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Flood Risk Assessment

for

**Proposed Development at
Hollyacre, Toddington Lane,
Littlehampton, West Sussex**

E5589

February 2013 (Rev 1)

**Proposed Development,
Hollyacre, Toddington Lane
Littlehampton**

**Flood Risk Assessment and
Foul Drainage Statement**

February 2013

Prepared by	Reviewed by
Liam Foord	Graham Waller

Client:

Wilmington Homes

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0 INTRODUCTION

- a) Instructions were received from Wilmington Homes to undertake a Flood Risk Assessment, to appraise a development on land known as Hollyacre in Toddington Lane, Littlehampton, West Sussex.
- b) The assessment has been undertaken in compliance with the Technical Guidance to the National Planning Policy Framework (TGNPPF). This document is based upon the FRA Proforma provided in Appendix C of "Development and Flood Risk: A Practice Guide Companion to PPS25" and has been expanded upon where appropriate.
- c) The information used for the preparation of the assessment is given in the Appendices.

1 DEVELOPMENT DESCRIPTION & LOCATION

a) *What type of development is proposed and where will it be located?*

The development comprises the construction of residential dwellings on land that is currently in agricultural use. The site is located to the north of Littlehampton on the south side of Toddington Lane.



The subject site lies is relatively flat with a gentle fall in a south easterly direction.

The site lies in a semi-rural area and is 1.7Ha. in size.

b) *What is the vulnerability classification?*

In accordance with Table D2 in PPS 25 and Table 2 in TGNPPF, the proposed residential dwellings are classified as “more vulnerable”.

c) *Is the proposed development consistent with the Local Development Documents?*

The 2013 draft local plan shows the site to be located within the Built Up Boundary but it is not designated as a strategic site. The proposed development however is compatible with the flood zone in which it lies.

d) *Please provide evidence that the Sequential Test or Exception Test has been applied in the selection of this site for this development type?*

As identified in Table D3 in PPS25 and Table 3 in TGNPPF the proposed development and its use is appropriate for the flood zoning in which it is located. Sequential and Exception testing is therefore not required.

2 DEFINITION OF THE FLOOD HAZARD

a) *What sources of flooding could affect the site?*

Potential Source	Yes/No
Flooding from Rivers	No
Flooding from the Sea	No
Flooding from Land	No
Flooding from Groundwater	No
Flooding from Sewers	No
Flooding from Reservoirs, Canals and Other Artificial Sources	No

b) *For each identified source, describe how flooding would occur, with reference to any historic records wherever these are available?*

FLOODING FROM RIVERS

The Environment Agency flood mapping shows that the site is located in Flood Zone 1. The SFRA considers the effects of climate change and the flood defences that are in place and also concludes that the site is at low risk of flooding (Zone 1)

FLOODING FROM THE SEA

The site is located approximately 1.7 miles from the coast and the Environment Agency and SFRA flood mapping show that the site is outside of tidal flood risk area.

FLOODING FROM LAND

The site is located in an area that is generally quite flat but it is elevated above Toddington Lane (on the northern boundary) by approximately 750mm. An assessment

of the local topography shows that the site is unlikely to be affected by overland flows.

FLOODING FROM GROUNDWATER

The SFRA mapping suggests that the site lies with a groundwater emergence zone however the FRA concludes that there have been no recorded instances of groundwater within the Arun District. Due to the site being elevated above the adjacent boundary, it is likely that ground water would spring at a lower level than the site.

FLOODING FROM SEWERS

The public sewer maps have been obtained and there are currently no public sewers in close proximity to the site. A new foul water sewer to serve the proposed development will be constructed to suitable design standards.

FLOODING FROM RESERVIORS, CANALS AND OTHER ARTIFICIAL SOURCES

There are no reservoirs or other artificial sources which would contribute to the risk of flooding. The SFRA confirms that the site is not at risk of flooding from artificial sources.

c) *What are the existing surface water drainage arrangements for this site?*

The majority of site is currently in agricultural use is not formally drained. There are some buildings and hard standings which appear to be drained by infiltration.

The greenfield run-off rate has been calculated using 2 methods and it is recommended that the lower of the 2 results is adopted as the greenfield run-off rate.

ICP SUDS method	QBAR = 7.1l/s
ADAS 345	QBAR = 4.2/s.

Calculations for these rates are included in the appendices.

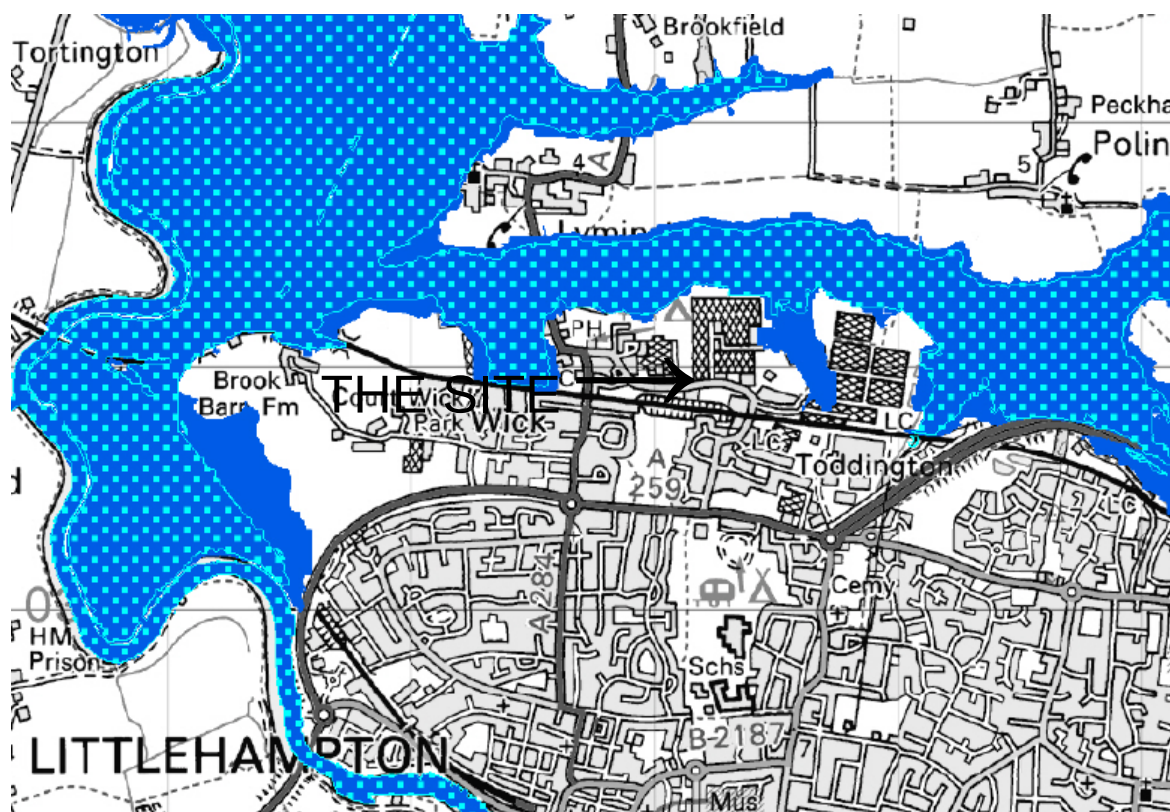
3 **PROBABILITY**

a) ***Which flood zone is the site within?***

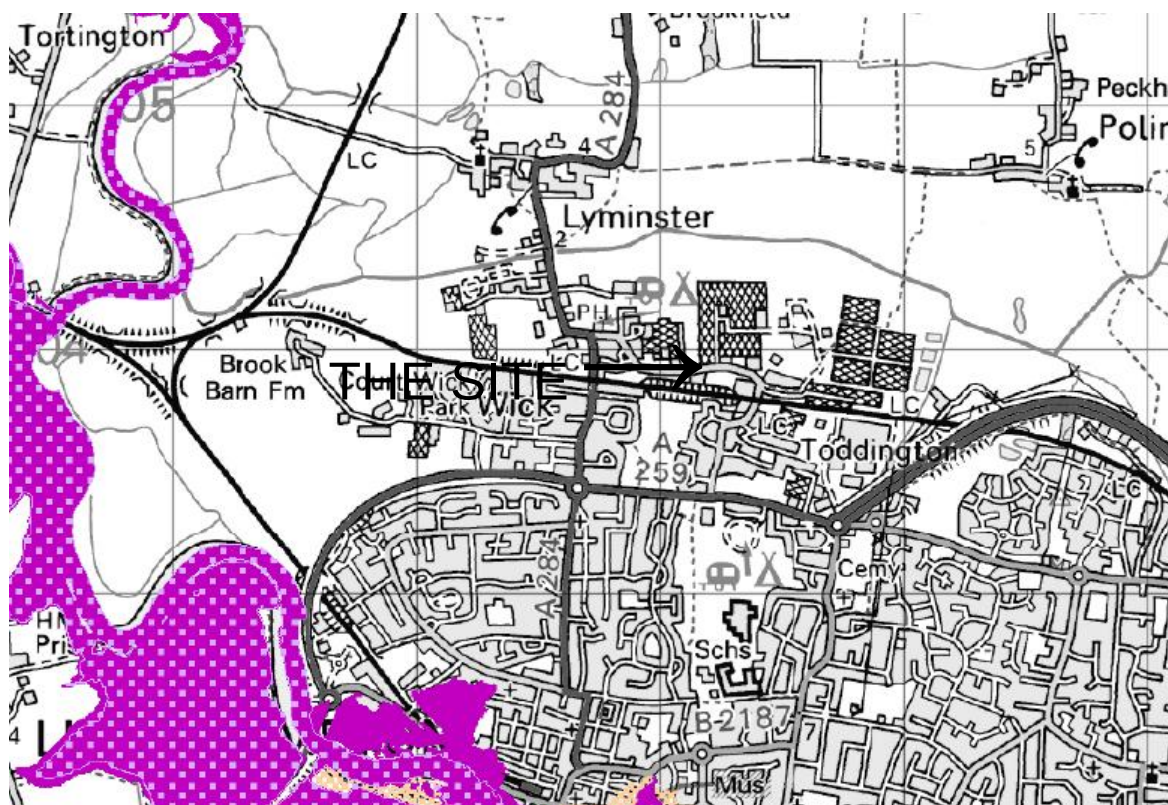
The flood maps attached to the SFRA and provided by the Environment Agency which are included in the Appendix represent current best estimates of zone 2 and zone 3 flooding as defined in Table 1 of TGNPPF.

Zone 1	Low Probability of river or sea flooding
Zone 2	Medium Probability of river or sea flooding
Zone 3a	High Probability of river or sea flooding
Zone 3b	Functional Floodplain

The Environment Agency and SFRA flood mapping (extracts below) confirm that the site falls within Zone 1. A full copy of the maps is included in Appendix A.



Extract from SFRA fluvial flood map



Extract from SFRA tidal flood map

- b) ***If there is a Strategic Flood Risk Assessment covering this site, what does it show?***

A SFRA has been prepared by Capita Symond for Arun District Council, dated 2008. This shows that the site lies within Zone 1 at that date and also in 2056 and 2106.

- c) ***What is the probability of the site flooding taking account of the contents of the SFRA and of any further site-specific assessments?***

The SFRA flood mapping shows that the site is located in Zone 1. TGNPPF defines the flood zones areas as having the following probability of flooding:

Zone 1	1 in 1000 or less annual probability of river flooding
Zone 2	Between 1 in 100 and 1 in 1000 annual probability of river flooding
Zone 3a	1 in 100 or greater annual probability of river flooding
Zone 3b	1 in 20 or greater annual probability of river flooding

The mapping shows that the site lies close to an area which is at risk of flooding although a significant amount of this area benefits from flood defences. The residual flood risk affects land which is lower lying than the site.

- d) ***What are the existing rates and volumes of run-off generated by this site?***

Using ICP SUDS method of calculation the predevelopment run-off rates are as follows

(excluding any allowance for climate change):

- 1 in 1 year storm event 6.1/s
- 1 in 30 year storm event 15.5l/s
- 1 in 100 year storm event 21.0l/s.
- QBAR 7.1l/s.

Existing volumes of run-off are as follows for storms of 6 hour duration (including an increase in rainfall intensity of 30%):

- 1 in 2 year storm 85.672m³
- 1 in 100 year storm 242.786m³

Calculations for these figures are included in the appendices.

4 **CLIMATE CHANGE**

a) ***How is flood risk at the site likely to be affected by climate change?***

The flood mapping within the SFRA allows for the effects of climate change up to 2106 and shows that the site remains in Zone 1.

A 30% increase in peak rainfall intensity should be included in the development design calculations to ensure that the proposed surface water drainage system takes account of the effects of climate change.

5 **DETAILED DEVELOPMENT PROPOSALS**

a) ***Please provide details of the development layout, referring to the relevant drawings.***

The development comprises the construction of 61 residential dwellings on land that is currently in agricultural use. A proposed site layout is provided in Appendix B.

The flood receptors for the proposed development are the Residential Units.

The proposed development is classified as more vulnerable to table 2 in TGNPPF.

With regard to the proposed drainage strategy there is a preference to dispose of surface water run-off by infiltration methods. If infiltration is not possible then discharging to a watercourse should be considered before discharge to a sewer. The following table considers each of the options:

Method	Yes/No	Reason
Infiltration	Yes	The Geotechnical Desk Study has been carried out and concludes that the underlying soil is likely to have moderate soakage potential.
Watercourse	No	There is no watercourse in the vicinity of the site.
Sewers	No	There are no existing surface water sewers in the vicinity of the site.

In summary, it is proposed to dispose of the run-off from the site by infiltration using soakaways and areas of porous paving. The proposed drainage system should be designed to ensure that the site is protected against flooding for storm events up to and including 1 in 100 year return period plus 30%. Infiltration testing show variable results across the site and it is therefore recommended that where possible infiltration devices are linked.

- b) ***Where appropriate, demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding.***

The site is located within Zone 1 and therefore a sequential approach to the layout of the site is not applicable.

6 **FLOOD RISK MANAGEMENT MEASURES**

- a) ***How will the site be protected from flooding, including the potential impacts of climate change, over the developments lifetime?***

The proposed surface water drainage system should be designed to ensure that the site is protected against flooding for storm events up to and including 1 in 100 year return period plus 30%. Failure of the drainage system should be considered and any overland flow paths that are required should be established and maintained during the life of the development.

7 **OFF SITE IMPACTS**

- a) ***How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?***

The flood protection measures will not result in an increase in the rate or volume of run-off leaving the site therefore the risk of flooding elsewhere will not be increased.

- b) ***How will you prevent run-off from the completed development causing an impact elsewhere?***

All surface water run-off from the development will be disposed of within the boundary of the site by infiltration ensuring that there is no increase in the rate or volume of run-off leaving the site.

8 **RESIDUAL RISKS**

- a) ***What flood-related risks will remain after you have implemented the measures to protect the site from flooding?***

The drainage system will require periodic maintenance to ensure that it remains effective, the details of which should be provided to the end users of the proposed dwellings. The maintenance is likely to include but is not limited to the following:

- Jetting or rodding of drains to remove silt
- Removal of silt from catchpit and gully sumps

- Sweeping external surfaces to remove debris
- Maintenance of porous surfaces in accordance with manufactures recommendations

b) *How and by whom will these risks be managed over the lifetime of the development?*

The maintenance of the surface water drainage system will be the responsibility of householders although it is likely that a management company will be established for shared parking areas and roadways that are not to be offered for adoption.

The maintenance of the drainage of the proposed public highways will be the responsibility of the Highway Authority.

9 FOUL WATER DRAINAGE

a) *What are the existing foul water drainage arrangements for the site?*

Whilst there are existing buildings on the site it is not clear how the foul drainage from them is disposed of. There is no foul sewer in close proximity to the site and it is therefore likely that some form of treatment plant is in use.

b) *What are the proposed foul water drainage arrangements for the site?*

A network of new foul sewers should be constructed to serve the proposed dwellings which will be offered to Southern Water for adoption under a S104 agreement.

There is an existing foul sewer located approximately 300 metres to the west of the site in Mill Lane. An assessment of the level of this sewer in relation to the levels of the site and Toddington Lane concluded that it is not possible to connect to it by gravity.

It is therefore proposed to install an adoptable pumping station on the site and lay a rising main along Toddington Lane to connect to the existing public sewer. The location of the pumping station is shown on the site layout and is based on a Type 3 compound in accordance with Sewers for Adoption 7th Edition.

10 CONCLUSIONS

- The proposed development is located in Zone 1 and is at low risk of flooding and will remain at low risk of flooding following the development.
- The flood mapping provided as part of the SFRA and considered in this assessment allow for the effects of climate change
- There will be an increase in the impermeable area following the development but run-off from the development will be disposed of by infiltration within the site boundary.
- The proposed drainage system should be designed to ensure that the proposed dwellings are protected against flooding for storm events up to 1:100 year return period including an allowance for the effects of climate change by applying an increase in the rainfall intensity of 30%.
- The proposed surface water drainage system should include infiltration techniques such as porous paving and soakaways.
- The risk of flooding elsewhere will remain unchanged.
- A new foul sewer network should be constructed on the site to serve to proposed dwellings. A new pumping station will be required on the site discharging to an existing foul sewer located in Mill Lane.

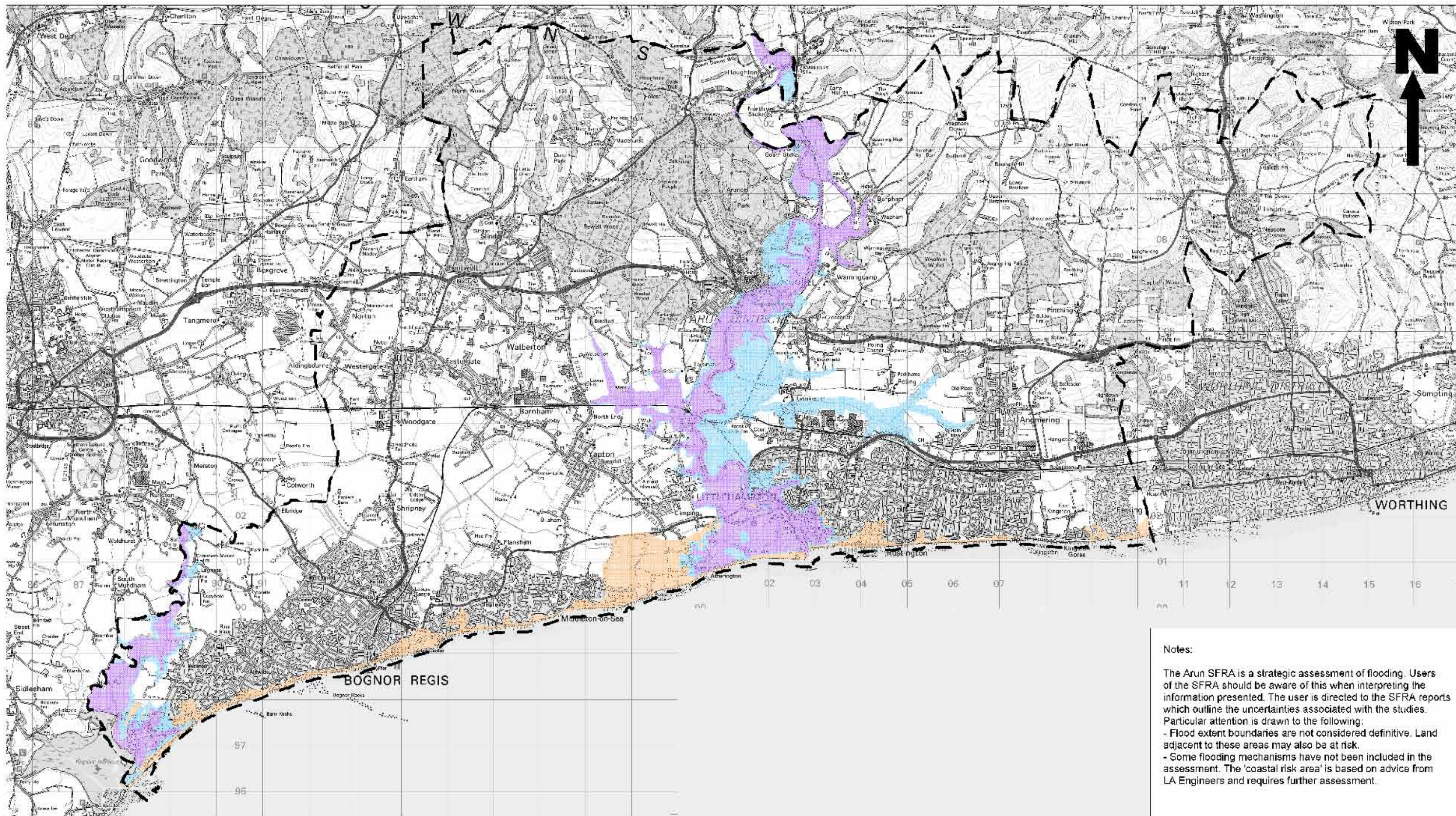
APPENDIX A:

Flood Risk Maps from SFRA
Extracts from Public Sewer Map
Extracts from Geotechnical Desk Study

Littlehampton

Map ref.		Littlehampton
Site of interest		Existing nursery, north of railway
Approx. NGR		503300, 103900
Area (ha)		Unknown
Type		Strategic greenfield site. Mixed land-use (residential and commercial)
Former land-use		Nurseries
Estimated design life		50 to 100 years
Description of site		This site lies north of Littlehampton, adjacent to Black Ditch. The site is relatively flat, with lower ground levels adjacent to Black Ditch and in the centre of the site. Black Ditch is a tributary of the River Arun, which runs to the west. The site is located on chalk, overlain by sand and freely draining soils.
Flood risk management policy		CFMP Policy: Take further action to reduce flood risk (now and/or in the future). SMP Policy: hold the line. Maintain or upgrade the level of protection provided by defences.
Existing flood risk management at the site		Protected by river and sea flood defences along the River Arun. These include raised embankments estimated to protect against a flood with a 3.3% AEP. Parts of the site lie within river flood warning area F3C4.
Sources of flood risk	Rivers	Mixed probability. Land immediately adjacent to Black Ditch is high probability (Flood Zone 3) and functional floodplain (Flood Zone 3b). Existing flood defences do not prevent flooding in this area for the 1% AEP event. Flood extents similar for the 2056 and 2106 climate change flood extents. Land to the south of the site is mostly low probability (Flood Zone 1) although the low lying area in the centre of the site is medium probability (Flood Zone 2). Extent of 1% AEP flood expected to increase for 2056 and 2106 climate change time horizons.
	Sea	Mixed probability. Land immediately adjacent to Black Ditch is high probability (Flood Zone 3). However existing flood defences prevent flooding. Land expected to be flooded in 2106 climate change time horizon. Land to the south of the site is mostly low probability (Flood Zone 1). Not expected to be flooded in 2056 or 2106 climate change time horizons.
	Land	Medium to high probability of flooding from land. Land adjacent to Black Ditch is relatively flat and crossed by many drainage channels therefore higher risk of surface water flooding. Higher land south of the site is at lesser risk. Recorded incidents of surface water flooding in the site and vicinity.
	Groundwater	High potential for groundwater flooding. Located in groundwater emergence zone (Defra 2004). However no recorded incidents of groundwater flooding.
	Sewers	Medium probability. Unlikely to be significant sewer infrastructure at the site. Some recorded incidents of sewer flooding in the vicinity.
	Artificial sources	Low risk – no artificial sources of flooding identified.
	Possible strategic solutions	

Map ref.	Littlehampton
Site of interest	Existing nursery, north of railway
Requirements of FRA	Full FRA required for areas within Flood Zone 3 (adjacent to Black Ditch). FRA will need to consider maintenance of defences and likely standard of protection provided in the future. Revisit flood zones to ensure suitably accurate for land-use planning. Assessment of management of surface water runoff is required for sites larger than 1ha. Surface water runoff will need to be maintained at existing levels. Flooding from land and groundwater flooding requires further investigation. Sequential approach recommended placing “more vulnerable” development on higher ground to the south of the area of search. Exception test will be required for “more vulnerable” development located in areas where probability of river, sea or groundwater flooding is considered “high”. Only “water compatible” development is appropriate in Flood Zone 3b (according to PPS25 guidance).
Surface Water Management	Land west of the River Arun is generally greenfield therefore development of the site is likely to lead to increased runoff. Surface water runoff will need to be restricted to the existing rates. A strategic surface water management scheme may be feasible. Soils and geology information indicate the land is relatively permeable. Soakaways / infiltration may be effective and should be considered in preference to attenuation and storage of runoff. Land east of the river is generally developed therefore development is unlikely to significantly increase runoff. However development should seek to reduce runoff where possible. Restrictions on land availability may limit potential for large-scale storage / infiltration schemes. Source control measures (green roofs, permeable paving etc.) recommended.



Arun District Council SFRA

Map C1-T - Actual Sea Climate Change Extents (with defences)



CAPITA SYMONDS

Legend

- Arun District Boundary
- 2056 Climate Change Tidal Flooding Extents (0.5% AEP, defended)
- 2108 Climate Change Tidal Flooding Extents (0.5% AEP, defended)
- Coastal Risk Area



0 2 4

Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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Map_wor



Arun District Council SFRA

Map C1-F - Actual River Climate Change Extents (with defences)



CAPITA SYMONDS

Legend

- Arun District Boundary
- 2056 Climate Change River Flood Extents (1% AEP Defended)
- 2106 Climate Change River Flood Extents (1% AEP Defended)



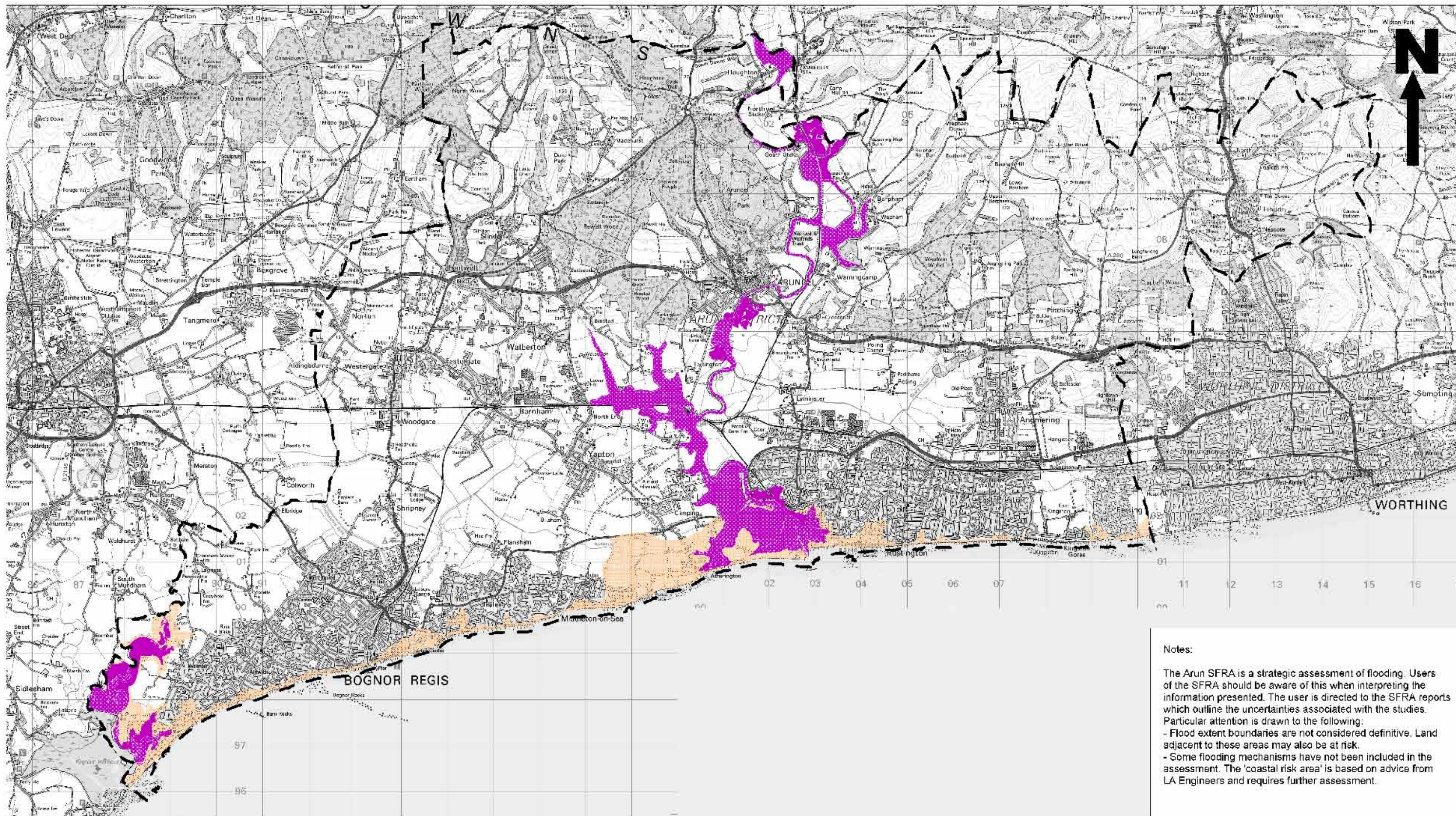
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Map_C1-F.wor



Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

Map A1-T - Actual and Residual Flooding from the Sea



CAPITA SYMONDS

Legend

- Arun District Boundary
- Actual Defended Tidal Flood Risk (0.5% AEP, 2006)
- Residual Defended Tidal Flood Risk (0.1% AEP, 2006)
- Coastal Risk Area



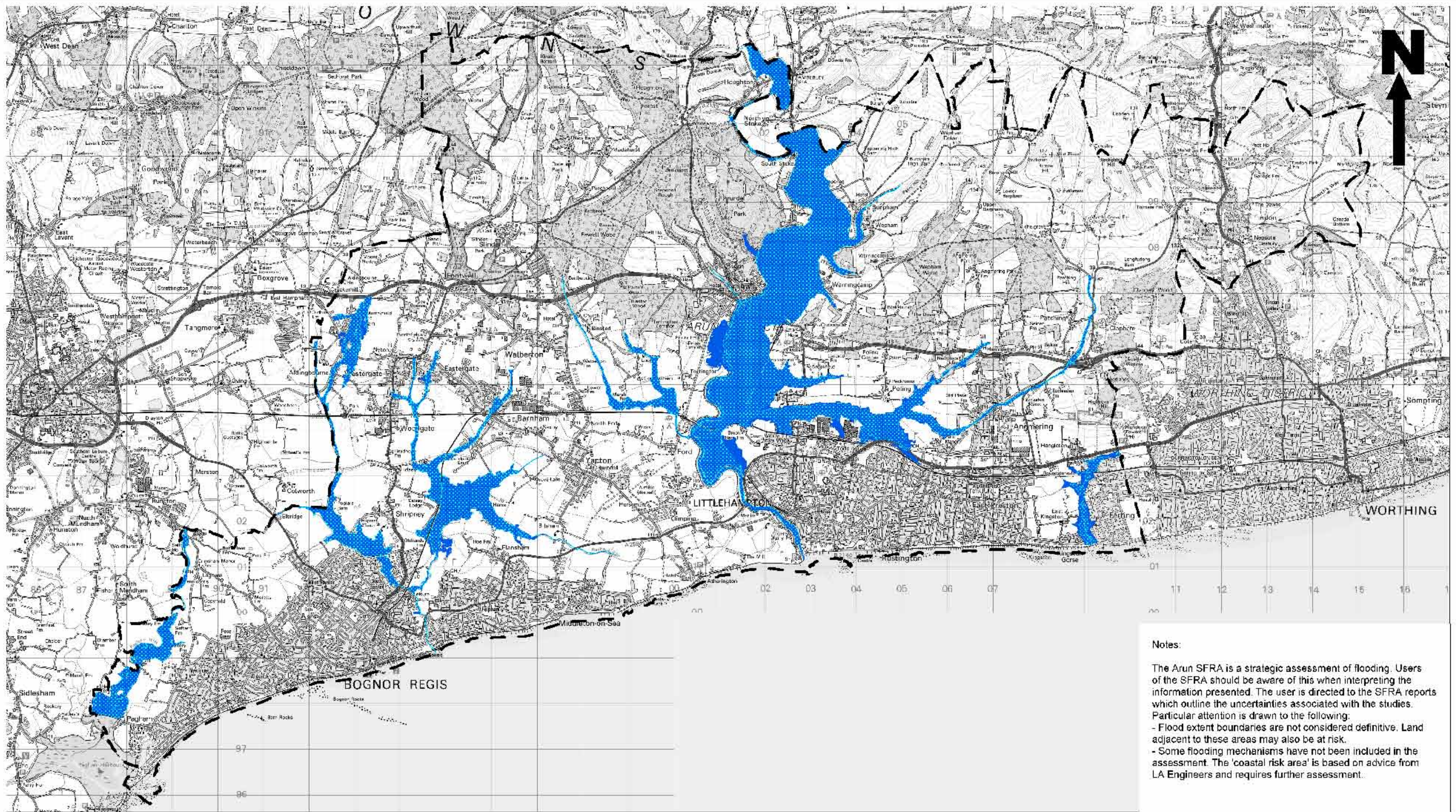
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Date: 31/01/2008

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Map_A1-T.wo



Arun District Council SFRA

Map A1-F - Actual and Residual Risk of Flooding from Rivers



CAPITA SYMONDS

Legend

- Arun District Boundary
- Actual Defended Fluvial Flood Risk (1% AEP, 2006)
- Residual Defended Fluvial Flood Risk (0.1% AEP, 2006)



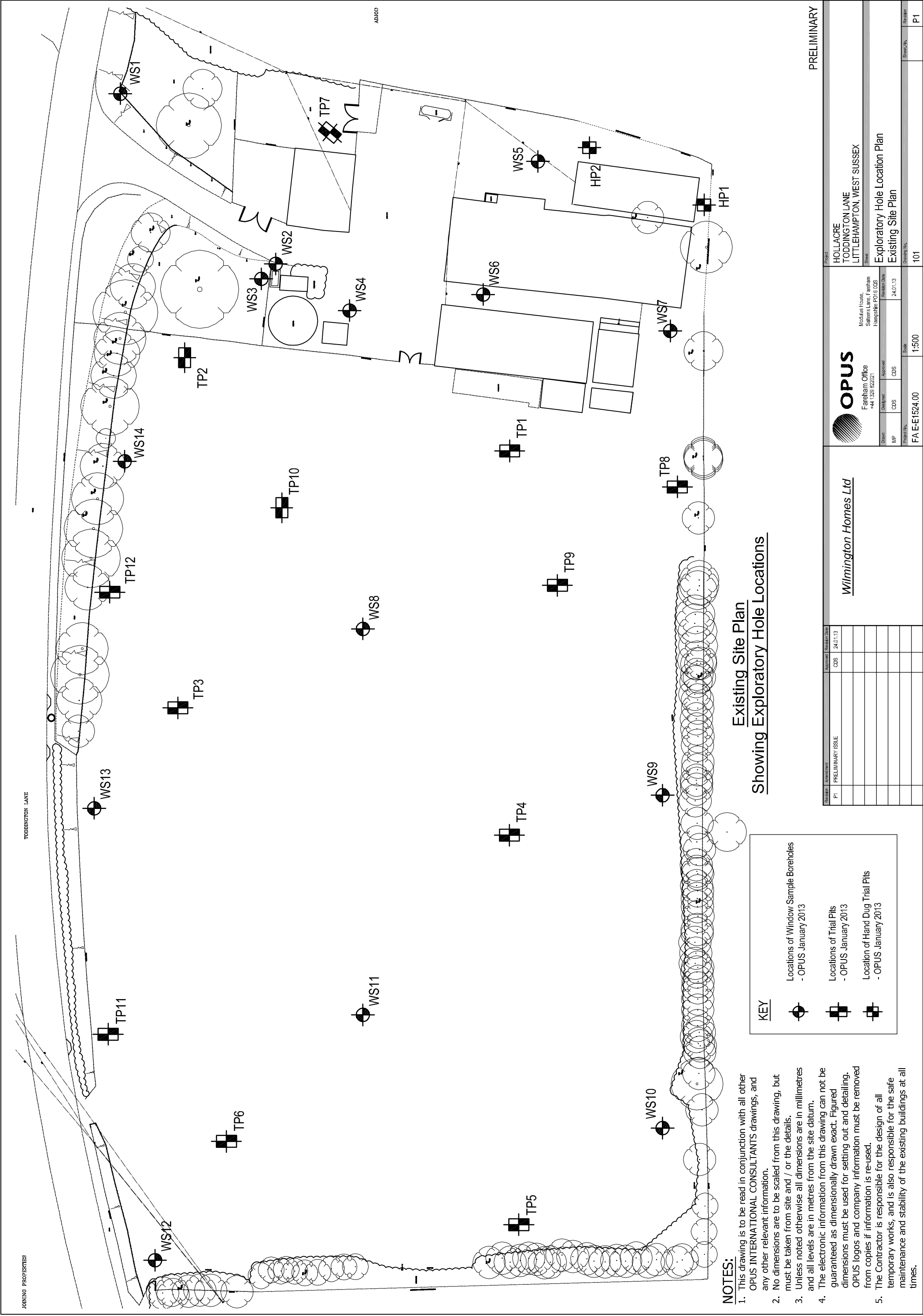
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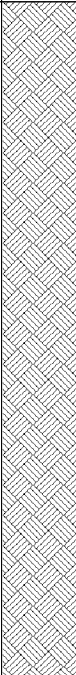
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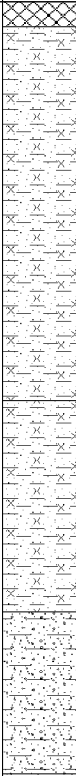
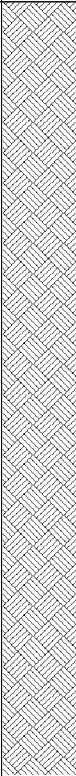
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Map_A1-F.wcr



Exploratory Hole ID: TP1		Client: Wilmington Homes				 www.opusinternational.co.uk			
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane							
Drilling Equipment/ Excavation Method: JCB 3CX		Co-ords:		Backfill Date: 15/01/2013		Field Records:			
		Ground Level (mAOD):		Logged: CDS		Chkd:		Appr:	
Strata Description		Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
MADE GROUND: comprising slightly gravelly, slightly clayey, dark brown fine to medium sand with rootlets. Gravel is subangular fine to medium of flint.		0.40			ES001	0.10	V= 75 kPa V= 94 kPa V= 64 kPa		
Orange/medium brown slightly silty, slightly clayey SAND. Sand is fine to medium grained. (River Terrace Deposits)					ES002 B003	0.50			
Firm consistency orange/brown slightly silty, slightly sandy medium to high strength CLAY. Sand is fine to medium grained. (River Terrace Deposits)		0.90		ES004 D005	2.00				
Orange slightly clayey slightly gravelly SAND. Sand is fine to medium grained. Gravel is angular fine to medium of flint. (River Terrace Deposits)		2.30			2.00				
End of Exploratory Hole at 2.71 m		2.71							
Remarks: 1. Groundwater not encountered in the exploratory hole. 2. Exploratory hole sides stable. 3. Permeability test undertaken in the trial pit.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading	
						Sheet: Sheet 1 of 1			

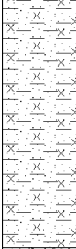
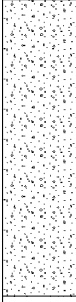
Exploratory Hole ID: TP2		Client: Wilmington Homes				 www.opusinternational.co.uk			
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane							
Drilling Equipment/ Excavation Method: JCB 3CX				Co-ords:		Backfill Date: 14/01/2013		Field Records:	
				Ground Level (mAOD):		Logged: CDS		Chkd: Appr:	
Strata Description		Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
MADE GROUND: comprising orange sandy, clayey, gravel. Sand is fine to coarse grained. Gravel is subrounded to rounded fine to coarse of flint.		0.10			ES001	0.05	V= 54 kPa V= 56 kPa V= 54 kPa		
Firm consistency medium brown slightly silty sandy medium strength CLAY. Sand is fine to coarse grained. (River Terrace Deposits)					ES002	0.80			
					D003	1.00			
Firm consistency orange slightly silty sandy medium strength CLAY. Sand is fine to coarse grained. (River Terrace Deposits)		1.60			ES004 D005	2.10	V= 58 kPa V= 63 kPa V= 64 kPa		
Orange slightly clayey slightly gravelly SAND. Sand is fine to coarse grained. Gravel is subangular to rounded fine to coarse of flint. (River Terrace Deposits)		2.45							
End of Exploratory Hole at 3.10 m		3.10							
Remarks: 1. Groundwater not encountered in the exploratory hole. 2. Exploratory hole sides stable. 3. Permeability test undertaken in the trial pit.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading	
						Sheet: Sheet 1 of 1			

Exploratory Hole ID: TP3		Client: Wilmington Homes				 www.opusinternational.co.uk							
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane								Start Date: 14/01/2013		End Date: 14/01/2013	
Drilling Equipment/ Excavation Method: JCB 3CX		Co-ords:		Backfill Date: 15/01/2013						Field Records:			
		Ground Level (mAOD):		Logged: CDS		Chkd:		Appr:					
Strata Description		Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details				
MADE GROUND: comprising white/grey/brown subangular to subrounded fine to medium gravel.		0.04			ES001	0.05							
MADE GROUND: comprising buff fine to coarse grained sand.		0.10											
Firm to stiff consistency grey/brown silty, slightly sandy medium strength CLAY. Sand is fine to coarse grained. (River Terrace Deposits).		0.50			B003 ES002	0.50-0.60 0.60	V= 72 kPa V= 68 kPa V= 74 kPa						
Firm consistency orange slightly silty sandy medium strength CLAY. Sand is fine to coarse grained. (River Terrace Deposits)					D003	1.25	V= 52 kPa V= 56 kPa V= 58 kPa						
					ES004 D005	2.00	V= 60 kPa V= 58 kPa V= 62 kPa						
Orange very slightly clayey gravelly SAND. Sand is fine to coarse grained. Gravel is subrounded to rounded fine to coarse of flint. (River Terrace Deposits)		2.50											
End of Exploratory Hole at 3.24 m		3.24											
Remarks: 1. Groundwater not encountered in the exploratory hole. 2. Exploratory hole sides stable. 3. Permeability test undertaken in the trial pit.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading					
						Sheet: Sheet 1 of 1							

Exploratory Hole ID: TP4		Client: Wilmington Homes				 www.opusinternational.co.uk				
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane								
Drilling Equipment/ Excavation Method: JCB 3CX		Co-ords:		Backfill Date: 15/01/2013		Field Records:				
		Ground Level (mAOD):		Logged: CDS		Chkd:		Appr:		
Strata Description		Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details	
MADE GROUND: comprising dark grey silty sandy clay, sand is fine to coarse grained. Short sections of wire sheathed inred plastic were observed at 0.50m.		0.50			ES001	0.05	V= 47 kPa V= 54 kPa V= 49 kPa			
Firm medium brown/orange consistency slightly silty, slightly sandy medium strength CLAY. Sand is fine to coarse grained. (River Terrace Deposits)					ES002	0.50				
Becoming high strength clay from 1.20m onwards.					ES003 B004	1.20				V= 74 kPa V= 84 kPa V= 86 kPa
Firm consistency brown slightly sandy high strength CLAY. Sand is fine to coarse grained. (River Terrace Deposits)					D005	2.00				V= 82 kPa V= 86 kPa V= 74 kPa
Orange slightly clayey, slightly gravelly CLAY. Sand is fine to coarse grained. Gravel is subrounded fine to coarse of flint. (River Terrace Deposits)						2.30				
Structureless CHALK composed of uncompact cream slightly gravelly sandy SILT. Gravel is weak rounded low density and white. (Grade Dm) (New Pit Chalk Formation)		2.80								
End of Exploratory Hole at 2.85 m		2.85								
Remarks: 1. Groundwater not encountered in the exploratory hole. 2. Exploratory hole sides stable. 3. Permeability test undertaken in the trial pit.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading		
						Sheet: Sheet 1 of 1				

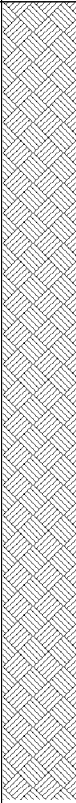
Exploratory Hole ID: TP5	Client: Wilmington Homes					 www.opusinternational.co.uk				
	Site: Hollyacre, Toddington Lane									
Job No: E-E1524.00						Start Date: 14/01/2013		End Date: 14/01/2013		
Drilling Equipment/ Excavation Method: JCB 3CX			Co-ords:			Backfill Date: 15/01/2013		Field Records:		
			Ground Level (mAOD):			Logged: CDS		Chkd: Appr:		
Strata Description			Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
MADE GROUND: comprising white/grey/brown subangular to subrounded fine to medium flint gravel.			0.05			ES001	0.20			
MADE GROUND: comprising buff fine to coarse grained sand.			0.10							
Firm consistency medium brown/orange slightly silty, slightly sandy medium strength CLAY. Sand is fine to coarse grained.(River Terrace Deposits)						B002	0.70	V= 54 kPa V= 64 kPa V= 62 kPa	1.20	
Firm consistency orange/brown slightly silty sandy CLAY. Sand is fine to coarse grained. (River Terrace Deposits)			1.75					V= 56 kPa V= 64 kPa V= 56 kPa	1.80	
End of Exploratory Hole at 2.41 m			2.41							
Remarks: 1. Seepage of groundwater from the sides of the excavation at 1.2m and 1.8m begl. 2. Long sides of excavation underbreak collapse at vertical fissures in clay from 1.2 to the base of the excavation. 3. Permeability test undertaken in the trial pit. Water level rose to 1.015m begl overnight and remained at this level during the second day of the test.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading		
						Sheet: Sheet 1 of 1				

Exploratory Hole ID: TP6	Client: Wilmington Homes					 www.opusinternational.co.uk				
	Site: Hollyacre, Toddington Lane									
Job No: E-E1524.00						Start Date: 14/01/2013		End Date: 14/01/2013		
Drilling Equipment/ Excavation Method: JCB 3CX			Co-ords:			Backfill Date: 15/01/2013		Field Records:		
			Ground Level (mAOD):			Logged: CDS		Chkd: Appr:		
Strata Description			Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
MADE GROUND: Comprising white/brown/grey subangular to subrounded fine to medium flint gravel.			0.03							
MADE GROUND: comprising light brown fine to coarse grained sand on a plastic membrane.			0.12			ES001	0.25			
Grey with red veins silty slightly sandy CLAY. Sand is fine to coarse grained. (River Terrace Deposits)			0.40			B002	0.70			
Firm consistency medium brown/orange slightly silty slightly sandy high strength CLAY. Sand is fine to medium grained. (River Terrace Deposits)								V= 76 kPa V= 86 kPa V= 78 kPa		
Firm consistency medium orange/brown slightly silty sandy CLAY. Sand is fine to medium grained. (River Terrace Deposits)			1.75					V= 72 kPa V= 74 kPa V= 76 kPa		
Orange/brown slightly clayey fine to coarse grained SAND. (River Terrace Deposits)			2.40							
Orange/brown slightly clayey slightly gravelly SAND. Sand is fine to coarse grained. Gravel is subangular to subrounded fine to coarse of flint. (River Terrace Deposits)			2.70 2.78							
End of Exploratory Hole at 2.78 m										
Remarks: 1. Groundwater not encountered during excavation of the exploratory trial pit. 2. Exploratory hole excavation sides stable. 3. Permeability test undertaken in the trial pit. Water level rose to 1.630m below ground level overnight and remained at this level during the second day of the test.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Penetrometer Reading PID - PID Reading V - Hand Shear Vane Reading		
						Sheet: Sheet 1 of 1				

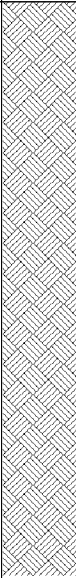
Exploratory Hole ID: TP7		Client: Wilmington Homes				 www.opusinternational.co.uk			
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane							
Drilling Equipment/ Excavation Method: JCB 3CX		Co-ords:		Backfill Date: 15/01/2013		Field Records:			
		Ground Level (mAOD):		Logged: CDS		Chkd:		Appr:	
Strata Description		Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
MADE GROUND: comprising brown black white sandy gravel. Sand is fine to coarse grained. Gravel is sub rounded to rounded fine to coarse flint.		0.15			ES001	0.08			
MADE GROUND: comprising brown/grey silty sandy clay. Sand is fine to coarse grained.		0.35			ES002	0.25			
Firm consistency orange/medium brown slightly silty slightly sandy medium strength CLAY. Sand is fine to coarse grained. (River Terrace Deposits)					B003	0.50			
Orange slightly gravelly fine to coarse grained SAND. Gravel is subangular to subrounded fine to coarse flint. (River Terrace Deposits)		1.40							
End of Exploratory Hole at 2.59 m		2.59							
Remarks: 1. Groundwater not encountered in the exploratory hole. 2. Exploratory excavation hole sides stable. 3. Permeability test undertaken in the trial pit, the noncohesive sand deposits slumped into the base of the trial pit during the test and the final base depth of the pit was 2.15m begl.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading	
						Sheet: Sheet 1 of 1			

Exploratory Hole ID: TP8		Client: Wilmington Homes				 www.opusinternational.co.uk			
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane							
Drilling Equipment/ Excavation Method: JCB 3CX		Co-ords:		Backfill Date: 15/01/2013		End Date: 15/01/2013			
		Ground Level (mAOD):		Logged: CDS		Chkd:		Appr:	
Strata Description		Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
MADE GROUND: comprising brown clayey sandy gravel. Sand is fine to coarse grained. Gravel is rounded fine to coarse.		0.23			ES001	0.15	V= 56 kPa V= 68 kPa V= 60 kPa V= 76 kPa V= 72 kPa V= 64 kPa		
MADE GROUND: comprising firm consistency orange/brown slightly silty sandy clay. Sand is fine to coarse grained. Occasional angular brick fragments.		0.55			ES002	0.50			
Firm consistency orange/brown slightly silty slightly sandy medium strength CLAY. Sand is fine to coarse grained. (River Terrace Deposits)					ES003 B004	1.05			
Orange slightly gravelly fine to coarse grained SAND. Gravel is subangular to subrounded fine to medium of flint. (River Terrace Deposits)		2.25			ES005 B006	2.80			
End of Exploratory Hole at 3.40 m		3.40							
Remarks: 1. Hole excavated adjacent to soakaway trench. 2. Seepage noted into the base of the trial pit, potentially from the soakaway trench adjacent. 3. Trial pit excavation sides stable. 4. Trial pit excavated through an area used for burning waste packaging materials.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading	
						Sheet: Sheet 1 of 1			

Exploratory Hole ID: TP9		Client: Wilmington Homes				 www.opusinternational.co.uk			
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane							
Drilling Equipment/ Excavation Method: JCB 3CX		Co-ords:		Backfill Date: 15/01/2013		Field Records:			
		Ground Level (mAOD):		Logged: CDS		Chkd:		Appr:	
Strata Description		Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
MADE GROUND: comprising light grey white/brown subangular to subrounded to fine flint gravel.		0.03			ES001	0.05			
MADE GROUND: comprising light orange fine to coarse sand.		0.10							
Black plastic sheet.					ES002	0.50			
MADEGROUND: comprising dark grey silty slightly sandy clay. Sand is fine to coarse grained. Piece of plastic noted at base of stratum.		0.60							
Firm consistency dark grey silty slightly sandy high strength CLAY. Sand is fine to coarse grained sand. (River Terrace Deposits)					ES003 B004	1.00	V= 78 kPa V= 70 kPa V= 84 kPa		
Firm consistency medium brown/orange slightly silty slightly sandy high strength CLAY. (River Terrace Deposits)		1.70			ES005 D006	1.80	V= 86 kPa V= 92 kPa V= 94 kPa		
Orange fine to coarse grained SAND. (River Terrace Deposits)		2.50							
End of Exploratory Hole at 2.65 m		2.65							
Remarks: 1. Groundwater not encountered the trial pit. 2. Trial pit excavation sides stable.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample			
						Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading			
						Sheet: Sheet 1 of 1			

Exploratory Hole ID: TP10		Client: Wilmington Homes				 www.opusinternational.co.uk							
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane								Start Date: 15/01/2013		End Date: 15/01/2013	
Drilling Equipment/ Excavation Method: JCB 3CX		Co-ords:		Backfill Date: 15/01/2013						Field Records:			
		Ground Level (mAOD):		Logged: CDS		Chkd:		Appr:					
Strata Description		Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details				
MADE GROUND: comprising grey/white brown subangular to subrounded fine to medium flint gravel.		0.05			ES001	0.08	V= 110 kPa V= 112 kPa V= 110 kPa V= 72 kPa V= 74 kPa V= 74 kPa						
MADE GROUND: comprising light orange fine to coarse sand.		0.15			ES002	0.45							
Black plastic membrane.					B003	0.50							
Firm/stiff consistency grey with red veins silty slightly sandy CLAY. Sand is fine to coarse grained. (River Terrace Deposits)		0.80			ES004 D005	1.00							
Firm/stiff consistency orange/ medium brown slightly silty sandy high strength CLAY. Sand is fine to coarse grained. (river Terrace Deposits)		1.20											
Firm consistency orange/medium brown slightly silty sandy medium strength CLAY. Sand is fine to coarse grained. (River Terrace Deposits)		1.90			B006	3.10							
Orange slightly clayey slightly gravelly SAND. Sand is fine to coarse grained. Gravel is subrounded to rounded fine to coarse of flint. (River Terrace Deposits)													
End of Exploratory Hole at 3.20 m		3.20											
Remarks: 1. Groundwater not encountered in the exploratory trial pit. 2. Trial pit excavation sides stable.						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading					
						Sheet: Sheet 1 of 1							

Exploratory Hole ID: TP11		Client: Wilmington Homes				 OPUS www.opusinternational.co.uk			
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane							
Drilling Equipment/ Excavation Method: JCB 3CX		Co-ords:		Backfill Date: 15/01/2013		Field Records:			
		Ground Level (mAOD):		Logged: CDS		Chkd:		Appr:	
Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details	
MADE GROUND: orange brown clayey sandy gravel, Sand is fine to coarse grained. Gravel is subrounded to rounded fine to coarse of flint.	0.10			ES001	0.50	V= 80 kPa V= 82 kPa V= 80 kPa V= 100 kPa V= 94 kPa V= 106 kPa			
MADE GROUND: comprising medium brown slightly silty sandy slightly graveely clay. Sand is fine to coarse grained. Gravel is angular to subrounded fine to coarse of flint with rare whole brick cobbles.									
Firm consistency orange/medium brown slightly silty slightly sandy high strength CLAY. (River Terrace Deposits)	1.05			ES002 B003	1.10 1.15				
Orange slightly clayey slightly gravelly SAND. Sand is fine to coarse grained. Gravel is subangular to subrounded fine to coarse of flint. (River Terrace Deposits)	2.00			B004	2.40				
End of Exploratory Hole at 2.50 m	2.50								
Remarks: 1. Groundwater not encountered in the trial pit. 2. Trial pit excavation sides stable					Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample		Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading		
					Sheet: Sheet 1 of 1				

Exploratory Hole ID: TP12		Client: Wilmington Homes				 www.opusinternational.co.uk			
Job No: E-E1524.00		Site: Hollyacre, Toddington Lane							
Drilling Equipment/ Excavation Method: JCB 3CX				Co-ords:		Backfill Date: 15/01/2013		Field Records:	
				Ground Level (mAOD):		Logged: CDS		Chkd: Appr:	
Strata Description		Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
MADE GROUND: comprising dark brown clayey sandy gravel. Sand is fine to coarse grained. Gravel is subrounded to rounded fine to coarse of flint.		0.20			ES001	0.10	V= 62 kPa V= 64 kPa V= 60 kPa		
Firm consistency orange/medium brown slightly silty sandy CLAY. Sand is fine to coarse grained. (River Terrace Deposits)					ES002	0.50			
					B003	0.80			
					B004	1.40			
Orange slightly gravelly SAND. Sand is fine to coarse grained. Gravel is subangular to subrounded fine to coarse of flint. (River Terrace Deposits)		2.00		B005	2.10				
End of Exploratory Hole at 2.30 m		2.30							
Remarks: 1. Groundwater not encountered in the trial pit. 2. Trial pit excavation sides stable						Sample Type Key D - Disturbed Representative B - Bulk Representative ES - Environmental Sample W - Water U - Undisturbed Representative J - Jar Sample P - Piston Sample			
						Test Type Key (C) - Cone SPT (S) - Spoon SPT P - Pocket Pentrometer Reading PID - PID Reading V - Hand Shear Vane Reading			
						Sheet: Sheet 1 of 1			

Trial Hole: TP7

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PROJECT NO: E-E1524 SHEET NO:

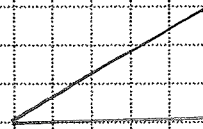
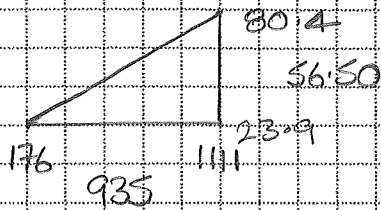
REV :

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PROJECT: HOLLYACRE, TOPDINGTON LANETP4

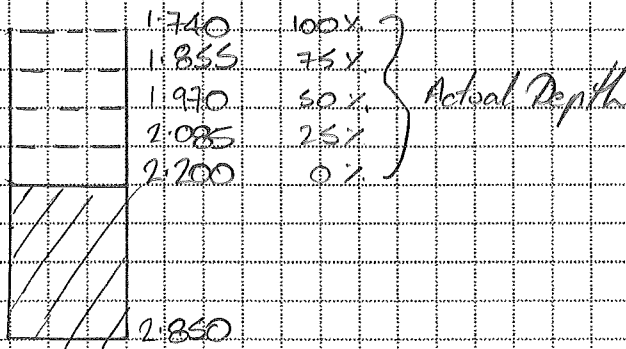
$$\frac{935}{56.5} \times 5.4 = 89.3628$$

$$\frac{935}{56.5} \times 1.1 = 18.2035$$

$$176 + 89.3628 = 265.36$$

$$111.1 - 18.2035 = 1092.7$$

$$\text{Time of outflow from 75\% to 25\% effective depth} = 1093 - 265 = 828$$



$$V_{75-25} = 1.75 \times 0.48 (2.085 - 1.855) = \underline{0.1932 \text{ m}^3}$$

$$\begin{aligned} A_{150} &= (1.75 \times 0.48) + (1.75 \times 2 (2.085 - 1.97)) + (0.48 \times 2 (2.085 - 1.97)) \\ &= 0.84 + 3.08 + 0.8448 \\ &= \underline{4.7648 \text{ m}^2} \end{aligned}$$

$$\begin{aligned} \text{Soil Infiltration rate} &= \frac{0.1932}{4.7648 \times 828 \times 60} = \underline{8.16 \times 10^{-7} \text{ m/s}} \end{aligned}$$

Trial Hole: TP4

Trial Hole: TP4



Trial Hole: TP3

Time in minutes	Depth in meters to water surface	Depth in metres of water	Percentage of water depth at start
0.00	1.990	0.67	100.0%
22.00	2.235	0.43	63.4%
61.00	2.445	0.22	32.1%
135.00	2.565	0.10	14.2%
173.00	2.620	0.04	6.0%
248.00	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
	2.620	0.04	6.0%
248.00	2.620	0.04	6.0%

INFILTRATION CALCULATED FROM 75%-25% WATER DEPTH RANGE

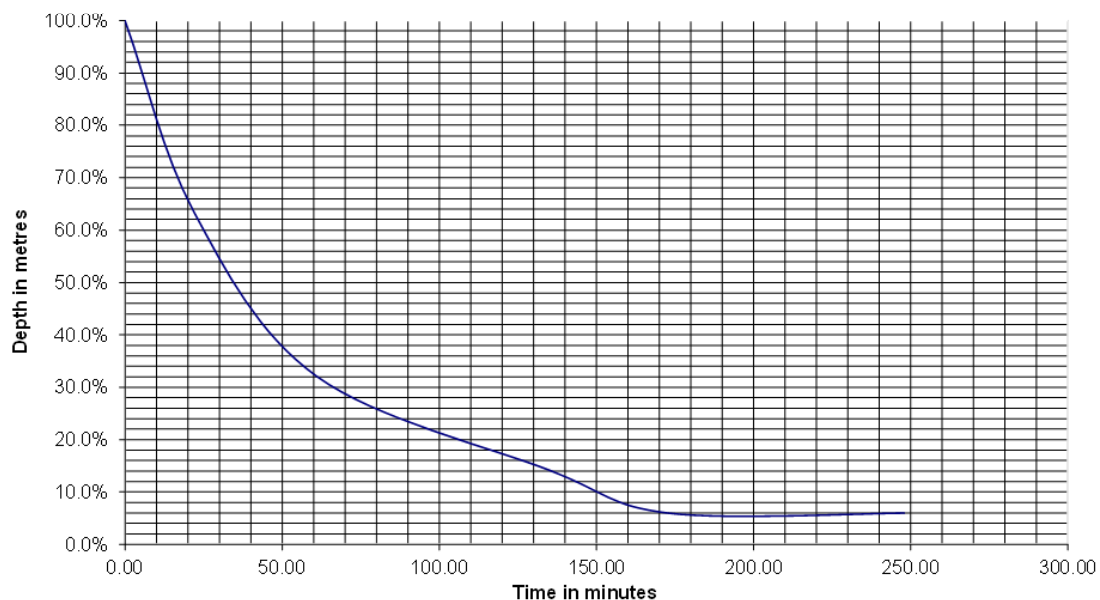
Pit Size	Time in mins
Length	15 75%
Width	90.5 25%
Depth	

Infiltration Rate

from 75%-25%

2.65064E-05

Permeability Graph TP3





OPUS

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PROJECT NO: E-E1524 SHEET NO:

REV :

DESIGNED: CDS

REVIEWED: AC

DATE: JAN 13

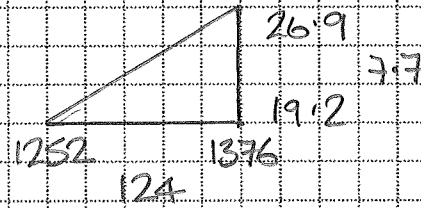
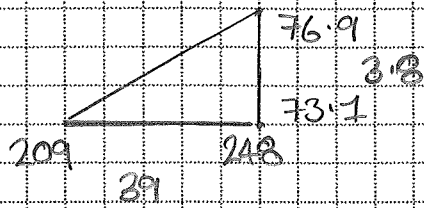
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PROJECT: HOLLYACRE, TODDINGTON LANE

TP2



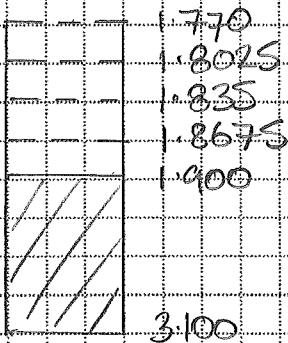
$$\frac{39}{3.8} \times 1.9 = 19.5$$

$$\frac{124}{7.7} \times 1.9 = 30.597$$

$$248 - 19.5 = 228.5 \text{ mins}$$

$$1252 + 30.597 = 1221.6 \text{ mins}$$

Time of outflow from 75% to 25% effective depth
 $= 1221.6 - 228.5 = 993.1 \text{ mins}$



$$V_{p75-25} = 1.70 \times 0.48 (1.8675 - 1.8025) = 0.05304 \text{ m}^3$$

$$\begin{aligned} A_{p25} &= (1.70 \times 0.48) + (1.70 \times 2 \times (3.1 - 1.835)) + (0.48 \times 2 \times (3.1 - 1.835)) \\ &= 0.816 + 4.301 + 1.2144 \\ &= 6.3314 \end{aligned}$$

$$\begin{aligned} \text{Soil Infiltration Rate} &= \frac{0.05304}{6.3314 \times 993.1 \times 60} = \underline{\underline{1.406 \times 10^{-7}}} \end{aligned}$$

Trial Hole: TP2

Trial Hole: TP2

not valid

**OPUS**

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Hampshire
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PROJECT NO: E-E1524 SHEET NO:

REV :

DESIGNED: CDSREVIEWED: ADATE: JAN 13

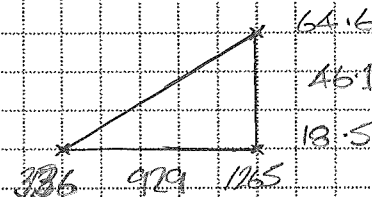
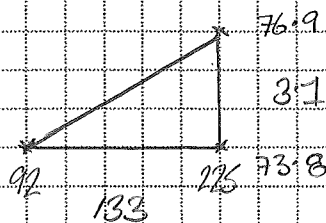
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PROJECT: HOLLYACRE, TODDINGTON LANETP14

As the full depth test was not completed between 75 to 25% effective depth. Therefore the soil infiltration rate calculation should be based on the time for the fall of water level from 75 to 25% of the actual maximum water depth achieved in the test



$$\frac{133}{3.1} = 42.91032 \times 1.2 = 51.48388$$

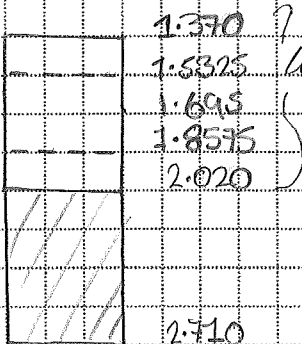
$$\frac{929}{46.1} \times 6.5 = 130.9869$$

$$= 225 - 51.483 = 173.517 \text{ mins} \approx 173.30$$

$$1165 - 130.9869 = 1034.0131 \text{ mins} \approx 1034$$

$$\text{Time of outflow from 75% to 25% effective depth} = 1034 - 173.30$$

$$= 860.7 \text{ mins} \approx 860.5$$



Water level during the test

$$\sqrt{V_{75-25}} = 1.60 \times 0.48 \times (1.8575 - 1.5325) = 0.2496 \text{ m}^3$$

$$\begin{aligned} A_{p50} &= (1.60 \times 0.48) + (1.60 \times 2 \times (2.71 - 1.695)) + (0.48 \times 2 \times (2.71 - 1.695)) \\ &= 0.768 + 3.248 + 0.9744 \\ &= 4.9904 \text{ m}^2 \end{aligned}$$

$$\text{Soil Infiltration Rate} = \frac{0.2496}{4.9904 \times 860.5 \times 60} = 8.68 \times 10^{-7}$$

Trial Hole: TP1

Trial Hole: TP1

not valid



103588

O.S. REF.
TQ0303NW

Drawn by: goswama

Scale: 1:2500

Title: 132691_Land at Hollyacre, Todd

Date: 01/03/2012

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.
ADDITIONAL BAC pipes are connected to Service Adaptors Current
MATERIALS: Unbonded Object materials may include bonded Adaptors Current

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Southern
Water

503738

APPENDIX B:

Site Layout
Drainage Strategy

SCHEDULE:

PHASE 1

Affordable Dwellings (30%):
3no. 2-bed houses @ 782sqft
10no. 3-bed houses @ 886sqft
3no. 3-bed houses @ 887sqft
4no. 3-bed houses @ 960sqft
20no. dwellings - total 17,704sqft
Car Parking:
1 allocated spaces per dwelling x15plots = 15
2 allocated spaces per dwelling x5plots =10

Open Market Dwellings
1no. 2-bed Flat @ 755sqft
1no. 2-bed Flat @ 805sqft
15no. 3-bed houses @ 835sqft
1no. 3-bed houses @ 894sqft
2no. 3-bed house @ 915sqft
1no. 3-bed house @ 950sqft
6no. 3-bed houses @ 970sqft
5no. 4-bed houses @ 1187sqft
32no. dwellings - total 29,518sqft
Car Parking:
2 allocated spaces per dwelling x32plots =64

PHASE 2 - RETAINED LAND

Open Market Dwellings
6no. 3-bed houses @ 820sqft
1no. 3-bed houses @ 880sqft
2no. 3-bed houses @ 900sqft
4no. 3-bed house @ 954sqft
1no. 4-bed houses @ 1168sqft
14no. dwellings - total 12,586sqft
Car Parking:
2 allocated spaces per dwelling x14plots =28
2no. visitors spaces

66no. Dwellings total
Overall Site Area 1.67Ha
Density 39.5dw/Ha
Allocated Car Spaces: 117no.
Visitors / Unallocated Car Parking: 24no.

G	04.04.13	Amended to sketches agreed with Planners	KE	AK
F	20.03.13	Revise housing mix. Plots No 25 - 46 renumbered	CL	KE
E	05.02.13	Highways details added along Toddington Lane	KE	EY
D	25.01.13	Schedule, notes & phasing amended	KE	EY
C	16.01.13	Additional visitors spaces added within Phase 3	KE	EY
B	15.01.13	Affordable types revised, roads adjusted to tracking	KE	EY
A	11.12.12	Updated with revised house types	KE	EY
Rev	Date	Revision Details	Dr	Ch

ECE Architecture

London: Unit 1 West Coate House 3 Coate Street
London E2 9AG
T 020 7729 5505 E london@ecearchitecture.com

Sussex: Brooklyn Chambers 11 Goring Road
Worthing West Sussex BN12 4AP
T 01903 248777 E sussex@ecearchitecture.com
www.ecearchitecture.com

Client's Name
Wilmington Homes

Job Title
Toddington Lane, Littlehampton

Drawing Title
Masterplan

Scale
1:500 @ A1 / 1:1000 @ A3

Drawn
KE

Checked
AC

Date
27.09.12

Job No
5691

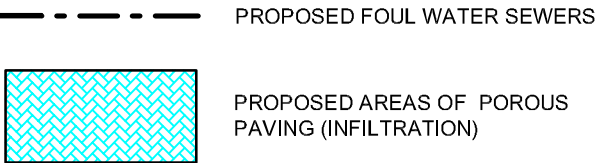
Drawing No
01

Rev
G

INFORMATION



- NOTES:
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER SWP DRAWINGS, AND WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND SPECIFICATION AND ANY DISCREPANCIES FOUND ARE TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
 2. NO DIMENSIONS ARE TO BE SCALED FROM THIS DRAWING. UNLESS NOTED OTHERWISE ALL DIMENSIONS ARE IN MILLIMETERS AND ALL LEVELS ARE IN METRES FROM THE SITE DATUM.
 3. 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.
 4. THE ELECTRONIC INFORMATION FROM THIS DRAWING CAN NOT BE GUARANTEED AS DIMENSIONALLY DRAWN EXACT. FIGURED DIMENSIONS MUST BE USED FOR SETTING OUT AND DETAILING. SWP LOGOS AND COMPANY INFORMATION MUST BE REMOVED FROM COPIES IF INFORMATION IS RE-USED.
 5. THE MAIN CONTRACTOR IS RESPONSIBLE FOR THE DESIGN OF ALL TEMPORARY WORKS, AND IS ALSO RESPONSIBLE FOR THE SAFE MAINTENANCE AND STABILITY OF EXISTING BUILDINGS AT ALL TIMES.
 6. THE MAIN CONTRACTOR IS RESPONSIBLE FOR ALL OCCURRENCES OF GROUND WATER DURING THE CONSTRUCTION PERIOD.
 7. ANY INFORMATION GIVEN REGARDING EXISTING UNDERGROUND SERVICES IS GIVEN IN GOOD FAITH AFTER CONSULTATION WITH THE RELEVANT AUTHORITY, HOWEVER ACCURACY IS NOT CERTAIN. THE MAIN CONTRACTOR IS RESPONSIBLE FOR CHECKING ALL INFORMATION ON SITE PRIOR TO WORK COMMENCING AND TAKING DUE CARE AND ATTENTION WHILST UNDERTAKING THE WORKS.
 8. THE CONTRACTOR MUST COMPLY WITH ALL CURRENT LEGISLATION RELATING TO HEALTH & SAFETY.
 9. ALL PRODUCTS SPECIFIED SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND INSTRUCTIONS. IF THERE ARE DISCREPANCIES BETWEEN THAT INFORMATION AND THE DETAILS ON ANY SWP DRAWINGS, THE MANUFACTURERS INSTRUCTIONS MUST BE USED.



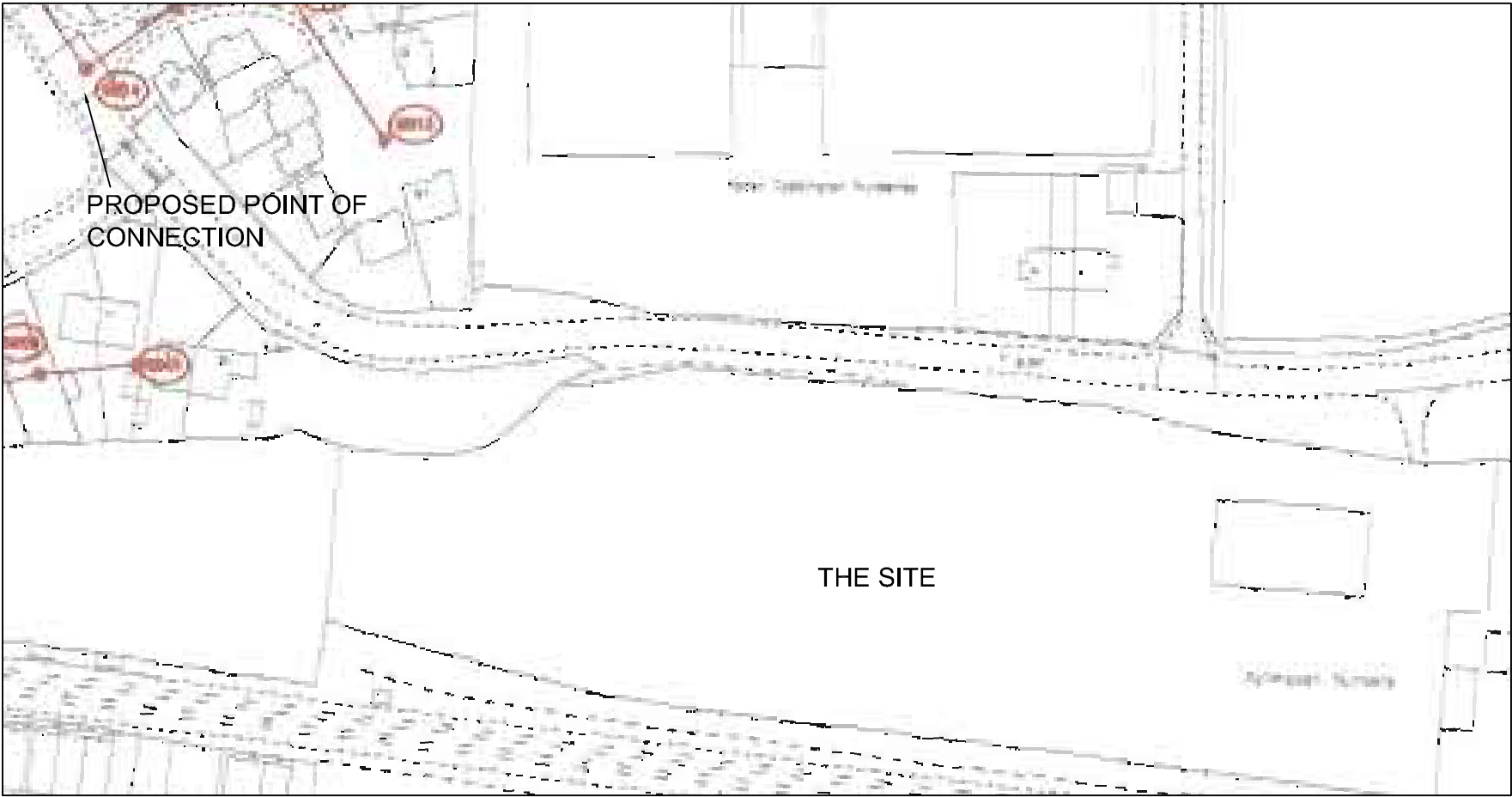
SITE AREA = 17035m²

EXISTING IMPERMEABLE AREA = 2066m²

NUMBER OF PROPOSED UNITS = 66

SURFACE WATER RUN-OFF FROM DEVELOPMENT TO BE DISPOSED OF BY INFILTRATION (SOAKAWAYS AND POROUS PAVING).

WASTEWATER TO BE PUMPED TO EXISTING SEWER NETWORK LOCATED IN MILL ROAD TO THE WEST OF THE SITE.



PRELIMINARY

PRELIMINARY			A		APR 13	LAYOUT REVISED
			REV.	DATE	DESCRIPTION	
CLIENT WILMINGTON HOMES			 STEPHEN WILSON PARTNERSHIP LTD. CONSULTING STRUCTURAL & CIVIL ENGINEERS 99, South Street, Eastbourne, Sussex, BN21 4LU Telephone: 01323 412020, Facsimile: 01323 432129 E-Mail: info@swpconsult.co.uk			
ARCHITECT ECE ARCHITECTURE						
JOB TITLE HOLLYACRE, TODDINGTON LANE LITTLEHAMPTON						
DRAWING TITLE DRAINAGE STRATEGY						
SCALE AT A2 1:500						
DATE FEB 13	DRAWN LF	JOB No. E5589	DRAWING No. SK201	REV. A		
ENG. LF	CHECKED -					

APPENDIX C:

Surface Water Calculations

Stephen Wilson Partnership Limited		Page 1																										
43 South Street Eastbourne Sussex BN21 4UT																												
Date 19/02/2013 09:35 File	Designed by liam.foord Checked by																											
Micro Drainage	Source Control 2013.1																											
<u>Greenfield Runoff Volume</u> FSR Data <table> <tr> <td>Return Period (years)</td> <td>2</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.000</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>1.700</td> </tr> <tr> <td>SAAR (mm)</td> <td>715</td> </tr> <tr> <td>CWI</td> <td>45.000</td> </tr> <tr> <td>Urban</td> <td>0.110</td> </tr> <tr> <td>SPR</td> <td>37.000</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>18.75</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>85.672</td> </tr> </table>			Return Period (years)	2	Storm Duration (mins)	360	Region	England and Wales	M5-60 (mm)	19.000	Ratio R	0.350	Areal Reduction Factor	1.00	Area (ha)	1.700	SAAR (mm)	715	CWI	45.000	Urban	0.110	SPR	37.000	Percentage Runoff (%)	18.75	Greenfield Runoff Volume (m³)	85.672
Return Period (years)	2																											
Storm Duration (mins)	360																											
Region	England and Wales																											
M5-60 (mm)	19.000																											
Ratio R	0.350																											
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Area (ha)	1.700																											
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CWI	45.000																											
Urban	0.110																											
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43 South Street Eastbourne Sussex BN21 4UT																												
Date 19/02/2013 09:34 File	Designed by liam.foord Checked by																											
Micro Drainage	Source Control 2013.1																											
<u>Greenfield Runoff Volume</u> FSR Data <table> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.000</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>1.700</td> </tr> <tr> <td>SAAR (mm)</td> <td>715</td> </tr> <tr> <td>CWI</td> <td>45.000</td> </tr> <tr> <td>Urban</td> <td>0.110</td> </tr> <tr> <td>SPR</td> <td>37.000</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>22.66</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>242.786</td> </tr> </table>			Return Period (years)	100	Storm Duration (mins)	360	Region	England and Wales	M5-60 (mm)	19.000	Ratio R	0.350	Areal Reduction Factor	1.00	Area (ha)	1.700	SAAR (mm)	715	CWI	45.000	Urban	0.110	SPR	37.000	Percentage Runoff (%)	22.66	Greenfield Runoff Volume (m ³)	242.786
Return Period (years)	100																											
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43 South Street Eastbourne Sussex BN21 4UT																		
Date 19/02/2013 09:41 File	Designed by liam.foord Checked by																	
Micro Drainage		Source Control 2013.1																
<u>ADAS 345 Mean Annual Flood</u> Input <table> <tr> <td>Area (ha)</td> <td>1.700</td> <td>Soil Type Factor (St)</td> <td>0.500</td> </tr> <tr> <td>Length (m)</td> <td>167.000</td> <td>Paved Area (%)</td> <td>1.100</td> </tr> <tr> <td>Average Slope (1:X)</td> <td>300.0</td> <td>Region Number</td> <td>Region 7</td> </tr> <tr> <td>AAR (mm)</td> <td>715</td> <td></td> <td></td> </tr> </table> Results l/s Q0 - Peak Flood Flow 3.7 Total Q0 3.7 QBAR 4.2 Q100 years 13.2 Q1 year 3.6 Q2 years 3.7 Q5 years 5.4 Q10 years 6.8 Q20 years 8.4 Q25 years 9.0 Q30 years 9.4 Q50 years 10.9 Q100 years 13.2 Q200 years 15.5 Q250 years 16.3 Q1000 years 21.4			Area (ha)	1.700	Soil Type Factor (St)	0.500	Length (m)	167.000	Paved Area (%)	1.100	Average Slope (1:X)	300.0	Region Number	Region 7	AAR (mm)	715		
Area (ha)	1.700	Soil Type Factor (St)	0.500															
Length (m)	167.000	Paved Area (%)	1.100															
Average Slope (1:X)	300.0	Region Number	Region 7															
AAR (mm)	715																	
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43 South Street Eastbourne Sussex BN21 4UT																										
Date 19/02/2013 09:20 File	Designed by liam.foord Checked by																									
Micro Drainage	Source Control 2013.1																									
<u>ICP SUDS Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.400</td> </tr> <tr> <td>Area (ha)</td> <td>1.700</td> <td>Urban</td> <td>0.110</td> </tr> <tr> <td>SAAR (mm)</td> <td>715</td> <td>Region Number</td> <td>Region 7</td> </tr> </table> Results l/s <table> <tr> <td>QBAR Rural</td> <td>5.9</td> </tr> <tr> <td>QBAR Urban</td> <td>7.1</td> </tr> <tr> <td>Q100 years</td> <td>21.0</td> </tr> <tr> <td>Q1 year</td> <td>6.1</td> </tr> <tr> <td>Q30 years</td> <td>15.5</td> </tr> <tr> <td>Q100 years</td> <td>21.0</td> </tr> </table>			Return Period (years)	100	Soil	0.400	Area (ha)	1.700	Urban	0.110	SAAR (mm)	715	Region Number	Region 7	QBAR Rural	5.9	QBAR Urban	7.1	Q100 years	21.0	Q1 year	6.1	Q30 years	15.5	Q100 years	21.0
Return Period (years)	100	Soil	0.400																							
Area (ha)	1.700	Urban	0.110																							
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43 South Street Eastbourne Sussex BN21 4UT		Hollyacre, Toddington... Littlehampton Sample Soakaway			
Date Feb 13 File		Designed by LF Checked by			
Micro Drainage		Source Control 2013.1			
Summary of Results for 100 year Return Period (+30%)					
Half Drain Time : 1619 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.544	0.544	0.0	2.2	0 K
30 min Summer	99.728	0.728	0.0	2.9	0 K
60 min Summer	99.928	0.928	0.0	3.7	0 K
120 min Summer	100.133	1.133	0.0	4.5	0 K
180 min Summer	100.248	1.248	0.0	4.9	0 K
240 min Summer	100.322	1.322	0.0	5.2	0 K
360 min Summer	100.419	1.419	0.0	5.6	0 K
480 min Summer	100.480	1.480	0.0	5.9	0 K
600 min Summer	100.520	1.520	0.0	6.0	0 K
720 min Summer	100.545	1.545	0.0	6.1	0 K
960 min Summer	100.569	1.569	0.0	6.2	0 K
1440 min Summer	100.574	1.574	0.0	6.2	0 K
2160 min Summer	100.562	1.562	0.0	6.2	0 K
2880 min Summer	100.534	1.534	0.0	6.1	0 K
4320 min Summer	100.459	1.459	0.0	5.8	0 K
5760 min Summer	100.377	1.377	0.0	5.5	0 K
7200 min Summer	100.299	1.299	0.0	5.1	0 K
8640 min Summer	100.231	1.231	0.0	4.9	0 K
10080 min Summer	100.170	1.170	0.0	4.6	0 K
15 min Winter	99.610	0.610	0.0	2.4	0 K
30 min Winter	99.816	0.816	0.0	3.2	0 K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	115.731	0.0	19		
30 min Summer	77.804	0.0	34		
60 min Summer	49.937	0.0	64		
120 min Summer	30.956	0.0	124		
180 min Summer	23.058	0.0	184		
240 min Summer	18.577	0.0	242		
360 min Summer	13.656	0.0	362		
480 min Summer	10.974	0.0	482		
600 min Summer	9.254	0.0	602		
720 min Summer	8.046	0.0	720		
960 min Summer	6.447	0.0	960		
1440 min Summer	4.709	0.0	1200		
2160 min Summer	3.432	0.0	1576		
2880 min Summer	2.739	0.0	1988		
4320 min Summer	1.989	0.0	2812		
5760 min Summer	1.583	0.0	3640		
7200 min Summer	1.325	0.0	4464		
8640 min Summer	1.147	0.0	5272		
10080 min Summer	1.015	0.0	6056		
15 min Winter	115.731	0.0	19		
30 min Winter	77.804	0.0	34		
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43 South Street Eastbourne Sussex BN21 4UT		Hollyacre, Toddington... Littlehampton Sample Soakaway				
Date Feb 13 File		Designed by LF Checked by				
Micro Drainage		Source Control 2013.1				
Summary of Results for 100 year Return Period (+30%)						
Storm Event		Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
60 min Winter		100.040	1.040	0.0	4.1	0 K
120 min Winter		100.272	1.272	0.0	5.0	0 K
180 min Winter		100.403	1.403	0.0	5.6	0 K
240 min Winter		100.487	1.487	0.0	5.9	0 K
360 min Winter		100.598	1.598	0.0	6.3	0 K
480 min Winter		100.671	1.671	0.0	6.6	0 K
600 min Winter		100.719	1.719	0.0	6.8	0 K
720 min Winter		100.751	1.751	0.0	6.9	0 K
960 min Winter		100.786	1.786	0.0	7.1	0 K
1440 min Winter		100.793	1.793	0.0	7.1	0 K
2160 min Winter		100.772	1.772	0.0	7.0	0 K
2880 min Winter		100.732	1.732	0.0	6.9	0 K
4320 min Winter		100.623	1.623	0.0	6.4	0 K
5760 min Winter		100.507	1.507	0.0	6.0	0 K
7200 min Winter		100.397	1.397	0.0	5.5	0 K
8640 min Winter		100.299	1.299	0.0	5.1	0 K
10080 min Winter		100.212	1.212	0.0	4.8	0 K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
60 min Winter		49.937	0.0	64		
120 min Winter		30.956	0.0	122		
180 min Winter		23.058	0.0	180		
240 min Winter		18.577	0.0	240		
360 min Winter		13.656	0.0	356		
480 min Winter		10.974	0.0	472		
600 min Winter		9.254	0.0	588		
720 min Winter		8.046	0.0	700		
960 min Winter		6.447	0.0	924		
1440 min Winter		4.709	0.0	1330		
2160 min Winter		3.432	0.0	1664		
2880 min Winter		2.739	0.0	2128		
4320 min Winter		1.989	0.0	3028		
5760 min Winter		1.583	0.0	3920		
7200 min Winter		1.325	0.0	4760		
8640 min Winter		1.147	0.0	5616		
10080 min Winter		1.015	0.0	6456		
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43 South Street Eastbourne Sussex BN21 4UT	Hollyacre, Toddington... Littlehampton Sample Soakaway																															
Date Feb 13 File	Designed by LF Checked by																															
Micro Drainage		Source Control 2013.1																														
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.010 <table> <tr> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To: (ha)</th> </tr> <tr> <td>0</td> <td>4 0.010</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.000	Shortest Storm (mins)	15	Ratio R	0.350	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+30	Time (mins)	Area	From:	To: (ha)	0	4 0.010
Rainfall Model	FSR	Winter Storms	Yes																													
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43 South Street Eastbourne Sussex BN21 4UT	Hollyacre, Toddington... Littlehampton Sample Soakaway											
Date Feb 13 File	Designed by LF Checked by											
Micro Drainage		Source Control 2013.1										
<u>Model Details</u> Storage is Online Cover Level (m) 101.200 <u>Trench Soakaway Structure</u> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Infiltration Coefficient Base (m/hr) 0.00288</td> <td style="width: 50%;">Trench Width (m) 1.2</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr) 0.00288</td> <td>Trench Length (m) 11.0</td> </tr> <tr> <td>Safety Factor 1.0</td> <td>Slope (1:X) 0.0</td> </tr> <tr> <td>Porosity 0.30</td> <td>Cap Volume Depth (m) 0.000</td> </tr> <tr> <td>Invert Level (m) 99.000</td> <td>Cap Infiltration Depth (m) 0.000</td> </tr> </table>			Infiltration Coefficient Base (m/hr) 0.00288	Trench Width (m) 1.2	Infiltration Coefficient Side (m/hr) 0.00288	Trench Length (m) 11.0	Safety Factor 1.0	Slope (1:X) 0.0	Porosity 0.30	Cap Volume Depth (m) 0.000	Invert Level (m) 99.000	Cap Infiltration Depth (m) 0.000
Infiltration Coefficient Base (m/hr) 0.00288	Trench Width (m) 1.2											
Infiltration Coefficient Side (m/hr) 0.00288	Trench Length (m) 11.0											
Safety Factor 1.0	Slope (1:X) 0.0											
Porosity 0.30	Cap Volume Depth (m) 0.000											
Invert Level (m) 99.000	Cap Infiltration Depth (m) 0.000											
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APPENDIX D:

Conditions and Limitations

1. This report does not constitute a design document. It is the duty of the project designers, to confirm the content of this report and to design the scheme in accordance with their own research and other extraneous parameters.
2. This report is produced for the named Client and must not be relied upon by any third parties, without the express prior written permission of Stephen Wilson Partnership Ltd.
3. The copyright of this report remains the property of Stephen Wilson Partnership Ltd.
4. Unless specifically stated otherwise in the report, any recommendations for works given in the report are to be confirmed or modified as appropriate at design stage.
5. Under the Construction (Design & Management) Regulations, latest edition, the Client has obligations for ensuring the Health & Safety arising from any construction work. If it is proposed to proceed with construction works, based upon information or recommendations contained in this report, these regulations probably apply. Further details of any issues arising from our report or the client's obligations generally are available on request.