

**WANDLEYS FARM, WANDLEYS LANE,
WALBERTON, ARUNDEL BN18 0QR**

RESIDENTIAL DEVELOPMENT

Flood Risk Assessment

Prepared on Behalf of

Mr & Mrs Lillywhite

2016/D1209/FRA1.1

02 August 2017

DOCUMENT CONTROL

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Residential Development

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1 INTRODUCTION

1.1 Background

- 1.1.1 RGP Design Ltd (RGP) is instructed by Mr & Mrs Lillywhite to prepare a Site-Specific Flood Risk Assessment (FRA) to support a planning application for a residential development at Wandleys Farm, Wandleys Lane, Walberton, Arundel BN18 0QR.
- 1.1.2 This FRA has been undertaken in accordance with Planning Practice Guidance: Flood Risk and Coastal Change (FRCC) and National Planning Policy Framework Section 10.
- 1.1.3 The proposed development will involve the construction of five residential properties to the south of the existing property known as Wandleys Farm, to the east of Wandleys Lane.
- 1.1.4 In preparing this report, RGP has made reference to the following documents and information:
- Environment Agency Flood Maps for Planning
 - Long Term Flood Risk Assessment Surface Water Flood Risk Maps
 - Long Term Flood Risk Assessment Reservoir Flood Risk Maps
 - Local Authorities Strategic Flood Risk Assessment
 - Arun District Council Drainage Records
 - Topographical Survey
 - British Geological Survey & Report
- 1.1.5 This FRA has been prepared to assess if the proposed development is suitable for the site and confirms if mitigation is required to ensure that flood risk is not increased and that the proposed development remains safe during its design life.
- 1.1.6 This report has been prepared for the benefit of the named Client only.

1.2 Site Location and Description

- 1.2.1 The site is located on the eastern side of Wandleys Lane, on land to the south of Wandleys Farm
- 1.2.2 The site is located approximately 5km west of Arundel and 8km east of Chichester. It is a semi-rural/residential area and lies at approximately 23.82m to 20.11m AOD, generally falling from north to south.
- 1.2.3 The site is an undeveloped greenfield site, located on adjacent land directly to the south of the existing property known as Wandleys Farm,

- 1.2.4 The proposed development will involve the construction of five units in total; four affordable two-bedroom residential dwellings, one market house and associated hard standing for access and parking. This will require two new vehicular points of access and egress to the development, both of which will be off of Wandleys Lane.
- 1.2.5 The overall site area is 1.17Ha as shown on drawing **SK200**.
- 1.2.6 The existing impermeable area is 715m² (0.071Ha)
- 1.2.7 There are no main rivers located within the immediate vicinity of the site.
- 1.2.8 There is an ordinary watercourse located immediately to the west of the proposed development site.

1.3 Ground Conditions

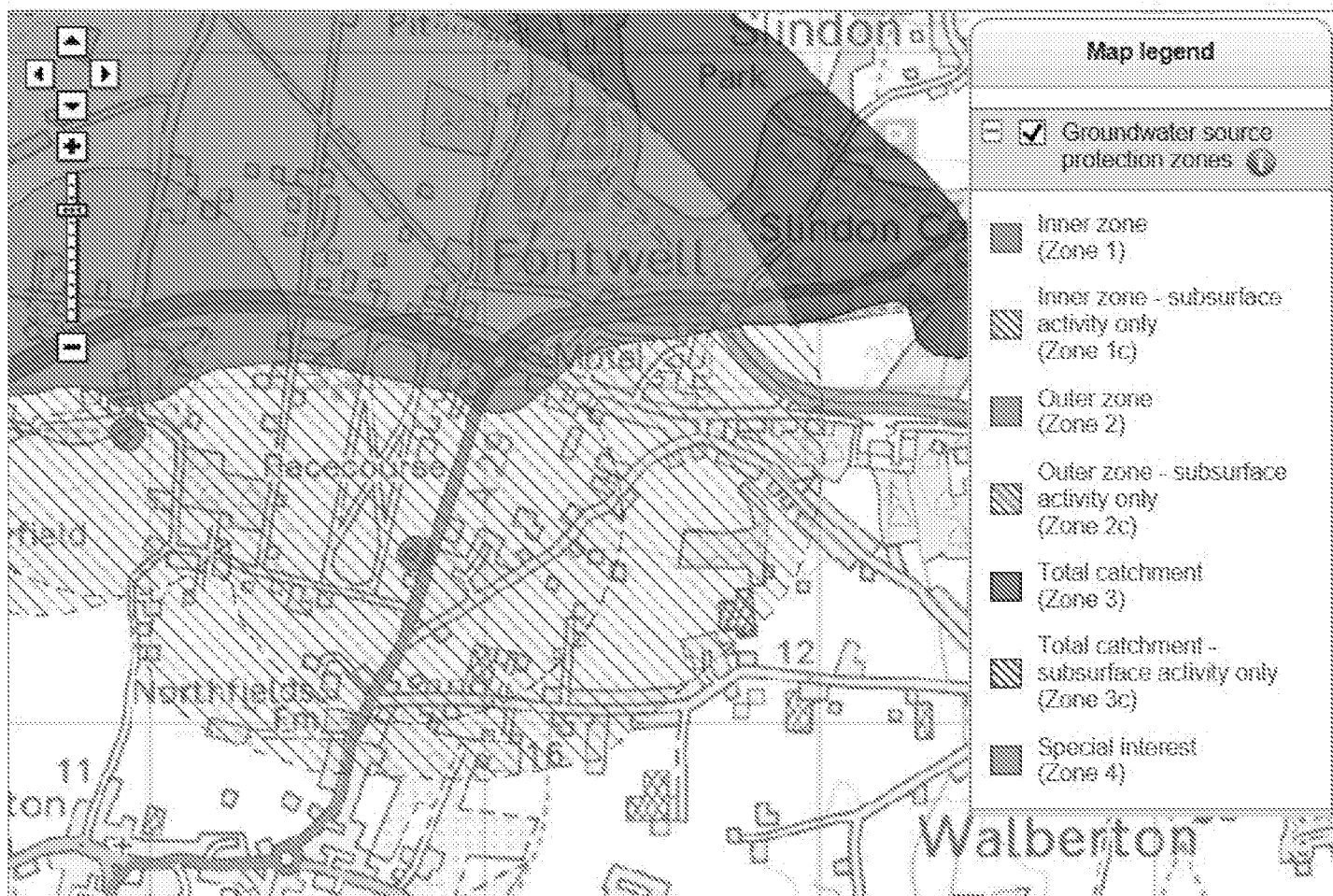
- 1.3.1 An intrusive geotechnical study has not been undertaken for the site, meaning precise infiltration testing results are not available. Furthermore, as a direct result it has not been possible to ascertain or determine the level of Groundwater, as Groundwater monitoring has not been conducted.
- 1.3.2 In view of 1.3.1, reference has been made to the British Geological Survey (BGS) website.
- 1.3.3 Bedrock geology is reported by the BGS as being 'Lambeth Group – Clay, Silt and Sand London Clay Formation – Clay, Silt and Sand.'
- 1.3.4 Superficial deposits are reported by the BGS as being 'Head – Clay, Silt, Sand and Gravel' and 'Head – Gravel, Sand, Silt and Clay.'



- 1.3.5 An historical borehole exists to the north of the site (SU90NE34) as confirmed by BGS (Appendix C), with a recorded depth of 6.00m. This identifies made ground as being 500mm deep. A 'very clayey gravel' was recorded with a thickness of 1.30m, consisting of gravel – coarse with fine, angular to sub-rounded, flint with white patina, fine gravel mostly white flint, sand – coarse with fine and medium, angular and fines of clay, mottled brown.' Beneath this layer, silt, sandy brown raised beach deposits were experienced. This consisted of 'very clayey sand, fine sand with a trace of medium, angular to sub-rounded with fines of silt, brown with some clay. This extended to a further 1.00m below ground level. In addition to this, silt, sandy clayey brown was noted (800mm thick), sand, grey with some clay (500mm) and mudstone, grey near top, dark red below (900mm+ thick) were evident during the excavating process.
- 1.3.6 With reference to the borehole mentioned in 1.3.5, no reference to groundwater has been made, therefore assuming none was experienced during the investigation.
- 1.3.7 The site is located in a Groundwater Source Protection Zone, as confirmed by information available on the Environment Agency's website. The classification is 'Inner zone – subsurface activity only (Zone 1c)

Map of BN18 0QR at scale 1:20,000

Other maps  Data search  Text only version 



- 1.3.8 In addition to point 1.3.7, the site is deemed to fall within a groundwater vulnerability zone. The site is classified as falling within a 'Minor Aquifer High' category.

1.4 Existing Drainage

1.4.1 The existing drainage systems have been identified by reviewing the OS mapping along with statutory records obtained from the local Water Authority, Southern Water.

1.4.2 Surface Water:

- The Southern Water sewer records (Appendix B) suggest that there are no public surface water sewers located within the vicinity of the site.
- Arun District Council have provided further mapping of existing infrastructure in relation to the site, however, this is again lacking in locating possible services. In this correspondence it is stated that it is likely that there are more assets located on and/or across the site.
- Greenfield runoff rate (Qbar) has been calculated to be 2.4l/s (Q1=2.1l/s, Q30=5.5l/s and Q100 = 7.8l/s).
- The Greenfield run-off volume is calculated to be 32.28m³ (Based on FEH, SPR of 30.00%).
- There is an ordinary watercourse located along the western boundary of the development site. This watercourse does not appear to be named, and the outfall to which is unknown.

1.4.3 Foul Water:

- The Southern Water sewer records (Appendix B) show there is an existing public foul water sewer located in the centre of Wandleys Lane, to the west of the site and area of proposed development. This is recorded as being 150mm dia. in size and of vitrified clay construction, flowing from north-east to south-west down Wandleys Lane.

1.4.4 Highway Drainage:

- Wandleys Lane does not appear to be served by any positive surface water drainage infrastructure. It is believed that it is drained by 'over the edge' methods, the outfall of which is believed to fall to the ordinary watercourse along the eastern edge of the road.

2 PROBABILITY

2.1 Sources of Information

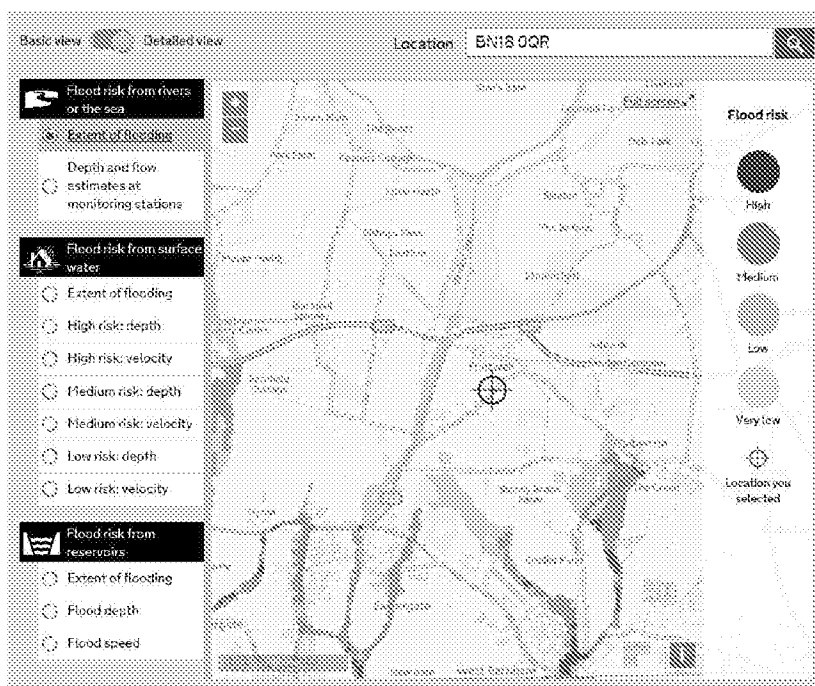
2.1.1 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwater, Sewers and Man-made reservoirs/canals.

2.1.2 The likelihood of the site flooding has been established by reviewing the following information:

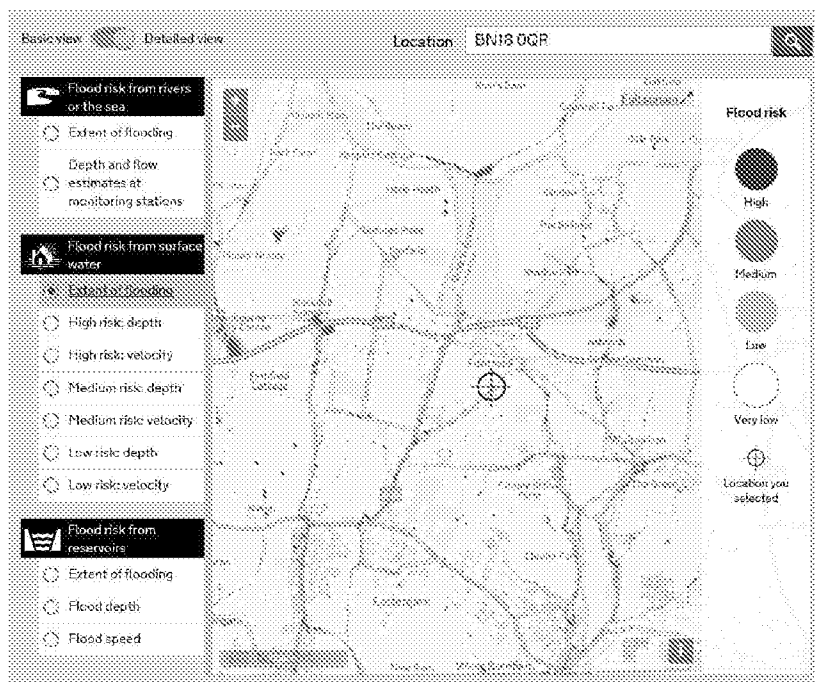
- Environment Agency Flood Maps for Planning
- Long Term Flood Risk Assessment Surface Water Flood Risk Maps
- Long Term Flood Risk Assessment Reservoir Flood Risk Maps
- Local Authorities Strategic Flood Risk Assessment
- Consultation with Local Authority/Lead Local Flood Authority
- Topographic Survey

2.2 Flood Maps and Modelling

2.2.1 The Environment Agency's on-line Flood Maps for Planning (rivers and sea) show that the site is in Flood Zone 1.

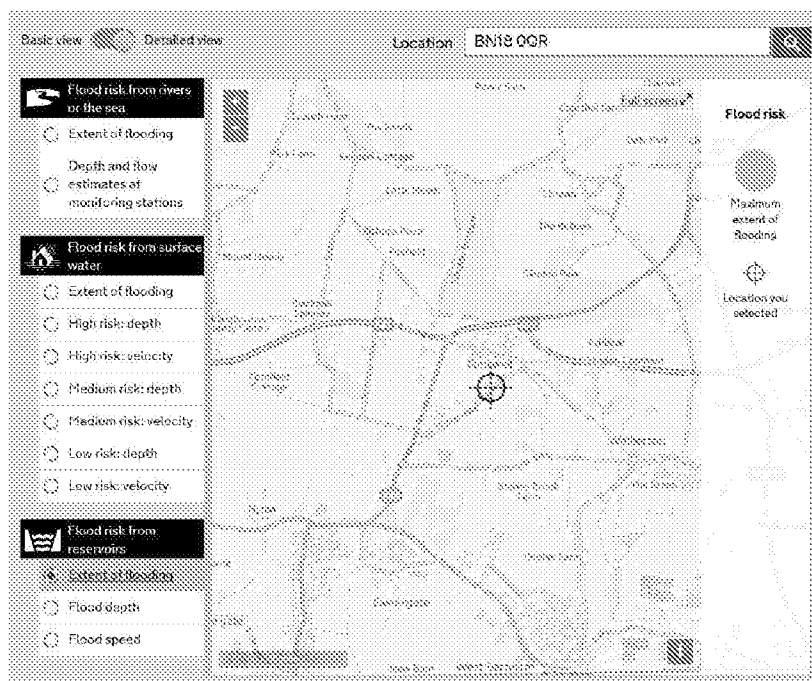


2.2.2 The Long-Term Flood Risk Map for Surface Water show that the site is at low risk of surface water flooding. This is also consistent with information obtained from the Environment Agency.



2.2.3 Whilst the SFRA indicates the permeability of soils in this area to be highly variable, the BGS website borehole data does not indicate high groundwater and therefore the site is at a low risk of ground water flooding.

2.2.4 The Flood Maps for Reservoirs (gov.uk) show that the site is not at risk from this source.



2.2.5 There is no evidence to suggest a Sewer flood risk within the vicinity of the site.

2.2.6 There are no known artificial sources in the area.

2.3 Strategic Flood Risk Assessment

- 2.3.1 The site falls within the boundaries of West Sussex County Council (WSCC) and Arun District Council (ADC).
- 2.3.2 WSCC has published a Local Flood Risk Management Strategy covering 2013-2018. Flood mapping and information obtained therein is consistent with other flood maps reviewed and detailed within this report. This site and/or area is not specifically identified for development and is not identified to be high risk.

2.4 Historic Flooding

- 2.4.1 The SFRA & The Environment Agency has confirmed that they are not aware of any historical flooding within the confines of the site.

2.5 Summary of Flood Risk

- 2.5.1 The potential sources of flooding are:
- Overtopping or breach of the watercourse
 - Blockages in drains or culverts (*)
 - Surface water flooding (low)
- 2.5.2 The site has been confirmed, by all sources reviewed, as falling completely within Flood Zone 1, and as a result, is deemed as being at low risk of surface water flooding.
- 2.5.3 Further to 2.5.2, neither the Environment Agency or ADC hold records of any instances or occurrences of surface water flooding affecting the site.
- 2.5.4 The aforementioned data confirms the following sources and level of risk:

Source of Flooding	Level of Risk
Rivers and Watercourses	Low
The Sea	Very low
Surface water	Low
Groundwater	Low
Sewers (*)	Low
Artificial Sources	None

3 PROPOSED DEVELOPMENT

3.1 Description of Development

- 3.1.1 The development comprises the construction of five new dwellings on the land immediately adjacent to the south of the existing structure(s) at Wandleys Farm. The development will incorporate the construction of two new access points off Wandleys Lane which will consist of areas of hardstanding and associated parking.
- 3.1.2 Of the proposed five new dwellings, four will be affordable two-bedroom properties, whilst the fifth will be a market house - each of which will include areas of hardstanding for access/egress as well as parking, as stated in 3.1.1.
- 3.1.3 The type of development falls within the More Vulnerable classification (Flood Risk and Costal Change Table 2) and is compatible with Flood Zones 1 and 2 (Flood Risk and Costal Change Table 3).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	x	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	x	x	x	✓*

- 3.1.4 The proposed development encompasses the currently un-development greenfield site to the south of the existing structure(s) known as Wandleys Farm, and has an impermeable area of approximately 715m². The proposed development involves the creation of additional impermeable area and will increase the rate or volume of run off generated by the site. Post-development, the impermeable areas will amount to 2,726m². The increase in impermeable area will result in an increase in surface water run-off, which will be mitigated through the use of SuDS methods and techniques within the bounds of the site to ensure that the development has no impact on flood risk either on or off the site.
- 3.1.5 The proposed site layout is shown on drawing 17031_05 (**Appendix A**) prepared by Roger Harden Design Consultants.p

4 PROPOSED DRAINAGE STRATEGY

4.1 Surface Water

- 4.1.1 The SUDS manual and Building Regulations set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The Hierarchy favours infiltration methods of disposal over other methods such as watercourse and sewers.

SUDS Technique	Suitable	Comments
Living Roof	Yes	
Basins and Ponds		
- Constructed Wetlands	No	Constraints on existing site limits the use of these techniques
- Balancing Ponds	No	
- Detention Basins	No	
- Retention Ponds	No	
Filter strips and swales	No	Constraints on existing site limits the use of these techniques
Infiltration Devices		
- Soakaways	Yes	Infiltration potential of underlying soil unknown without further testing
- Infiltration trenches and basins	Yes	
Permeable surfaces and filter drains		
- Gravelled areas	Yes	Infiltration potential of underlying soil unknown without further testing
- Solid paving blocks	Yes	
Porous paviers	Yes	
Tanked systems		
Oversized pipes	Yes	
Cellular tanks	Yes	

- 4.1.2 It is proposed to employ porous paving across the site to cater for an increase in potential surface water run-off in view of the increase of impermeable areas. This will ensure that all surface water is drained via sustainable drainage methods outlined within the SuDS manual as well as Building Regulations, which both seek to maximise the use of sustainable drainage techniques.
- 4.1.3 The strategy above will ensure that there is no increase in the rate of run-off leaving the site, therefore no increase in the risk of flooding from this source as the increase in surface water run-off will be drained via infiltration.

4.2 Treatment

- 4.2.1 The use of porous paving will ensure that the run-off from the road receives a level of treatment that meets the requirement of the SuDS Manual due to naturally occurring microbes digesting Hydrocarbons entering the system and the filtration effects of the aggregates and geotextiles.
- 4.2.2 Impermeable hard stand areas will be drained by trapped road gullies and/or channel with a sump providing a basic level of treatment by collecting silts and oil pollutants. Catchpits will also be provided to collect silts and oil pollutants.
- 4.2.3 The CIRIA SuDS Manual C753 outlines three categories of pollution hazard identification for the various types of land use as follows:
- Total Suspended Solids (TSS).
 - Metals (M).
 - Hydrocarbons (H).
- 4.2.4 In accordance with C753 table 26.2 the proposed land uses at the site are categorised as follows:
- Residential Roofs - very low/TSS-0.2/M-0.2/H-0.05.
 - For other impermeable surfaces - low/TSS-0.5/M-0.4/H-0.4.
- 4.2.5 In accordance with C753 table 26.3 to establish whether a proposed surface water management technique can provide sufficient treatment for runoff, the values are compared. If the treatment score for each pollutant category is higher than the pollution score then the chosen technique is sufficient. If a single technique is not judged to provide enough treatment then other techniques can be added to the system.
- 4.2.6 The treatment afforded by the proposed outline surface water management strategy has been assessed based on the following components:
- Permeable pavement – TSS-0.7/M-0.6/H-0.7
- 4.2.7 In conclusion, the proposed porous pavement can be considered to provide sufficient treatment.

4.3 Foul Water Drainage

- 4.3.1 It is proposed to connect the development to the existing foul water sewer located in Wandleys Lane, subject to confirmation of its levels. A Section 106 application will need to be submitted with Southern Water before a connection can be made.
- 4.3.2 Based on the residual design guidance provided in Sewers for Adoption, the proposed foul flow will be in the region of 0.23l/s (based on 4,000 l/day Sewers for Adoption 7th Edition).

4.4 Climate Change

- 4.4.1 NPPF sets out percentage increases to be applied to the peak rainfall intensity values used in the design of a surface water drainage system to allow for the effects of climate change.
- 4.4.2 In accordance with NPPF 'climate change allowances' update 12th April 2016, an increase of 20% should be applied for this development and a review should be undertaken to determine the impact of an increase of 45%.
- 4.4.3 The available long-term flood maps suggest that the effects of climate change will not increase the 'predicted' fluvial flood zone expanse in the future. Whilst the extent of the site at risk of flooding is predicted to increase for 100 years lifetime, this is not as a result of the minor development proposals, i.e. this will occur to all properties in this location unless further mitigation works are implemented.
- 4.4.4 As previously discussed, the site is located fully in Flood Zone 1 (lowest risk of flooding) and is expected to remain within such for the expected lifetime of the development.

5 RESIDUAL RISK AND MITIGATION

5.1 Residual Risk

- 5.1.1 As discussed in Section 2, the site is at low risk of flooding from all sources, therefore there is no residual risk of flooding.

5.2 Mitigation

- 5.2.1 As discussed in Section 2, the site is at low risk of flooding from all sources therefore no mitigation is proposed.

6 SEQUENTIAL AND EXCEPTION TESTS

6.1 Sequential Test

- 6.1.1 The site is located fully within Flood Zone 1 and is deemed to be at the lowest risk of flooding. In view of this, the application of the sequential test is not required.

6.2 Exception Test

- 6.2.1 Table 3 within Paragraph 067 of Flood Risk and Coastal Change confirms that developments classified as 'More Vulnerable' are suitable for Zones 1 and 2. The proposed development is in Zone 1 and therefore an exception test is not required.

7 FLOOD RISK MANAGEMENT

7.1 Safe Access and Egress

- 7.1.1 The proposed development falls entirely within Flood Zone 1 and is expected to remain in that zone throughout its design life.
- 7.1.2 The site is confirmed as being at low risk of surface water flooding and, in view of such, the risk of access and egress being affected by flooding is low.

7.2 Flood Warning

- 7.2.1 The site is at low risk of flooding therefore there is no requirement for a Flood Plan or warning system to be implemented.

7.3 Maintenance

- 7.3.1 Maintenance plays an important part in the long-term performance of a surface water drainage system and will be required to ensure that it remains fully operational.
- 7.3.2 The traditional parts (inspection chambers, pipes, gullies etc.) of the proposed surface water drainage system will need a minimal amount of maintenance similar to other traditional systems.
- 7.3.3 The SuDS devices will require slightly more maintenance focusing on reducing the amount of silt that is allowed to enter the system. Upstream catchpits and gully sumps will need to be regularly emptied of silt.
- 7.3.4 It is important to ensure that the porous paved areas are properly maintained in accordance with the manufacturers recommendations which may include:
- Periodic surface sweeping to reduce silt and debris accumulation.
 - Periodic silt removal from porous paved construction.
 - Redressing the joints on the block paved surface as required.
- 7.3.5 It is recommended that a simple maintenance strategy is prepared by monitoring the proposed drainage system over a specific duration to establish the rate at which silt builds up, which can then inform a programme of regular works.
- 7.3.6 It is anticipated that individual property owners/tenants will be responsible for the ongoing maintenance of the proposed surface water drainage system on the site.

8 OFFSITE IMPACTS

- 8.1.1 The proposed development will not have an impact on flooding issues off-site.
- 8.1.2 There will be no increase in the rate of run-off leaving the site and no significant impact to the existing surface water system.
- 8.1.3 There will be no adverse impact on overland flood flow routes because the proposals will follow the existing general topography (falls from north to south).
- 8.1.4 The effects of climate change should be considered in the design of the proposed surface water drainage system, to ensure there is no off-site impact.

9 SUMMARY

- 9.1.1 This site-specific flood risk assessment is based on Flood Maps, the Local Authority's Strategic Flood Risk Assessment, Topographical Survey data and Public Sewer Records.
- 9.1.2 The site is currently occupied by the existing structure(s) known as Wandleys Farm, whilst the area of proposed development is un-developed greenfield land.
- 9.1.3 The site lies at approximately 20.11m AOD to 23.82m AOD and falls from north to south.
- 9.1.4 The existing impermeable area is 0.071ha and will increase to 0.27Ha following the proposed development.
- 9.1.5 The site lies fully within Flood Zone 1 and it is expected to remain unchanged for the duration of the development's life expectancy.
- 9.1.6 The run-off from the site is believed to following existing overland flow routes whilst it is possible there is existing private surface water drainage infrastructure which serves the site, although the location and extent of such is unknown at present. Post development, the use of porous paving will be employed to deal with the increase in surface water run-off.
- 9.1.7 The wastewater from the proposed development will outfall to the existing public foul water sewer, located within Wandleys Lane, to the west of the proposed development.
- 9.1.8 As a result of an increase in impermeable areas across the site, an increase in surface water run-off will occur. This will be managed by sustainable drainage methods and techniques (with porous paving) within the bounds of the site, meaning there will be no increase in the rate of surface water run-off leaving the site.
- 9.1.9 Following completion of the development the flood risk both on and off the site will remain unchanged.
- 9.1.10 Application of the Sequential Test and Exception Test is not required.
- 9.1.11 A maintenance regime should be established to ensure the long-term effectiveness of the surface water drainage system.
- 9.1.12 In conclusion, from a flood risk point of view the proposed development is suitable.

DRAWINGS

SK100 Site Location Plan
SK101 LiDAR Contours
SK102 LiDAR Banding
SK200 Impermeable Area Comparison
SK300 Drainage Strategy



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A3

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4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

A	02/08/2017	Title block information updated	SPB
-	31/07/2017	Original Issue	SMO
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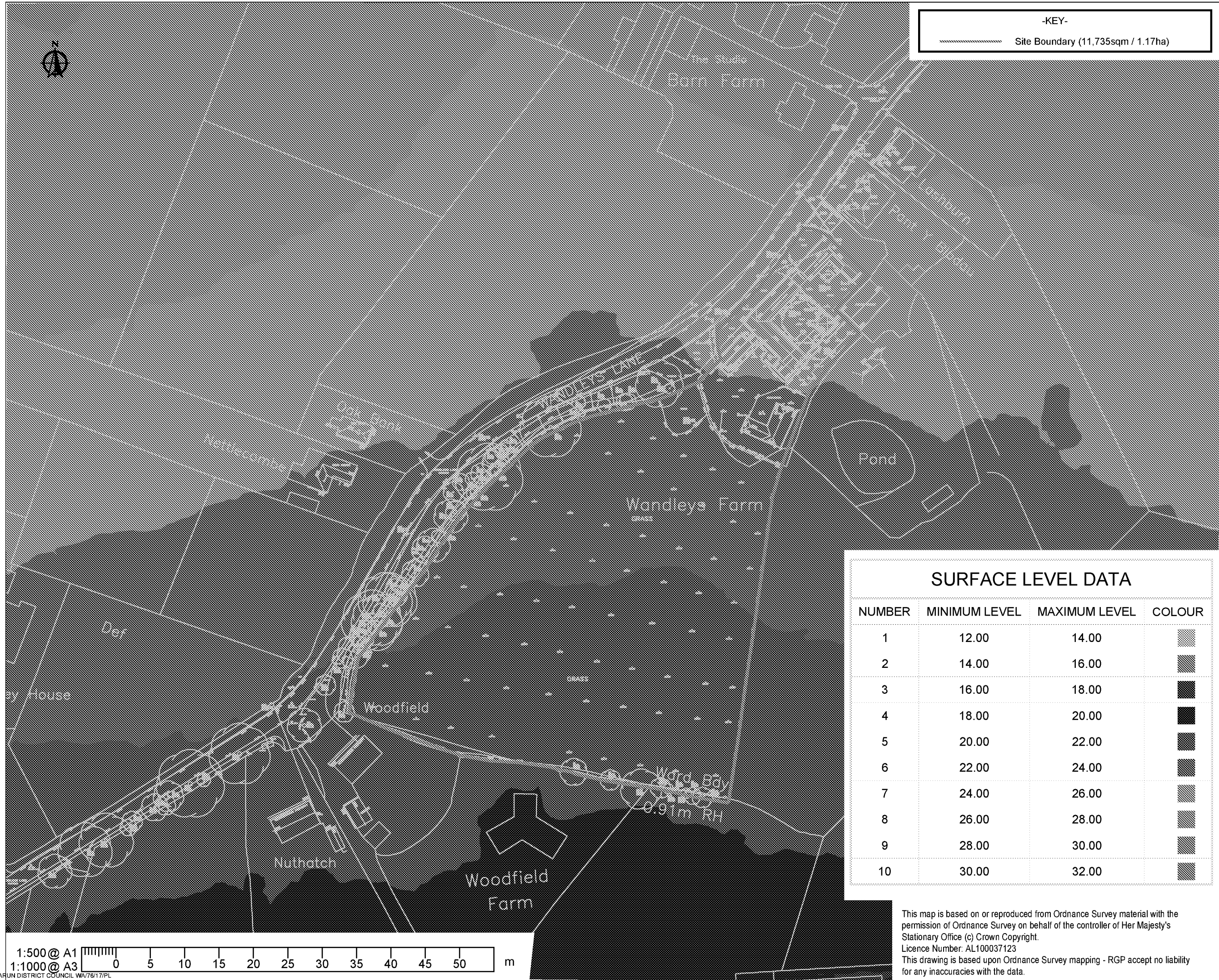
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Walberton, BN18 0QR

Drawing Title
Site Location Plan

Scale	1:1000	Drawn By	SPB	Checked By	MJA	Approved By	MJA
Date	August 2017	Drawing No.	2017/D1209/SK100	Rev.	A		



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SURFACE LEVEL DATA

NUMBER	MINIMUM LEVEL	MAXIMUM LEVEL	COLOUR
1	12.00	14.00	
2	14.00	16.00	
3	16.00	18.00	
4	18.00	20.00	
5	20.00	22.00	
6	22.00	24.00	
7	24.00	26.00	
8	26.00	28.00	
9	28.00	30.00	
10	30.00	32.00	

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Rev.	Date	Amendments	Drawn
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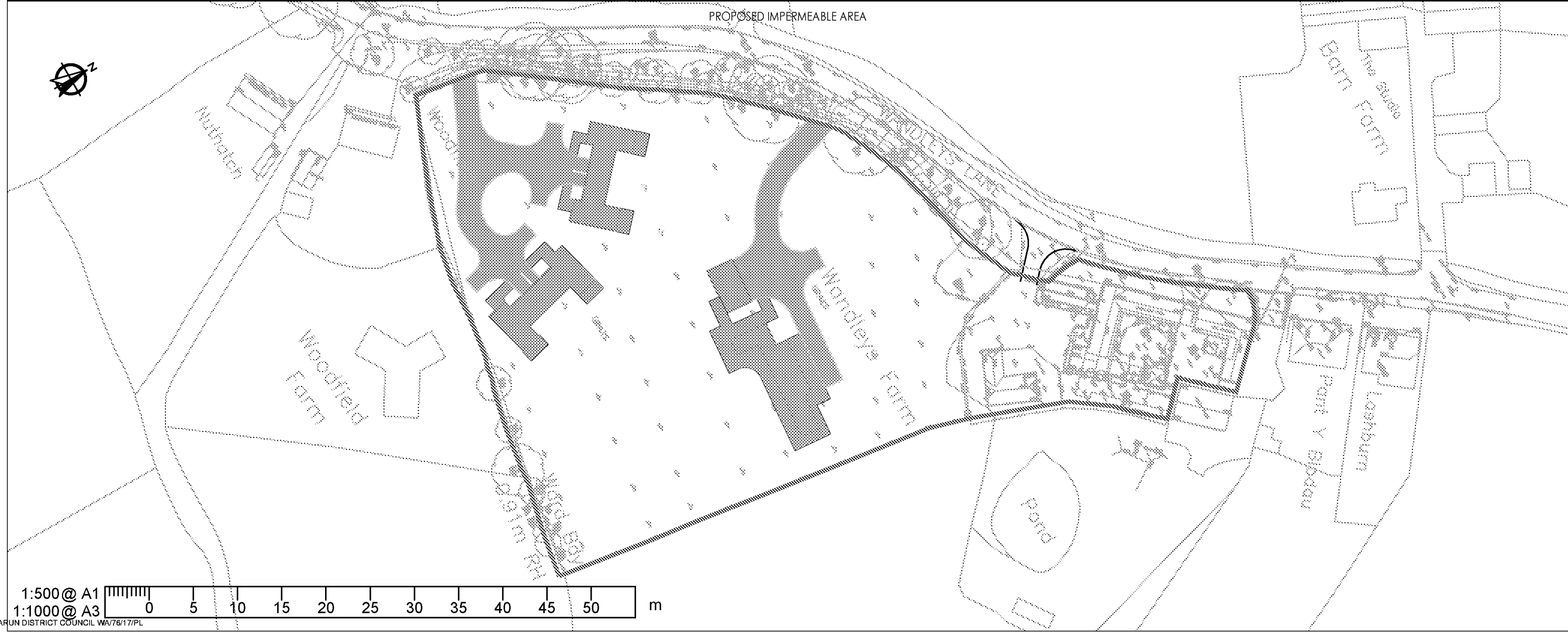
Client

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Walberton, BN18 0QR

Drawing Title
LiDAR Banding

Scale	1:1000	Drawn By	SPB	Checked By	MJA	Approved By	MJA
Date	August 2017	Drawing No.	2017/D1209/SK102	Rev.	-		



EXISTING IMPERMEABLE AREA

PROPOSED IMPERMEABLE AREA

-KEY-

Site Boundary (11,735sqm / 1.17ha)

Existing Impermeable Area (715sqm)

Proposed Impermeable Area (2,011sqm)

NOTES

A3

1

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Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

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-	10/04/2017	Original Issue	SMO
Rev.	Date	Amendments	Drawn

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Walberton, BN18 0QR

Drawing Title

Impermeable Areas
Comparison

Scale

1:1000

Drawn By

SPB

Checked By

MJA

Approved By

MJA

Date

August 2017

Drawing No.

2017/D1209/SK200

Rev.

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PROPOSED DRAINAGE STRATEGY

Existing drains to be investigated to determine level, connectivity and condition prior to detailed design stage.

All with drainage works can be achieved within the confines of the site.

FOUL STRATEGY

- New connection via manhole subject to S106 Consent
- Post development increase in peak flow to 0.23l/s

SURFACE WATER STRATEGY

- Increased impermeable areas post development will be drained to the ground through the use of porous paving
- The use of SuDS is the preferred methodology, such as the use of soakaway(s) and/or porous paving, subject to full infiltration testing
- Preliminary 'assumed' infiltration rate of 1x10-5 used for design until confirmation received following on-site investigation

PUBLIC SEWERS OVERLAID TO OS MAP FROM SOUTHERN WATER RECORDS.

EXACT LOCATIONS OF APPARATUS MAY VARY ON SITE & SHALL BE VERIFIED PRIOR TO FINALISING DRAINAGE STRATEGY.

Ex FWMH 3601
CL 24.40
IL 22.75
D 1.65m

Proposed Culvert (Subject to Land Drainage Consent)

Ex FWMH 3602
CL 23.35
IL Unknown

Existing Watercourse

Proposed Culvert (Subject to Land Drainage Consent)

Carriageway to Future Foul Water Sewer running to Street - 10% application with S106 consent

Ex FWMH 2501
CL 21.86
IL 19.29
D 2.57m

LEGEND			
	Site Boundary (111,735sqm / 1.17Ha)		
	Existing Watercourse		
	Proposed Culvert		
	8m Buffer Zone		
	Existing Public Foul Water Sewer		
	Existing Public Foul Water Sewer		
	Proposed Foul Water Drain		
	Proposed Foul Water Manhole		
	Proposed Diffuser		
	Porous Block Paving (1,059sqm)		
	Existing Spot Level		
	Proposed Spot Level		
	Plot # Proposed Plot Number		
	Proposed Finished Floor Level (Subject to Detailed Design)		
	Tree Root Protection Area		
	Proposed Root Protection Area Construction		

NOTES

A3

1. This drawing is to be read in conjunction with all other RGP drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
2. RGP accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.
3. Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.
4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

Rev.	Date	Amendments	Drawn
A	02/08/2017	Title block information/Plot No's updated	SPB
-	31/07/2017	Original Issue	SPB

rgp Design

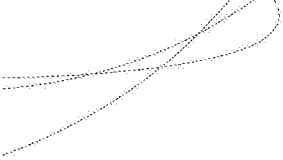
Transport Planning and Infrastructure Design Consultants
Metro House, Northgate, Chichester, West Sussex, PO19 1BE
Tel: 01243 210418 Fax: 01483 861682 www.rgp.co.uk

Client
Mr and Mrs Lillywhite

Project
Wandleys Farm, Wandleys Lane,
Walberton, BN18 0QR

Drawing Title
Surface and Foul Water Drainage
Strategy

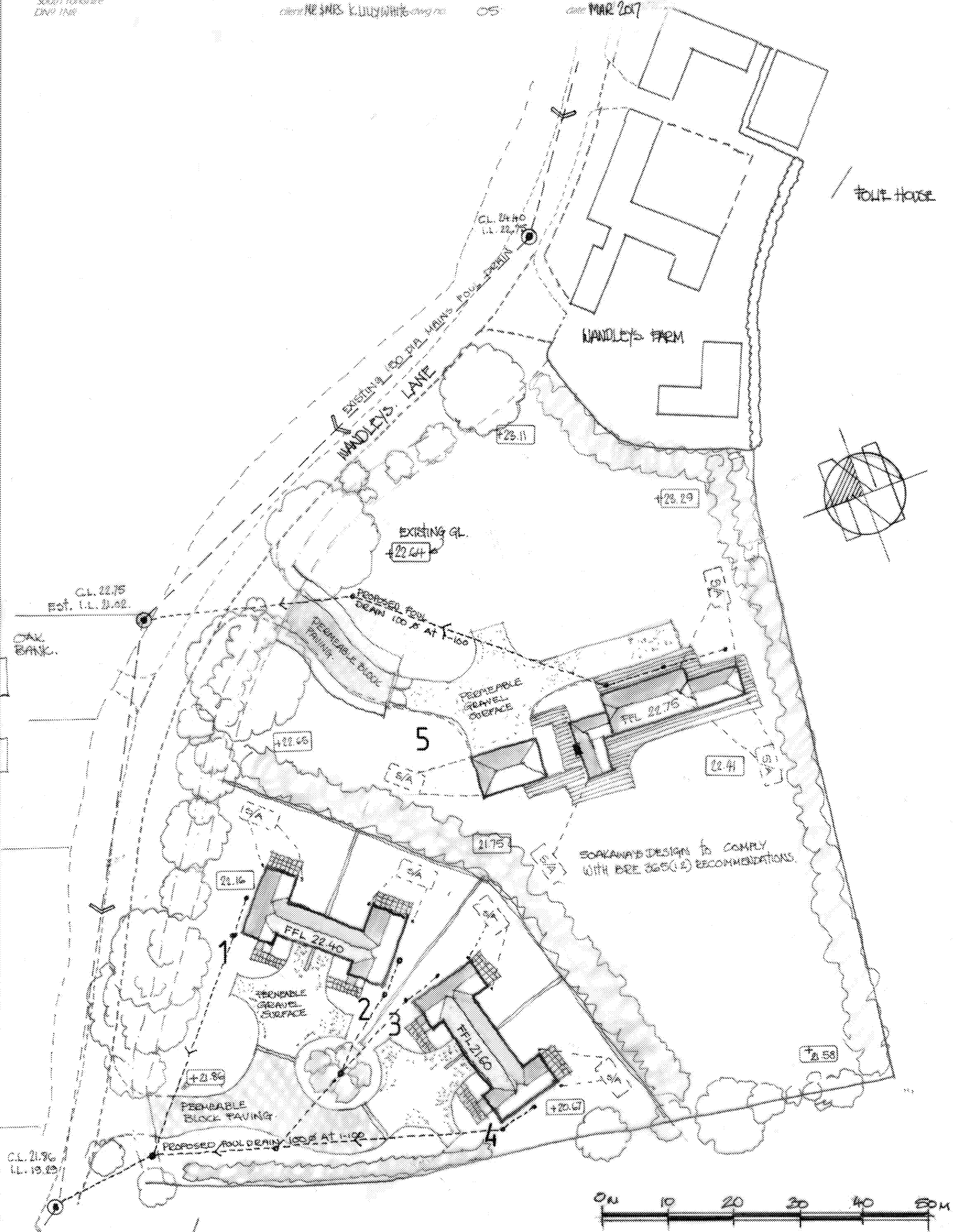
Scale	Drawn By	Checked By	Approved By
1:750	SPB	MJA	MJA
Date	Drawing No.	Rev.	
August 2017	2017/D1209/SK300	A	



APPENDICIES

Appendix A Architects Layout GA

TOUL HOUSE



Appendix B Public Sewer Maps

SEWER RECORDS PAGE 1 OF 2

106743



106455

495119

O.S. REF.

SU9506NW

Title: 245586_Wandleys Farm, Wanleys

Drawn by: yadavs

Scale: 1:1250

Date: 22/05/2017

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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495590

Appendix C Historical Borehole Records

SU 90 NE 34

9544 8683

Wandleys Farm

Block C

Surface level +23.6 m
Water struck at +21.8 m
September 1981

Overburden 0.5 m
Mineral 1.3 m
Waste 1.0 m
Mineral 1.0 m
Waste 0.8 m
Bedrock 1.4 m+

LOG

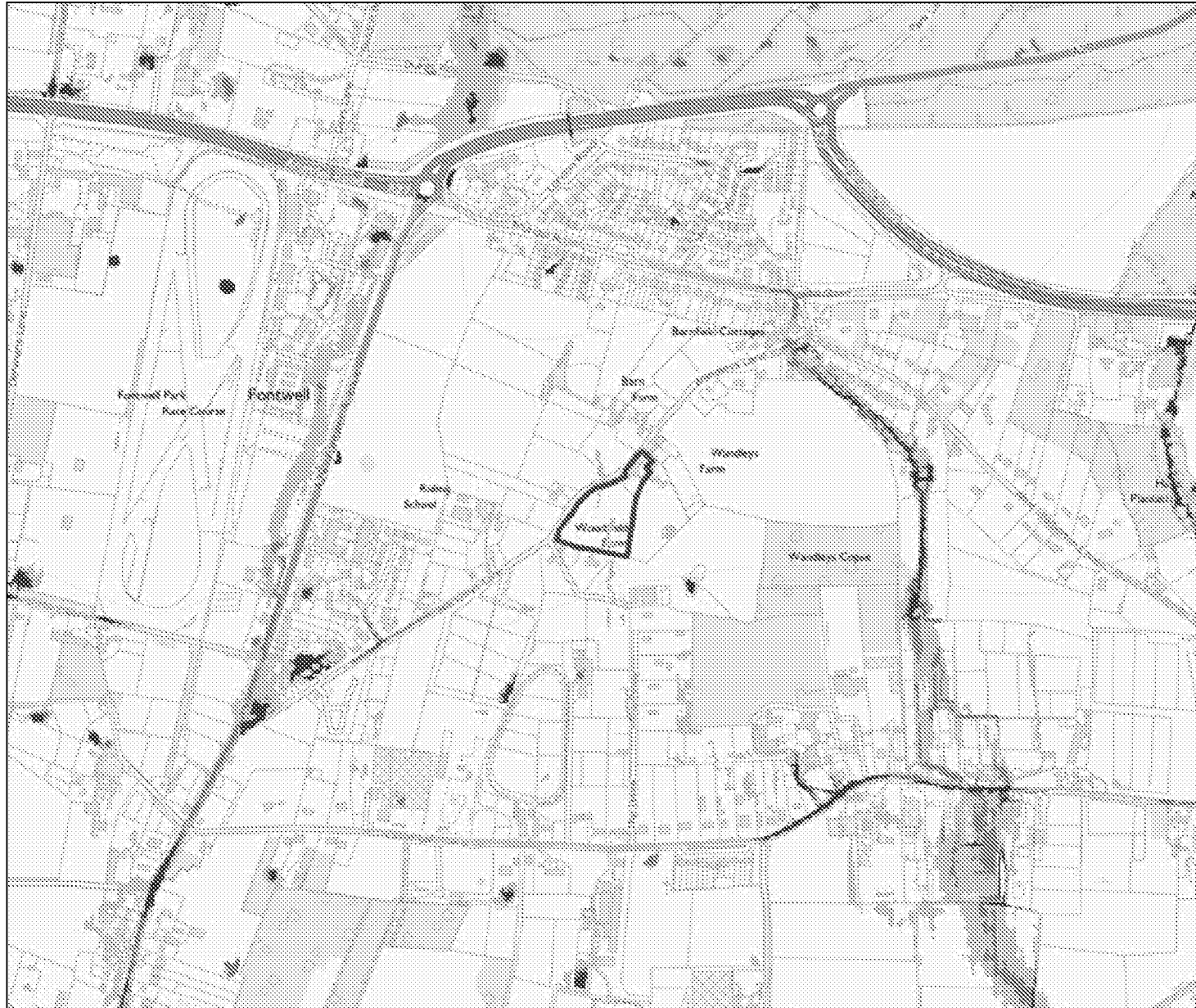
Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.5	0.5
Head Gravel	a 'Very clayey' gravel Gravel: coarse with fine, angular to subrounded; flint with white patina, fine gravel mostly white flint Sand: coarse with fine and medium, angular; flint Fines: clay, mottled brown	1.3	1.8
Raised Beach Deposits (older)	Silt, sandy, brown	1.0	2.8
	b 'Very clayey' sand Sand: fine with trace of medium, angular to subrounded; quartz Fines: silt, brown, with some clay	1.0	3.8
	Silt, sandy, clayey, brown	0.8	4.6
Woolwich and Reading Beds	Sand, grey, with some clay	0.5	5.1
	Mudstone, grey near top, dark red below	0.9+	6.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
						+4 -16	+16 -64	+64 mm	+4 -16	+16 -64	+64 mm
a	22	16	62	0.5-1.8	22	3	2	11	18	44	0
b	39	61	0	2.8-3.8	39	58	3	0	0	0	0
a+b	29	36	35	Mean	29	27	3	6	10	25	0

Appendix D LLFA/LPA Flood Risk

Risk of flooding from Surface Water. Centred BN18 0QR. Created 15/06/2017.



Scale 1:10,000



Likelihood of flooding from Surface Water

- Sealed Main Rivers
- High ($\geq 3.3\%$)
- Medium (3.3% - 1%)
- Very Low (0.1% - 0.1%)

Likelihood of flooding from Surface Water

- High: Greater than or equal to 3.3% (1 in 30) chance in any given year
- Medium: Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
- Low: Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
- Very Low: Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on our website.

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). E-mail: enquires@environment-agency.gov.uk

Appendix E Microdrainage/Run-off Calculations

RGP Design Limited		Page 1
Metro House Northgate Chichester PO19 1BE		
Date 31/07/2017 09:54 File	Designed by sburnett Checked by	
XP Solutions		Source Control 2016.1

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	1.170	Urban	0.000
SAAR (mm)	786	Region Number	Region 7

Results 1/s

QBAR Rural	2.4
QBAR Urban	2.4
Q100 years	7.8
Q1 year	2.1
Q30 years	5.5
Q100 years	7.8

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RGP Design Limited		Page 1
Metro House Northgate Chichester PO19 1BE		
Date 31/07/2017 09:55 File	Designed by sburnett Checked by	
XP Solutions		Source Control 2016.1

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.600
Ratio R	0.322
Areal Reduction Factor	1.00
Area (ha)	0.000
SAAR (mm)	786
CWI	116.097
Urban	0.000
SPR	30.000

Results

Percentage Runoff (%)	32.28
Greenfield Runoff Volume (m ³)	0.000

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RGP Design Limited				Page 1																																																																																																																																																																																																																			
Metro House Northgate Chichester PO19 1BE		Wandleys Farm Wandleys Lane Rev A																																																																																																																																																																																																																					
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XP Solutions		Source Control 2016.1																																																																																																																																																																																																																					
<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 141 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>21.321</td><td>0.121</td><td>5.3</td><td>38.6</td><td>O K</td></tr><tr><td>30 min Summer</td><td>21.365</td><td>0.165</td><td>5.3</td><td>52.6</td><td>Flood Risk</td></tr><tr><td>60 min Summer</td><td>21.405</td><td>0.205</td><td>5.3</td><td>65.3</td><td>Flood Risk</td></tr><tr><td>120 min Summer</td><td>21.429</td><td>0.229</td><td>5.3</td><td>72.9</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>21.433</td><td>0.233</td><td>5.3</td><td>74.1</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>21.431</td><td>0.231</td><td>5.3</td><td>73.3</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>21.421</td><td>0.221</td><td>5.3</td><td>70.3</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>21.408</td><td>0.208</td><td>5.3</td><td>66.0</td><td>Flood Risk</td></tr><tr><td>600 min Summer</td><td>21.393</td><td>0.193</td><td>5.3</td><td>61.5</td><td>Flood Risk</td></tr><tr><td>720 min Summer</td><td>21.379</td><td>0.179</td><td>5.3</td><td>56.9</td><td>Flood Risk</td></tr><tr><td>960 min Summer</td><td>21.352</td><td>0.152</td><td>5.3</td><td>48.2</td><td>Flood Risk</td></tr><tr><td>1440 min Summer</td><td>21.306</td><td>0.106</td><td>5.3</td><td>33.6</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>21.262</td><td>0.062</td><td>5.3</td><td>19.7</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>21.246</td><td>0.046</td><td>4.9</td><td>14.8</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>21.235</td><td>0.035</td><td>3.7</td><td>11.1</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>21.228</td><td>0.028</td><td>3.0</td><td>9.0</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>21.224</td><td>0.024</td><td>2.5</td><td>7.6</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>21.221</td><td>0.021</td><td>2.2</td><td>6.5</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>21.218</td><td>0.018</td><td>1.9</td><td>5.8</td><td>O K</td></tr><tr><td>15 min Winter</td><td>21.339</td><td>0.139</td><td>5.3</td><td>44.2</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>125.522</td><td>0.0</td><td>18</td></tr><tr><td>30 min Summer</td><td>85.463</td><td>0.0</td><td>32</td></tr><tr><td>60 min Summer</td><td>55.544</td><td>0.0</td><td>62</td></tr><tr><td>120 min Summer</td><td>34.781</td><td>0.0</td><td>110</td></tr><tr><td>180 min Summer</td><td>26.000</td><td>0.0</td><td>142</td></tr><tr><td>240 min Summer</td><td>21.002</td><td>0.0</td><td>174</td></tr><tr><td>360 min Summer</td><td>15.563</td><td>0.0</td><td>242</td></tr><tr><td>480 min Summer</td><td>12.559</td><td>0.0</td><td>310</td></tr><tr><td>600 min Summer</td><td>10.623</td><td>0.0</td><td>378</td></tr><tr><td>720 min Summer</td><td>9.260</td><td>0.0</td><td>444</td></tr><tr><td>960 min Summer</td><td>7.448</td><td>0.0</td><td>570</td></tr><tr><td>1440 min Summer</td><td>5.467</td><td>0.0</td><td>810</td></tr><tr><td>2160 min Summer</td><td>4.003</td><td>0.0</td><td>1144</td></tr><tr><td>2880 min Summer</td><td>3.204</td><td>0.0</td><td>1472</td></tr><tr><td>4320 min Summer</td><td>2.337</td><td>0.0</td><td>2204</td></tr><tr><td>5760 min Summer</td><td>1.868</td><td>0.0</td><td>2936</td></tr><tr><td>7200 min Summer</td><td>1.571</td><td>0.0</td><td>3672</td></tr><tr><td>8640 min Summer</td><td>1.364</td><td>0.0</td><td>4400</td></tr><tr><td>10080 min Summer</td><td>1.211</td><td>0.0</td><td>5136</td></tr><tr><td>15 min Winter</td><td>125.522</td><td>0.0</td><td>18</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	21.321	0.121	5.3	38.6	O K	30 min Summer	21.365	0.165	5.3	52.6	Flood Risk	60 min Summer	21.405	0.205	5.3	65.3	Flood Risk	120 min Summer	21.429	0.229	5.3	72.9	Flood Risk	180 min Summer	21.433	0.233	5.3	74.1	Flood Risk	240 min Summer	21.431	0.231	5.3	73.3	Flood Risk	360 min Summer	21.421	0.221	5.3	70.3	Flood Risk	480 min Summer	21.408	0.208	5.3	66.0	Flood Risk	600 min Summer	21.393	0.193	5.3	61.5	Flood Risk	720 min Summer	21.379	0.179	5.3	56.9	Flood Risk	960 min Summer	21.352	0.152	5.3	48.2	Flood Risk	1440 min Summer	21.306	0.106	5.3	33.6	O K	2160 min Summer	21.262	0.062	5.3	19.7	O K	2880 min Summer	21.246	0.046	4.9	14.8	O K	4320 min Summer	21.235	0.035	3.7	11.1	O K	5760 min Summer	21.228	0.028	3.0	9.0	O K	7200 min Summer	21.224	0.024	2.5	7.6	O K	8640 min Summer	21.221	0.021	2.2	6.5	O K	10080 min Summer	21.218	0.018	1.9	5.8	O K	15 min Winter	21.339	0.139	5.3	44.2	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	125.522	0.0	18	30 min Summer	85.463	0.0	32	60 min Summer	55.544	0.0	62	120 min Summer	34.781	0.0	110	180 min Summer	26.000	0.0	142	240 min Summer	21.002	0.0	174	360 min Summer	15.563	0.0	242	480 min Summer	12.559	0.0	310	600 min Summer	10.623	0.0	378	720 min Summer	9.260	0.0	444	960 min Summer	7.448	0.0	570	1440 min Summer	5.467	0.0	810	2160 min Summer	4.003	0.0	1144	2880 min Summer	3.204	0.0	1472	4320 min Summer	2.337	0.0	2204	5760 min Summer	1.868	0.0	2936	7200 min Summer	1.571	0.0	3672	8640 min Summer	1.364	0.0	4400	10080 min Summer	1.211	0.0	5136	15 min Winter	125.522	0.0	18
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RGP Design Limited				Page 2	
Metro House Northgate Chichester PO19 1BE		Wandleys Farm Wandleys Lane Rev A			
Date 02/08/2017 File 2017_08_02.srcx		Designed by SPB Checked by MJA			
XP Solutions		Source Control 2016.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	21.389	0.189	5.3	60.1	Flood Risk
60 min Winter	21.436	0.236	5.3	74.9	Flood Risk
120 min Winter	21.466	0.266	5.3	84.7	Flood Risk
180 min Winter	21.468	0.268	5.3	85.4	Flood Risk
240 min Winter	21.464	0.264	5.3	84.0	Flood Risk
360 min Winter	21.449	0.249	5.3	79.1	Flood Risk
480 min Winter	21.428	0.228	5.3	72.4	Flood Risk
600 min Winter	21.405	0.205	5.3	65.2	Flood Risk
720 min Winter	21.382	0.182	5.3	58.0	Flood Risk
960 min Winter	21.340	0.140	5.3	44.5	O K
1440 min Winter	21.274	0.074	5.3	23.6	O K
2160 min Winter	21.244	0.044	4.6	13.8	O K
2880 min Winter	21.235	0.035	3.7	11.1	O K
4320 min Winter	21.226	0.026	2.7	8.1	O K
5760 min Winter	21.221	0.021	2.2	6.5	O K
7200 min Winter	21.217	0.017	1.8	5.4	O K
8640 min Winter	21.215	0.015	1.6	4.8	O K
10080 min Winter	21.213	0.013	1.4	4.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	85.463	0.0	32		
60 min Winter	55.544	0.0	60		
120 min Winter	34.781	0.0	116		
180 min Winter	26.000	0.0	164		
240 min Winter	21.002	0.0	188		
360 min Winter	15.563	0.0	264		
480 min Winter	12.559	0.0	338		
600 min Winter	10.623	0.0	410		
720 min Winter	9.260	0.0	478		
960 min Winter	7.448	0.0	606		
1440 min Winter	5.467	0.0	824		
2160 min Winter	4.003	0.0	1124		
2880 min Winter	3.204	0.0	1472		
4320 min Winter	2.337	0.0	2204		
5760 min Winter	1.868	0.0	2920		
7200 min Winter	1.571	0.0	3552		
8640 min Winter	1.364	0.0	4416		
10080 min Winter	1.211	0.0	5024		
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XP Solutions Source Control 2016.1		

Model Details

Storage is Online Cover Level (m) 21.650

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	21.2
Membrane Percolation (mm/hr)	1000	Length (m)	50.0
Max Percolation (l/s)	294.4	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	21.200	Membrane Depth (m)	0

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