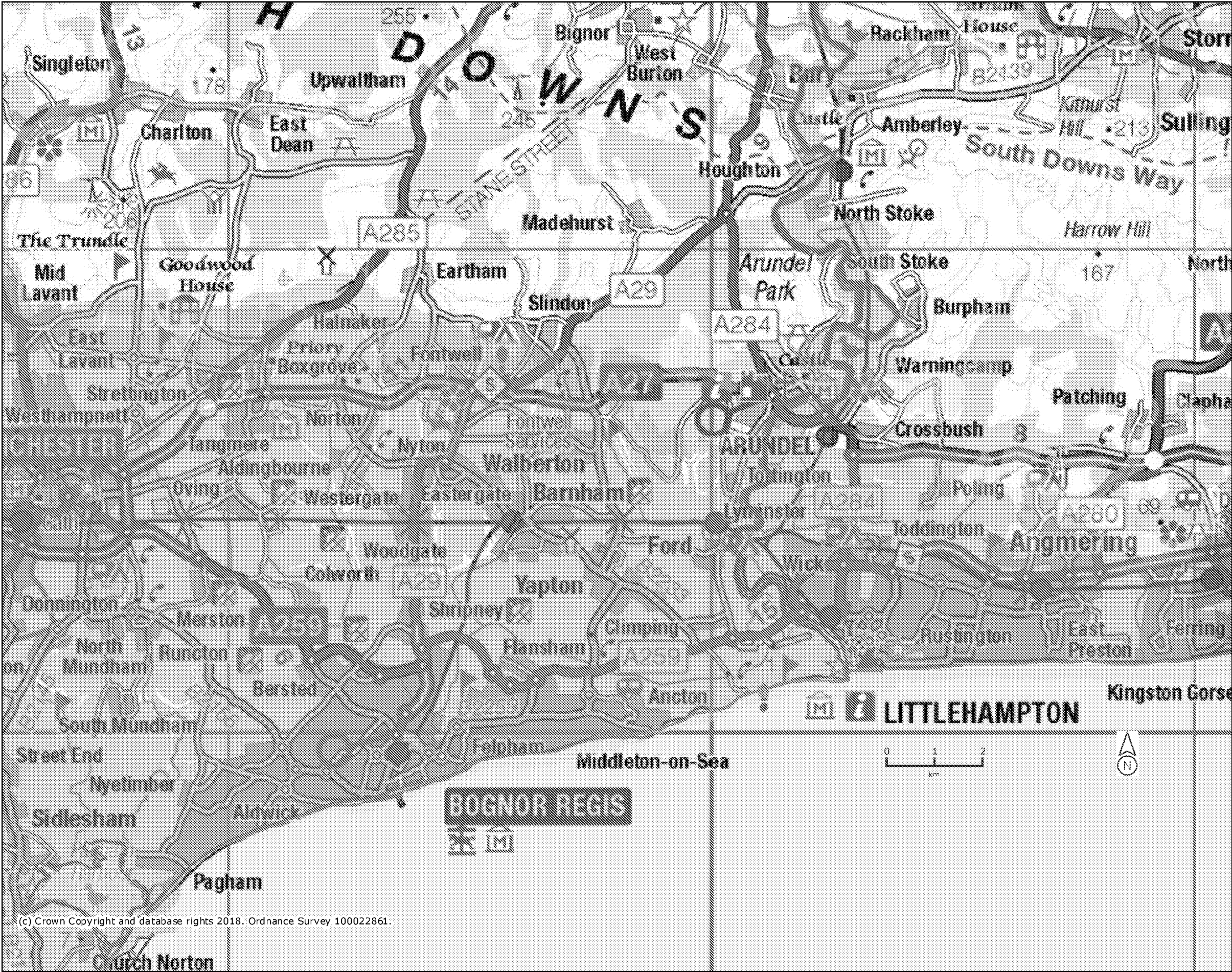
Legend

Aquifer Designation Map
(Bedrock) (England)

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unproductive

Projection = OSGB36
xmin = 477900
ymin = 95400
xmax = 518200
ymax = 114800

Map produced by MAGIC on 7 November, 2018.
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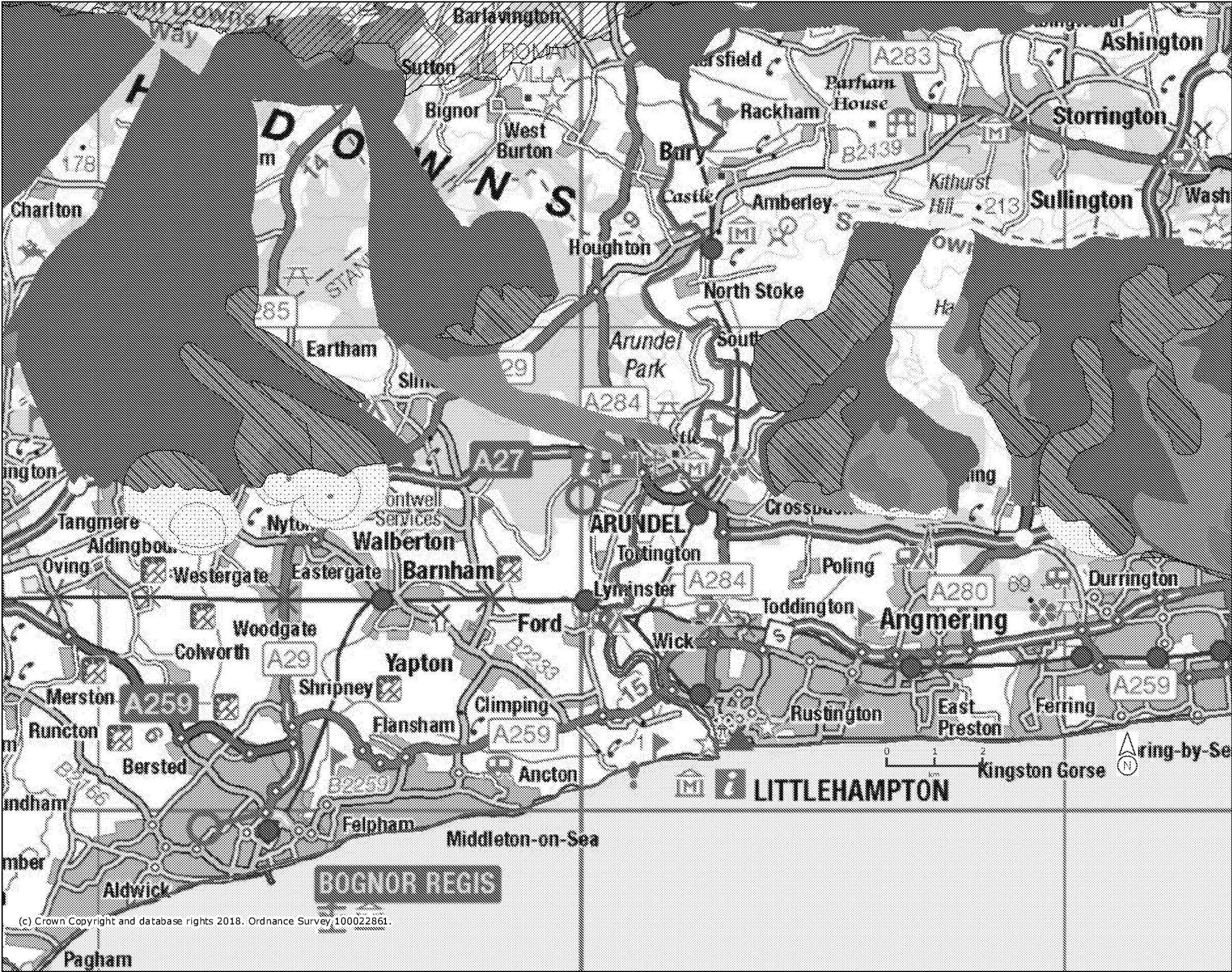
Legend

Aquifer Designation Map
(Superficial Drift) (England)

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unknown (lakes+landslip)
- Unproductive

Projection = OSGB36
xmin = 477900
ymin = 95400
xmax = 518200
ymax = 114800

Map produced by MAGIC on 7 November, 2018.
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Legend

- Drinking Water Safeguard Zones (Surface Water) (England)
- Drinking Water Safeguard Zones (Groundwater) (England)

Source Protection Zones merged (England)

- Zone I - Inner Protection Zone
- Zone I - Subsurface Activity
- Zone II - Outer Protection Zone
- Zone II - Subsurface Activity
- Zone III - Total Catchment
- Zone III - Subsurface Activity
- Zone of Special Interest

Projection = OSGB36
xmin = 480600
ymin = 97010
xmax = 520900
ymax = 116400

Map produced by MAGIC on 12 November, 2018.
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Appendix 5

Flood Maps and Correspondence

Flood map for planning

Your reference
23110

Location (easting/northing)
497799/103767

Created
2 Nov 2018 3:03

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data.
<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>



Flood map for planning

Your reference

23110

Location (easting/northing)

497799/103767

Scale

1:10000

Created

2 Nov 2018 3:03



Selected point



Flood zone 3



Flood zone 3: areas
benefitting from flood
defences



Flood zone 2



Flood zone 1



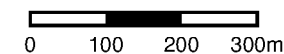
Flood defence



Main river



Flood storage area



Page 2 of 2



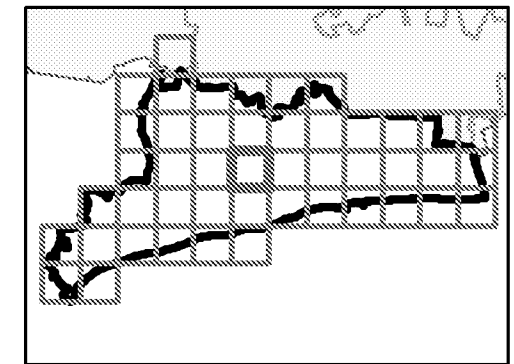
Notes

Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. It is issued earlier than a flood warning, to give customers advice notice of the possibility of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

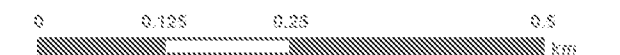
Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one

Key Plan



Legend

	Arun District SFRA boundary		065FWF6005
	065FWC2401		065FWC2801
	065FWF4303		065FWC2802
	065FWF4504		065FWC2801
	065FWF6001		065FWF6006
	065FWF6302		065FWF4801
	065FWF5007		065FWC2402
	065FWF6006		065FWC2402



REF	Date	Comments
A	June 2016	-
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX G FLOOD WARNING AREAS

Sheet No: 23 of 48 Index Number: AGC_25

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From: [REDACTED]
To: [REDACTED]
Cc: [REDACTED]
Subject: RE: 23110 - Land at North End Road, Yapton - Flood Information
Date: 30 Oct 30 / 2018 13:18:30
Attachments: [Drainage - Supplementary Guidance Notes.pdf](#)

Hi Nathan,

Thanks for your enquiry.

We hold no historic flooding records for this location. Our mapping shows that there is a low risk of surface water flooding to surrounding areas, but not to the site itself.

I have attached our supplementary guidance notes. Surface water drainage should follow the hierarchy for sustainable drainage, with infiltration fully investigated. We also advocate the use of open SuDS features as much as possible.

Infiltration rates for soakage structures are to be based on percolation tests undertaken in the winter period and at the location and depth of the proposed structures. The percolation tests must be carried out in accordance with BRE 365, CIRIA R156 or a similar approved method and cater for the 1 in 10 year storm between the invert of the entry pipe to the soakaway, and the base of the structure. It must also have provision to ensure that there is capacity in the system to contain below ground level the 1 in 100 year event plus 40% on stored volumes, as an allowance for climate change. Adequate freeboard must be provided between the base of the soakaway structure and the highest recorded annual groundwater level identified in that location.

Any SuDS or soakaway design must include adequate groundwater monitoring data to determine the highest winter groundwater table in support of the design. For a development of this size groundwater monitoring should be completed October- March inclusive.

Kind Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

Laura Gibbons | Engineer (Drainage & Coastal), Engineering Services, Arun District Council |
Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF
Internal: 37818 | External: +44 (0) 1903 737818 | Fax: +44 (0) 1903 716018 | E-mail:
laura.gibbons@arun.gov.uk
Arun is Working in Partnership with Chichester District Council
Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk



Save the environment - think before you print.

From: Nicola Spencer **On Behalf Of** Planning
Sent: 24 October 2018 09:48
To: Land Drainage
Subject: FW: 23110 - Land at North End Road, Yapton - Flood Information

Nicola Spencer | Technical Support Manager, Planning Department, Arun District Council | Location: First floor,
Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF
Internal: 37446 | External: +44 (0) 1903 737500 ext 37446 | E-mail: nicola.spencer@arun.gov.uk

Visit Arun's web site at www.arun.gov.uk.



Save the environment - think before you print.

From: Nathan Shields [redacted]
Sent: 19 October 2018 15:11
To: Planning
Cc: r [redacted]
Subject: 23110 - Land at North End Road, Yapton - Flood Information

Good afternoon,

We are currently working on a proposed residential development at the above site.

Can you please provide us with any flood information, including historic flooding information you may hold affecting this site?

The site is at OS reference SU 977 037 and the nearest post code is BN18 0DU. I attach a location plan for your reference.

Please do not hesitate to contact me if you require any additional information.

Kind regards

Nathan Shields

The Civil Engineering Practice

11 Tungsten Building
George Street
Fishersgate
West Sussex
BN41 1RA

As an ISO 9001 : 2008 certified company, we invite you to reply to this email with any feedback (positive or negative) that you would like to share. Any response will be reviewed by the directors and quality assurance department.

This transmission contains information which may be confidential and which may also be privileged. It is intended for the named addressee only. Unless you are the named addressee, or authorised to receive it for the addressee, you may not copy or use it, or disclose it to anyone else. If you have received this transmission in error, please

Appendix 6

Proposed Indicative Site Layout Plan



TITLE Proposed Indicative Site Layout Plan			
SCALE	NTS@A3	PROJECT No.	23110
REPORT TYPE	FRA	DWG. No.	03

Appendix 7

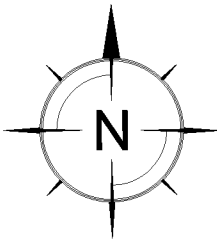
Proposed Impermeable Area Plan

Preliminary Drainage Strategy Plan

and Preliminary Surface Water Calculations



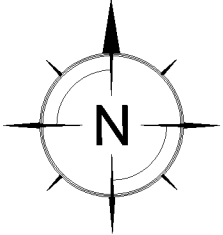
APPROX AREAS		
=====	TOTAL AREA OF SITE	17180
IMPERMEABLE AREAS		
[Pattern]	MAIN ROAD FOOTWAY	2,127
[Pattern]	PLOT ROOFS	2,777
[Pattern]	FOOTPATH	347
[Pattern]	PRIVATE DRIVES	1,770
[Pattern]	PRIVATE PATHS	100
	TOTAL IMPERMEABLE	7897



TITLE		Proposed Site Impermeable Area Plan	
SCALE	NTS@A3	PROJECT No.	23110
REPORT TYPE	FRA	DWG. No.	04

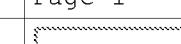


- DRAINAGE KEY:**
- - - - - - Existing Storm Sewer
 - - - - - - Existing Foot Sewer
 - - - - - Existing sewer to be removed
 - - - - - - Surface Water Manhole
 - - - - - - Road Gully
 - Permeable Silt Base - min 300mm deep
 - Private Cellular Cattle Soakaway
 - - - - - - Proposed 150mm Gritted Trench (208m in total)
 - - - - - - Proposed 150mm Driveway Gully (8m long)
 - Roof Water Runoff Flow Direction
 - - - - - - Foot Sewer Manhole



TITLE Proposed Drainage Strategy Plan			
SCALE	NTS@A3	PROJECT No.	23110
REPORT TYPE	FRA	DWG. No.	05

PERMEABLE BLOCK PAVING

The Civil Engineering Practice		Page 1
11 Tungsten Building George Street Fishersgate BN41 1RA	23110 Land West of North End Road Yapton	
Date 09/11/18 File POROUS CAR PARK.SRCX	Designed by TZ Checked by SRM	
XP Solutions Source Control 2017.1.2		

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 261 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	6.121	0.171	0.1	1.7	Flood Risk
30 min Summer	6.153	0.203	0.1	2.5	Flood Risk
60 min Summer	6.181	0.231	0.2	3.2	Flood Risk
120 min Summer	6.202	0.252	0.2	3.8	Flood Risk
180 min Summer	6.208	0.258	0.2	4.0	Flood Risk
240 min Summer	6.211	0.261	0.2	4.1	Flood Risk
360 min Summer	6.213	0.263	0.2	4.1	Flood Risk
480 min Summer	6.212	0.262	0.2	4.1	Flood Risk
600 min Summer	6.210	0.260	0.2	4.1	Flood Risk
720 min Summer	6.208	0.258	0.2	4.0	Flood Risk
960 min Summer	6.201	0.251	0.2	3.8	Flood Risk
1440 min Summer	6.187	0.237	0.2	3.4	Flood Risk
2160 min Summer	6.168	0.218	0.2	2.8	Flood Risk
2880 min Summer	6.150	0.200	0.1	2.4	Flood Risk
4320 min Summer	6.123	0.173	0.1	1.8	Flood Risk
5760 min Summer	6.102	0.152	0.1	1.4	Flood Risk
7200 min Summer	6.086	0.136	0.1	1.1	O K
8640 min Summer	6.073	0.123	0.1	0.9	O K
10080 min Summer	6.062	0.112	0.1	0.8	O K
15 min Winter	6.134	0.184	0.1	2.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	124.470	0.0	22
30 min Summer	83.961	0.0	36
60 min Summer	54.074	0.0	64
120 min Summer	33.619	0.0	122
180 min Summer	25.073	0.0	176
240 min Summer	20.211	0.0	204
360 min Summer	14.890	0.0	266
480 min Summer	11.979	0.0	334
600 min Summer	10.110	0.0	402
720 min Summer	8.797	0.0	470
960 min Summer	7.056	0.0	606
1440 min Summer	5.161	0.0	870
2160 min Summer	3.766	0.0	1256
2880 min Summer	3.008	0.0	1620
4320 min Summer	2.187	0.0	2376
5760 min Summer	1.742	0.0	3064
7200 min Summer	1.460	0.0	3816
8640 min Summer	1.265	0.0	4496
10080 min Summer	1.120	0.0	5240
15 min Winter	124.470	0.0	22

The Civil Engineering Practice					Page 2
11 Tungsten Building George Street Fishersgate BN41 1RA		23110 Land West of North End Road Yapton			
Date 09/11/18 File POROUS CAR PARK.SRCX		Designed by TZ Checked by SRM			
XP Solutions		Source Control 2017.1.2			
<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 (m³)	Status
30 min Winter	6.168	0.218	0.2	2.8	Flood Risk
60 min Winter	6.197	0.247	0.2	3.7	Flood Risk
120 min Winter	6.221	0.271	0.2	4.4	Flood Risk
180 min Winter	6.230	0.280	0.2	4.7	Flood Risk
240 min Winter	6.233	0.283	0.2	4.7	Flood Risk
360 min Winter	6.233	0.283	0.2	4.7	Flood Risk
480 min Winter	6.231	0.281	0.2	4.7	Flood Risk
600 min Winter	6.227	0.277	0.2	4.6	Flood Risk
720 min Winter	6.223	0.273	0.2	4.4	Flood Risk
960 min Winter	6.211	0.261	0.2	4.1	Flood Risk
1440 min Winter	6.190	0.240	0.2	3.5	Flood Risk
2160 min Winter	6.163	0.213	0.1	2.7	Flood Risk
2880 min Winter	6.140	0.190	0.1	2.2	Flood Risk
4320 min Winter	6.105	0.155	0.1	1.4	Flood Risk
5760 min Winter	6.080	0.130	0.1	1.0	O K
7200 min Winter	6.062	0.112	0.1	0.8	O K
8640 min Winter	6.048	0.098	0.1	0.6	O K
10080 min Winter	6.037	0.087	0.1	0.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	83.961	0.0	36		
60 min Winter	54.074	0.0	64		
120 min Winter	33.619	0.0	120		
180 min Winter	25.073	0.0	176		
240 min Winter	20.211	0.0	230		
360 min Winter	14.890	0.0	286		
480 min Winter	11.979	0.0	362		
600 min Winter	10.110	0.0	438		
720 min Winter	8.797	0.0	512		
960 min Winter	7.056	0.0	656		
1440 min Winter	5.161	0.0	926		
2160 min Winter	3.766	0.0	1320		
2880 min Winter	3.008	0.0	1700		
4320 min Winter	2.187	0.0	2424		
5760 min Winter	1.742	0.0	3120		
7200 min Winter	1.460	0.0	3824		
8640 min Winter	1.265	0.0	4504		
10080 min Winter	1.120	0.0	5248		
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The Civil Engineering Practice		Page 4																								
11 Tungsten Building George Street Fishersgate BN41 1RA	23110 Land West of North End Road Yapton																									
Date 09/11/18 File POROUS CAR PARK.SRCX	Designed by TZ Checked by SRM																									
XP Solutions Source Control 2017.1.2																										
<u>Model Details</u> Storage is Online Cover Level (m) 6.400 <u>Porous Car Park Structure</u> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">Infiltration Coefficient Base (m/hr)</td> <td style="width: 20%;">0.01260</td> <td style="width: 20%;">Width (m)</td> <td style="width: 30%;">10.0</td> </tr> <tr> <td>Membrane Percolation (mm/hr)</td> <td>1000</td> <td>Length (m)</td> <td>10.0</td> </tr> <tr> <td>Max Percolation (l/s)</td> <td>27.8</td> <td>Slope (1:X)</td> <td>40.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Depression Storage (mm)</td> <td>5</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Evaporation (mm/day)</td> <td>3</td> </tr> <tr> <td>Invert Level (m)</td> <td>5.950</td> <td>Membrane Depth (m)</td> <td>0</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.01260	Width (m)	10.0	Membrane Percolation (mm/hr)	1000	Length (m)	10.0	Max Percolation (l/s)	27.8	Slope (1:X)	40.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	5.950	Membrane Depth (m)	0
Infiltration Coefficient Base (m/hr)	0.01260	Width (m)	10.0																							
Membrane Percolation (mm/hr)	1000	Length (m)	10.0																							
Max Percolation (l/s)	27.8	Slope (1:X)	40.0																							
Safety Factor	2.0	Depression Storage (mm)	5																							
Porosity	0.30	Evaporation (mm/day)	3																							
Invert Level (m)	5.950	Membrane Depth (m)	0																							
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PRIVATE CELLULAR CRATE SOKAWAY 1 in 10 YEAR RAINFALL

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11 Tungsten Building George Street Fishersgate BN41 1RA	23110 Land West of North End Road Yapton	
Date 09/11/18 File CELLULAR CRATES SOAKAWA...	Designed by TZ Checked by SRM	
XP Solutions	Source Control 2017.1.2	

Summary of Results for 10 year Return Period

Half Drain Time : 1347 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	4.817	0.117	0.0	1.0	O K
30 min Summer	4.855	0.155	0.0	1.3	O K
60 min Summer	4.895	0.195	0.0	1.7	O K
120 min Summer	4.937	0.237	0.0	2.0	O K
180 min Summer	4.962	0.262	0.0	2.2	O K
240 min Summer	4.979	0.279	0.0	2.4	O K
360 min Summer	5.001	0.301	0.0	2.6	O K
480 min Summer	5.016	0.316	0.0	2.7	O K
600 min Summer	5.025	0.325	0.0	2.8	O K
720 min Summer	5.031	0.331	0.0	2.8	O K
960 min Summer	5.036	0.336	0.0	2.9	O K
1440 min Summer	5.038	0.338	0.0	2.9	O K
2160 min Summer	5.033	0.333	0.0	2.8	O K
2880 min Summer	5.025	0.325	0.0	2.8	O K
4320 min Summer	5.005	0.305	0.0	2.6	O K
5760 min Summer	4.983	0.283	0.0	2.4	O K
7200 min Summer	4.962	0.262	0.0	2.2	O K
8640 min Summer	4.941	0.241	0.0	2.1	O K
10080 min Summer	4.921	0.221	0.0	1.9	O K
15 min Winter	4.832	0.132	0.0	1.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	54.372	0.0	23
30 min Summer	35.991	0.0	37
60 min Summer	22.913	0.0	66
120 min Summer	14.233	0.0	126
180 min Summer	10.687	0.0	186
240 min Summer	8.693	0.0	246
360 min Summer	6.488	0.0	364
480 min Summer	5.267	0.0	484
600 min Summer	4.479	0.0	602
720 min Summer	3.922	0.0	722
960 min Summer	3.179	0.0	958
1440 min Summer	2.363	0.0	1188
2160 min Summer	1.755	0.0	1576
2880 min Summer	1.420	0.0	1988
4320 min Summer	1.054	0.0	2812
5760 min Summer	0.852	0.0	3632
7200 min Summer	0.723	0.0	4464
8640 min Summer	0.632	0.0	5192
10080 min Summer	0.564	0.0	6048
15 min Winter	54.372	0.0	22

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11 Tungsten Building George Street Fishersgate BN41 1RA		23110 Land West of North End Road Yapton			
Date 09/11/18 File CELLULAR CRATES SOAKAWA...		Designed by TZ Checked by SRM			
XP Solutions		Source Control 2017.1.2			
<u>Summary of Results for 10 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	4.873	0.173	0.0	1.5	O K
60 min Winter	4.919	0.219	0.0	1.9	O K
120 min Winter	4.967	0.267	0.0	2.3	O K
180 min Winter	4.995	0.295	0.0	2.5	O K
240 min Winter	5.015	0.315	0.0	2.7	O K
360 min Winter	5.042	0.342	0.0	2.9	O K
480 min Winter	5.059	0.359	0.0	3.1	O K
600 min Winter	5.071	0.371	0.0	3.2	O K
720 min Winter	5.079	0.379	0.0	3.2	O K
960 min Winter	5.089	0.389	0.0	3.3	O K
1440 min Winter	5.091	0.391	0.0	3.3	O K
2160 min Winter	5.084	0.384	0.0	3.3	O K
2880 min Winter	5.072	0.372	0.0	3.2	O K
4320 min Winter	5.040	0.340	0.0	2.9	O K
5760 min Winter	5.006	0.306	0.0	2.6	O K
7200 min Winter	4.972	0.272	0.0	2.3	O K
8640 min Winter	4.940	0.240	0.0	2.0	O K
10080 min Winter	4.909	0.209	0.0	1.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	35.991	0.0	37		
60 min Winter	22.913	0.0	66		
120 min Winter	14.233	0.0	124		
180 min Winter	10.687	0.0	182		
240 min Winter	8.693	0.0	242		
360 min Winter	6.488	0.0	358		
480 min Winter	5.267	0.0	474		
600 min Winter	4.479	0.0	588		
720 min Winter	3.922	0.0	702		
960 min Winter	3.179	0.0	926		
1440 min Winter	2.363	0.0	1346		
2160 min Winter	1.755	0.0	1684		
2880 min Winter	1.420	0.0	2140		
4320 min Winter	1.054	0.0	3068		
5760 min Winter	0.852	0.0	3928		
7200 min Winter	0.723	0.0	4760		
8640 min Winter	0.632	0.0	5616		
10080 min Winter	0.564	0.0	6360		
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Date 09/11/18 File CELLULAR CRATES SOAKAWA...	Designed by TZ Checked by SRM	
XP Solutions Source Control 2017.1.2		

Model Details

Storage is Online Cover Level (m) 6.400

Cellular Storage Structure

Invert Level (m) 4.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.01260 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.01260

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	9.0	10.0	1.200	9.0	12.5
0.400	9.0	12.5	1.201	0.0	12.5
0.800	9.0	12.5	1.700	0.0	12.5

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PRIVATE CELLULAR CRATE SOKAWAY
1 in 100 YEAR RAINFALL + 40% CC

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Date 09/11/18 File CELLULAR CRATES SOAKAWA...	Designed by TZ Checked by SRM	
XP Solutions	Source Control 2017.1.2	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 3427 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	4.971	0.271	0.0	2.3	O K
30 min Summer	5.064	0.364	0.0	3.1	O K
60 min Summer	5.166	0.466	0.0	4.0	O K
120 min Summer	5.274	0.574	0.0	4.9	O K
180 min Summer	5.336	0.636	0.0	5.4	O K
240 min Summer	5.378	0.678	0.0	5.8	O K
360 min Summer	5.436	0.736	0.0	6.3	O K
480 min Summer	5.477	0.777	0.0	6.6	O K
600 min Summer	5.507	0.807	0.0	6.9	O K
720 min Summer	5.530	0.830	0.0	7.1	O K
960 min Summer	5.563	0.863	0.0	7.4	O K
1440 min Summer	5.595	0.895	0.0	7.6	O K
2160 min Summer	5.602	0.902	0.0	7.7	O K
2880 min Summer	5.586	0.886	0.0	7.6	O K
4320 min Summer	5.547	0.847	0.0	7.2	O K
5760 min Summer	5.508	0.808	0.0	6.9	O K
7200 min Summer	5.472	0.772	0.0	6.6	O K
8640 min Summer	5.438	0.738	0.0	6.3	O K
10080 min Summer	5.406	0.706	0.0	6.0	O K
15 min Winter	5.003	0.303	0.0	2.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	124.470	0.0	23
30 min Summer	83.961	0.0	38
60 min Summer	54.074	0.0	68
120 min Summer	33.619	0.0	128
180 min Summer	25.073	0.0	186
240 min Summer	20.211	0.0	246
360 min Summer	14.890	0.0	366
480 min Summer	11.979	0.0	486
600 min Summer	10.110	0.0	606
720 min Summer	8.797	0.0	726
960 min Summer	7.056	0.0	964
1440 min Summer	5.161	0.0	1442
2160 min Summer	3.766	0.0	2160
2880 min Summer	3.008	0.0	2736
4320 min Summer	2.187	0.0	3376
5760 min Summer	1.742	0.0	4144
7200 min Summer	1.460	0.0	4904
8640 min Summer	1.265	0.0	5784
10080 min Summer	1.120	0.0	6560
15 min Winter	124.470	0.0	23

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11 Tungsten Building George Street Fishersgate BN41 1RA		23110 Land West of North End Road Yapton			
Date 09/11/18 File CELLULAR CRATES SOAKAWA...		Designed by TZ Checked by SRM			
XP Solutions		Source Control 2017.1.2			
<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 (m³)	Status
30 min Winter	5.108	0.408	0.0	3.5	O K
60 min Winter	5.223	0.523	0.0	4.5	O K
120 min Winter	5.345	0.645	0.0	5.5	O K
180 min Winter	5.415	0.715	0.0	6.1	O K
240 min Winter	5.463	0.763	0.0	6.5	O K
360 min Winter	5.531	0.831	0.0	7.1	O K
480 min Winter	5.578	0.878	0.0	7.5	O K
600 min Winter	5.614	0.914	0.0	7.8	O K
720 min Winter	5.642	0.942	0.0	8.1	O K
960 min Winter	5.682	0.982	0.0	8.4	O K
1440 min Winter	5.727	1.027	0.0	8.8	O K
2160 min Winter	5.748	1.048	0.0	9.0	O K
2880 min Winter	5.742	1.042	0.0	8.9	O K
4320 min Winter	5.693	0.993	0.0	8.5	O K
5760 min Winter	5.643	0.943	0.0	8.1	O K
7200 min Winter	5.593	0.893	0.0	7.6	O K
8640 min Winter	5.544	0.844	0.0	7.2	O K
10080 min Winter	5.496	0.796	0.0	6.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	83.961	0.0	37		
60 min Winter	54.074	0.0	66		
120 min Winter	33.619	0.0	126		
180 min Winter	25.073	0.0	184		
240 min Winter	20.211	0.0	244		
360 min Winter	14.890	0.0	362		
480 min Winter	11.979	0.0	480		
600 min Winter	10.110	0.0	596		
720 min Winter	8.797	0.0	714		
960 min Winter	7.056	0.0	948		
1440 min Winter	5.161	0.0	1414		
2160 min Winter	3.766	0.0	2036		
2880 min Winter	3.008	0.0	2768		
4320 min Winter	2.187	0.0	3940		
5760 min Winter	1.742	0.0	4448		
7200 min Winter	1.460	0.0	5400		
8640 min Winter	1.265	0.0	6304		
10080 min Winter	1.120	0.0	7160		
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11 Tungsten Building George Street Fishersgate BN41 1RA	23110 Land West of North End Road Yapton	
Date 09/11/18 File CELLULAR CRATES SOAKAWA...	Designed by TZ Checked by SRM	
XP Solutions Source Control 2017.1.2		

Model Details

Storage is Online Cover Level (m) 6.400

Cellular Storage Structure

Invert Level (m) 4.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.01260 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.01260

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	9.0	10.0	1.200	9.0	12.5
0.400	9.0	12.5	1.201	0.0	12.5
0.800	9.0	12.5	1.700	0.0	12.5

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HIGHWAY GRAVEL TRENCH SOAKAWAY

1 in 100 YEAR RAINFALL + 40%cc

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11 Tungsten Building George Street Fishersgate BN41 1RA		23110 Land West of North End Road Yapton			
Date 09/11/18 File Highway Draiange _Grave...		Designed by TZ Checked by SRM			
XP Solutions		Source Control 2017.1.2			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Half Drain Time : 837 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	5.106	0.406	1.3	48.7	O K
30 min Summer	5.243	0.543	1.4	65.1	O K
60 min Summer	5.387	0.687	1.4	82.5	O K
120 min Summer	5.529	0.829	1.4	99.4	O K
180 min Summer	5.600	0.900	1.4	108.0	O K
240 min Summer	5.641	0.941	1.4	112.9	O K
360 min Summer	5.684	0.984	1.4	118.1	O K
480 min Summer	5.702	1.002	1.4	120.2	O K
600 min Summer	5.703	1.003	1.4	120.3	O K
720 min Summer	5.695	0.995	1.4	119.4	O K
960 min Summer	5.676	0.976	1.4	117.2	O K
1440 min Summer	5.630	0.930	1.4	111.6	O K
2160 min Summer	5.559	0.859	1.4	103.1	O K
2880 min Summer	5.491	0.791	1.4	95.0	O K
4320 min Summer	5.364	0.664	1.4	79.7	O K
5760 min Summer	5.253	0.553	1.4	66.3	O K
7200 min Summer	5.164	0.464	1.4	55.7	O K
8640 min Summer	5.093	0.393	1.3	47.2	O K
10080 min Summer	5.031	0.331	1.2	39.7	O K
15 min Winter	5.156	0.456	1.4	54.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	124.470	0.0	22		
30 min Summer	83.961	0.0	37		
60 min Summer	54.074	0.0	66		
120 min Summer	33.619	0.0	126		
180 min Summer	25.073	0.0	184		
240 min Summer	20.211	0.0	244		
360 min Summer	14.890	0.0	362		
480 min Summer	11.979	0.0	482		
600 min Summer	10.110	0.0	600		
720 min Summer	8.797	0.0	672		
960 min Summer	7.056	0.0	780		
1440 min Summer	5.161	0.0	1032		
2160 min Summer	3.766	0.0	1448		
2880 min Summer	3.008	0.0	1848		
4320 min Summer	2.187	0.0	2640		
5760 min Summer	1.742	0.0	3400		
7200 min Summer	1.460	0.0	4112		
8640 min Summer	1.265	0.0	4848		
10080 min Summer	1.120	0.0	5640		
15 min Winter	124.470	0.0	22		
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11 Tungsten Building George Street Fishersgate BN41 1RA		23110 Land West of North End Road Yapton			
Date 09/11/18		Designed by TZ			
File Highway Drairage _Grave...		Checked by SRM			
XP Solutions		Source Control 2017.1.2			
<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 (m³)	Status
30 min Winter	5.310	0.610	1.4	73.2	O K
60 min Winter	5.474	0.774	1.4	92.9	O K
120 min Winter	5.637	0.937	1.4	112.5	O K
180 min Winter	5.722	1.022	1.4	122.6	O K
240 min Winter	5.772	1.072	1.4	128.6	O K
360 min Winter	5.829	1.129	1.4	135.5	O K
480 min Winter	5.858	1.158	1.4	138.9	O K
600 min Winter	5.868	1.168	1.4	140.1	O K
720 min Winter	5.868	1.168	1.4	140.1	O K
960 min Winter	5.846	1.146	1.4	137.5	O K
1440 min Winter	5.783	1.083	1.4	130.0	O K
2160 min Winter	5.682	0.982	1.4	117.8	O K
2880 min Winter	5.579	0.879	1.4	105.5	O K
4320 min Winter	5.384	0.684	1.4	82.1	O K
5760 min Winter	5.222	0.522	1.4	62.6	O K
7200 min Winter	5.107	0.407	1.3	48.9	O K
8640 min Winter	5.014	0.314	1.2	37.7	O K
10080 min Winter	4.936	0.236	1.2	28.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	83.961	0.0	37		
60 min Winter	54.074	0.0	66		
120 min Winter	33.619	0.0	124		
180 min Winter	25.073	0.0	182		
240 min Winter	20.211	0.0	240		
360 min Winter	14.890	0.0	356		
480 min Winter	11.979	0.0	470		
600 min Winter	10.110	0.0	592		
720 min Winter	8.797	0.0	692		
960 min Winter	7.056	0.0	898		
1440 min Winter	5.161	0.0	1114		
2160 min Winter	3.766	0.0	1576		
2880 min Winter	3.008	0.0	2020		
4320 min Winter	2.187	0.0	2852		
5760 min Winter	1.742	0.0	3576		
7200 min Winter	1.460	0.0	4328		
8640 min Winter	1.265	0.0	5096		
10080 min Winter	1.120	0.0	5840		
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11 Tungsten Building George Street Fishersgate BN41 1RA	23110 Land West of North End Road Yapton																					
Date 09/11/18 File Highway Drainage _Grave...	Designed by TZ Checked by SRM																					
XP Solutions Source Control 2017.1.2																						
<u>Model Details</u> Storage is Online Cover Level (m) 6.400 <u>Trench Soakaway Structure</u> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">Infiltration Coefficient Base (m/hr)</td> <td style="width: 33%;">0.01260</td> <td style="width: 33%;">Trench Width (m)</td> <td style="width: 33%;">2.0</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr)</td> <td>0.01260</td> <td>Trench Length (m)</td> <td>200.0</td> </tr> <tr> <td>Safety Factor</td> <td>1.5</td> <td>Slope (1:X)</td> <td>0.0</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Cap Volume Depth (m)</td> <td>1.200</td> </tr> <tr> <td>Invert Level (m)</td> <td>4.700</td> <td>Cap Infiltration Depth (m)</td> <td>0.500</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.01260	Trench Width (m)	2.0	Infiltration Coefficient Side (m/hr)	0.01260	Trench Length (m)	200.0	Safety Factor	1.5	Slope (1:X)	0.0	Porosity	0.30	Cap Volume Depth (m)	1.200	Invert Level (m)	4.700	Cap Infiltration Depth (m)	0.500
Infiltration Coefficient Base (m/hr)	0.01260	Trench Width (m)	2.0																			
Infiltration Coefficient Side (m/hr)	0.01260	Trench Length (m)	200.0																			
Safety Factor	1.5	Slope (1:X)	0.0																			
Porosity	0.30	Cap Volume Depth (m)	1.200																			
Invert Level (m)	4.700	Cap Infiltration Depth (m)	0.500																			
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Appendix 8

Outline Drainage Maintenance Schedule

Drainage Maintenance Schedule



The Civil Engineering Practice
11 Tungsten Building
George Street
Fishergate
Sussex
BN41 1RA

Project	Land North of Yapton C of E Primary School
Project Number	23110

By Martin Kempshall

Date 30 April 2019

1 Indicative Schedule of Maintenance

- 1.1 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.
- 1.2 The Contractor will maintain the proposed drainage system during construction and until the handing over of the site. Upon completion the maintenance will be passed on to the property owner.
- 1.3 The following maintenance schedule details the typical tasks to be undertaken at different intervals.

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 Pits and Channel Debris	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
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	As required
	Inspect inlet, outlet from downpipe and gullies for blockages, standing water and clear	As required

Indicative Schedule of Maintenance for the Proposed Drainage System



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

Drainage System Maintenance Summary