

APPENDIX C

RGP Design Ltd Flood Risk Assessment (FRA)

**LAND AT WEST SOMPTING, SOMPTING,
WEST SUSSEX BN15 0DQ**

RESIDENTIAL DEVELOPMENT

Flood Risk and Drainage Strategy

Prepared on Behalf of

Persimmon Homes and Sompting Estate
Trustees

2017/D1358/FRA1.4

06 February 2019

DOCUMENT CONTROL

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1 INTRODUCTION

1.1 Background

- 1.1.1 RGP Design Ltd (RGP) is instructed by Persimmon Homes and Sompting Estate Trustees to prepare a Site-Specific Flood Risk Assessment (FRA) to support a planning application for a residential development in relation to the Land at West Sompting, Sompting, West Sussex BN15 0DQ.
- 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 site is subject to a Hybrid planning application. (1) Outline planning permission (all matters reserved with the exception of access) for the erection of up to and including 520 dwellings, community orchard/growing space, non-vehicular links between the site and Worthing, traffic calming measures, associated landscaping, open space / recreation areas, provision of formal playing pitches, ecological enhancements including improvements and extension to Cokeham Brooks Local Wildlife Site, and all other associated development works. (2) Full planning permission for 100 dwellings (part of the overall 520 dwellings comprising 9 no 1-bed, 44 no. 2-bed, 37 no. 3-bed and 10 no 4-bed homes, including 30% affordable housing) and all other associated development works (Phase1).
- 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
 - Southern Water and Local Authority Drainage Records
 - Topographical Survey
 - British Geological Survey & Records
 - Site Specific Geotechnical Investigation Study
- 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.

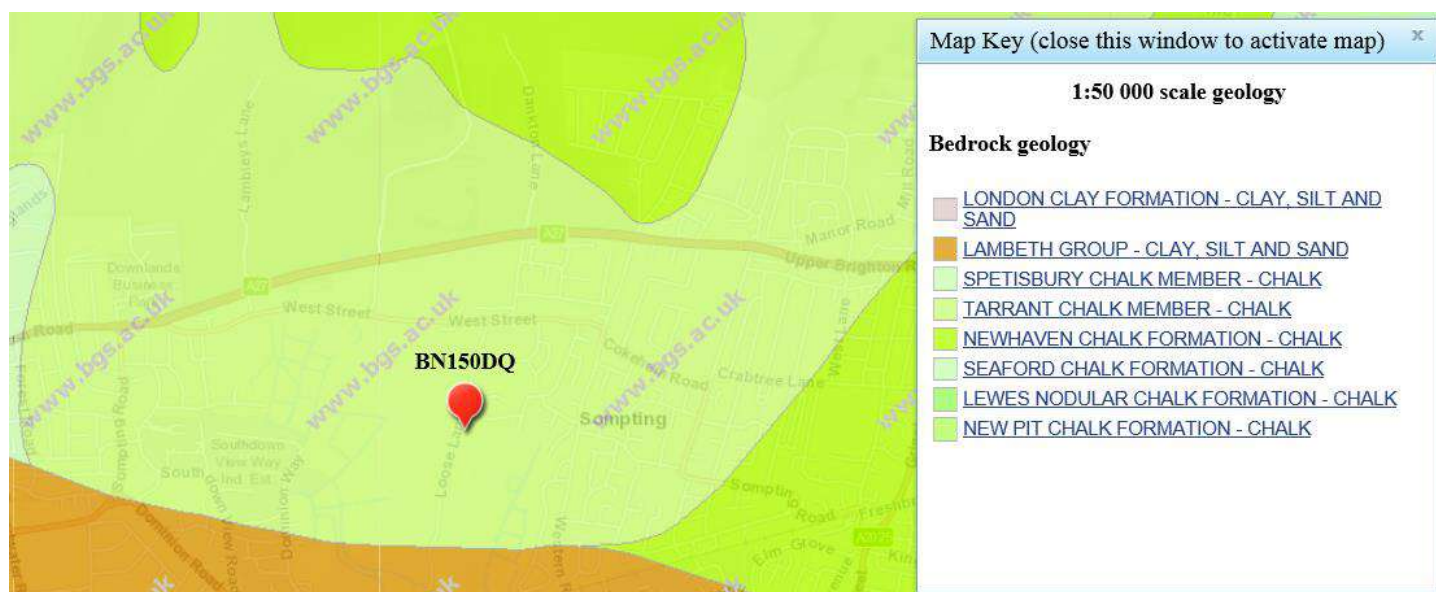
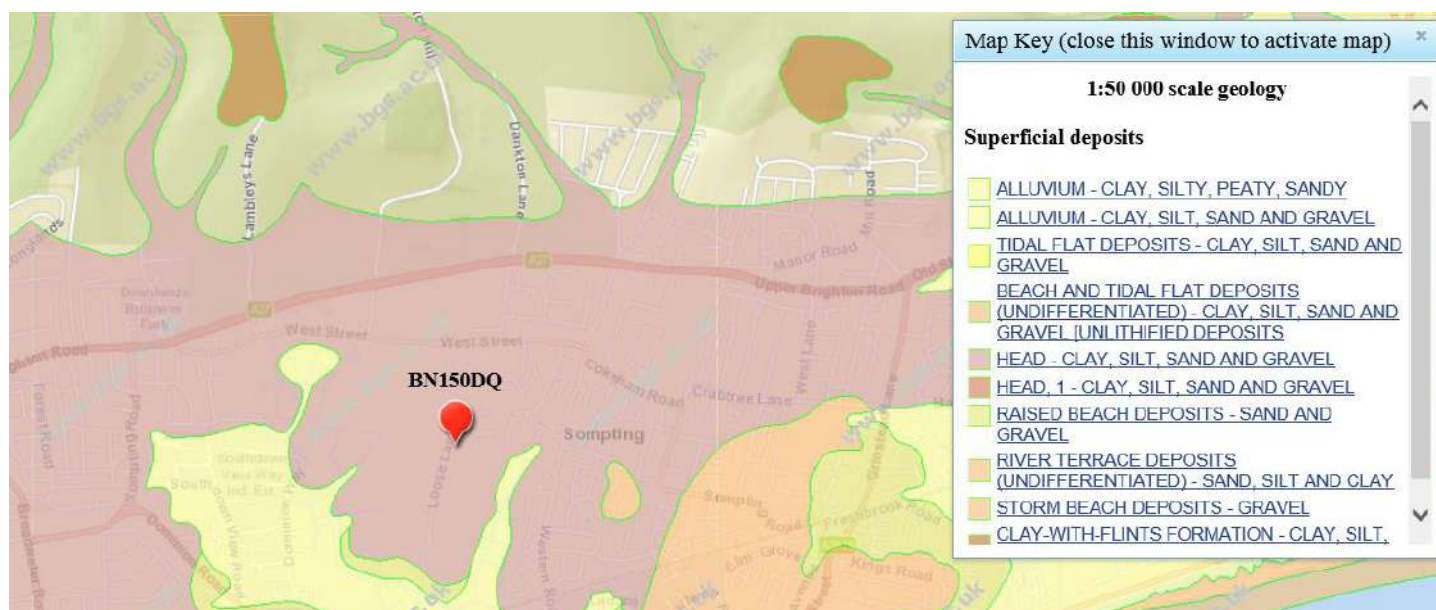
1.2 Site Location and Description

- 1.2.1 The site totals 44.54Ha in size and covers land to the north and south of West Street, Sompting. The northern site (referred to throughout this report as Sompting North) accounts for 9.20Ha, whilst the southern site (Sompting South) amounts to 35.32Ha. The proposed development will be split between these two areas of the site, as shown on drawing(s) **SK300-SK302**. Phase 1 is located south of West Street, in Sompting South and encompasses an area approximately 5.03Ha in size.
- 1.2.2 The site is located approximately 2km west of Lancing, 3.6km east of Worthing, 8.6km west of Shoreham-by-Sea and 19km west of Brighton. The site itself is currently an undeveloped greenfield location in a semi-rural/residential area, whilst an industrial estate exists approximately 0.50km to the south-west of Sompting South. Sompting North lies at approximately 10.43m to 20.92m AOD with a steep fall from north to south, towards West Street which runs both east and westbound along the southern boundary. Sompting South lies at approximately 9.98m to 1.63m AOD and although falls largely from north to south, also demonstrates varying crossfalls across the site, as shown on drawing **SK101**.
- 1.2.3 A watercourse is present to the east of Sompting South, and is unnamed. It is believed that this flows in a south-westerly direction, interacting with a number of other watercourses outside of the site boundary, before meeting the Main River; Teville Stream.
- 1.2.4 The site is currently an un-developed greenfield location with minimal existing hardstanding and/or impermeable areas. The existing impermeable area is approximately 771m².
- 1.2.5 The site is subject to a Hybrid planning application. (1) Outline planning permission (all matters reserved with the exception of access) for the erection of up to and including 520 dwellings, community orchard/growing space, non-vehicular links between the site and Worthing, traffic calming measures, associated landscaping, open space / recreation areas, provision of formal playing pitches, ecological enhancements including improvements and extension to Cokeham Brooks Local Wildlife Site, and all other associated development works. (2) Full planning permission for 100 dwellings (part of the overall 520 dwellings comprising 9 no 1-bed, 44 no. 2-bed, 37 no. 3-bed and 10 no 4-bed homes, including 30% affordable housing) and all other associated development works (Phase1).
- 1.2.6 The south-east corner of the southern section is proposed for ecological enhancements.

1.3 Ground Conditions

- 1.3.1 An intrusive geotechnical study was undertaken by Resource & Environmental Consultants Ltd (REC), dated July 2014. The report includes information relating to ground conditions (including groundwater) and composition as well as infiltration testing results.
- 1.3.2 The report states that the made ground composition comprises both fine and coarse soils. The coarse-grained soils are stated as comprising dark slightly clayey sandy gravel. The sand recorded was coarse grained with gravel comprising angular, fine to coarse flints with occasional brick. Fine grained soils were typical of dark brown slightly gravelly sandy silty clay.
- 1.3.3 Superficial Head Deposits were recorded as been highly variable across the intrusive locations, to a maximum depth of 9m bgl. The composition and consistency comprised both fine and coarse-grained soils. The coarse-grained soils typically comprised light brown slightly sandy clayey gravel and soft to firm clay/silt with a varying quantity of sand and gravel.
- 1.3.4 Bedrock has been identified as Tarrant Chalk Member, and was encountered during intrusive investigation at depths ranging between 1.70-9.00m bgl. This was recovered as creamy off-white putty chalk.

- 1.3.5 As well as the intrusive geotechnical study, reference has also been made to the BGS website where underlying ground conditions and composition is concerned. The information and mapping available through BGS is consistent with the findings of the geotechnical study conducted in relation to the site.

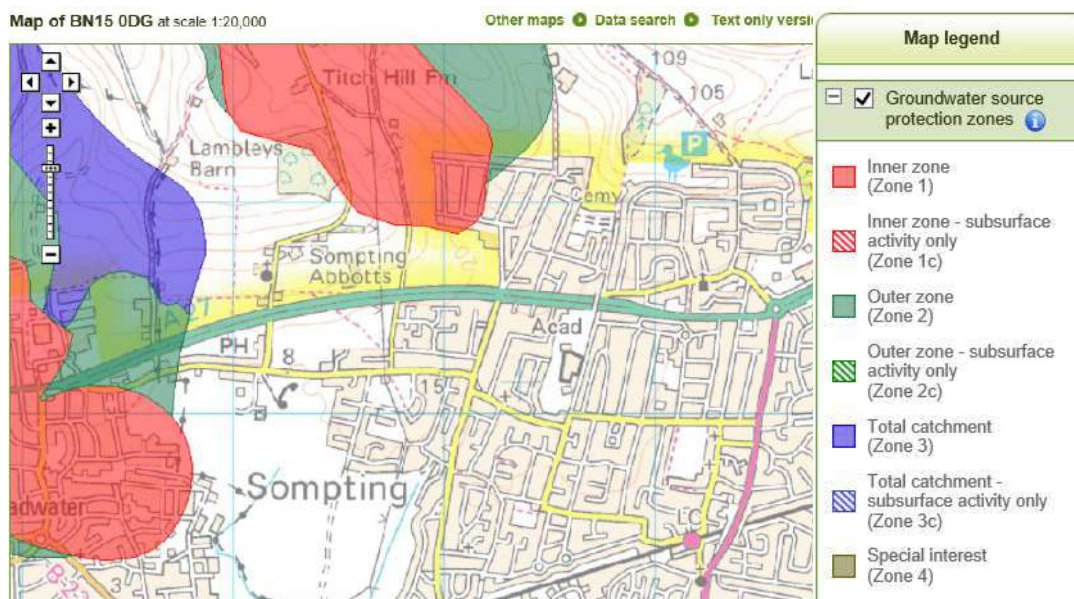


- 1.3.6 Soil infiltration testing was also undertaken as part of the intrusive geotechnical study. In total, seven infiltration tests were undertaken within locations SA1 to SA7 as demonstrated in **Appendix C**.
- 1.3.7 The infiltration rates determined during the geotechnical investigation, as well as the underlying ground conditions and composition indicate that soil conditions across the site would provide good potential for infiltration methods of drainage.

Soil Infiltration Results

Location	Trial Pit Depth (m bgl)	Material	Permeability Rate (m/s)
SA1	2.00	Head Deposits	9.38E-06
SA2	2.00	Head Deposits	5.24E-05
SA3	2.00	Head Deposits	2.36E-05
SA4	2.00	Head Deposits	1.53E-04
SA5	2.00	Head Deposits	7.62E-05
SA6	2.00	Head Deposits	9.87E-06
SA7	2.00	Head Deposits	3.39E-05

- 1.3.8 Groundwater has been identified at depths ranging between 1.20m-4.00m bgl across the site, although at depths generally exceeding 2.20m bgl. Further information in relation to this is available in **Appendix C**.
- 1.3.9 Environment Agency Groundwater Mapping indicates that the site is located nearby to Groundwater Source Protection Zones. Inner Zone (Zone 1) and Outer Zone (Zone 2) are present to the west and north of the proposed development site, although these protection zones do not fall within the bounds of the site itself.

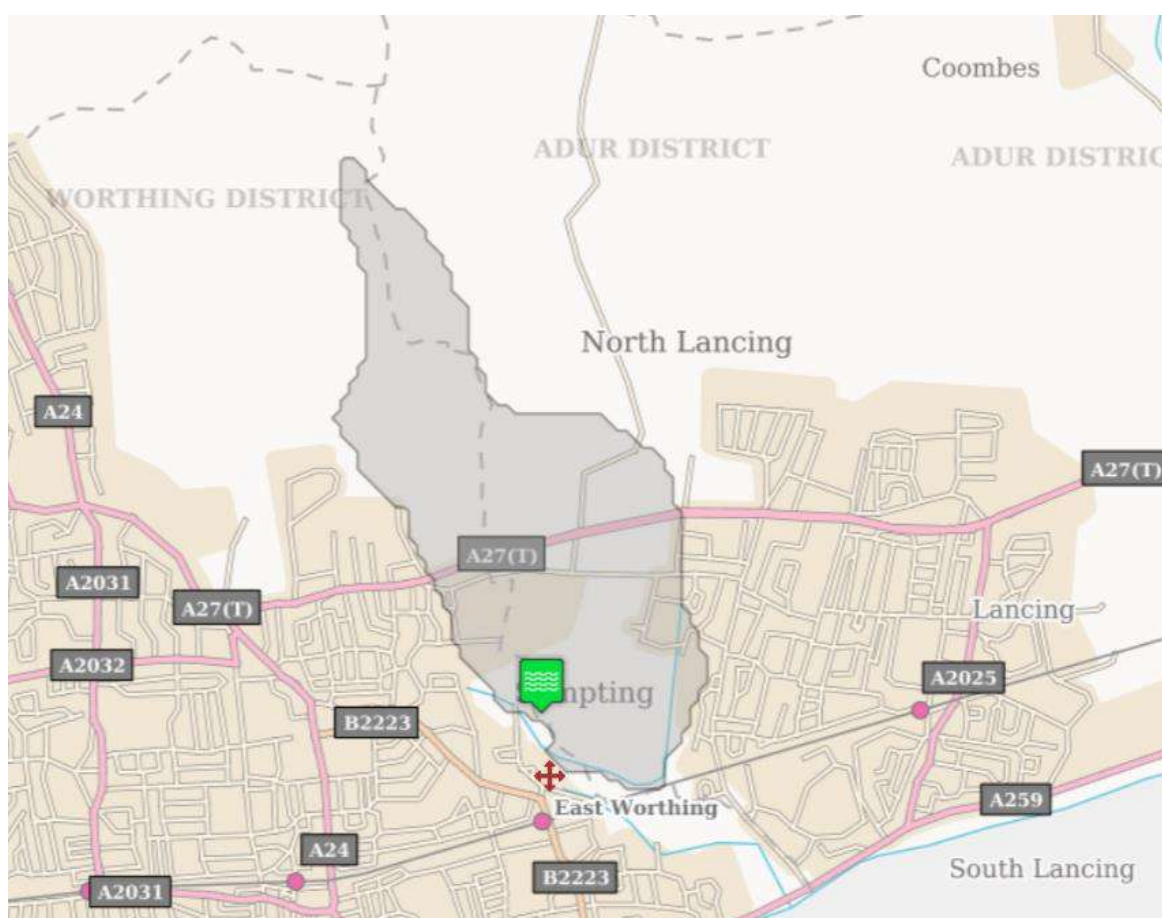


1.4 Existing Drainage

- 1.4.1 The existing drainage systems have been identified by reviewing OS mapping along with statutory records obtained from the local Water Authority, Southern Water. This is in addition to the topographical survey conducted for the site.

1.4.2 Surface Water:

- The Southern Water public sewer records (Appendix B) demonstrate that there are no public surface water sewers located within the vicinity of the site.
- It is believed that the site is drained partially by infiltration, whilst surface water is also discharged to the existing watercourse(s) located to the east and south-west of Sompting South, via naturally occurring overland flow routes.
- The Flood Estimation Handbook (FEH) website data confirms an upstream catchment of 3.73km as demonstrated below, which is conveyed through the existing watercourse(s) within the vicinity of the site.



- **Phase 1**
- Greenfield runoff rate (Q_{bar}) has been calculated to be 9.4l/s ($Q_1=8.0l/s$, $Q_{30}=21.3l/s$ and $Q_{100} = 30.0l/s$)
- The Greenfield percentage run-off has been determined to be 30.06%, whilst the Greenfield run-off volume is calculated to be 987.199m³ (based on FEH, SPR of 30.00%).

- **Sompting North**

- Greenfield runoff rate (Q_{bar}) has been calculated to be 17.3l/s ($Q_1=14.7l/s$, $Q_{30}=39.1l/s$ and $Q_{100} = 55.0l/s$)
- The Greenfield run-off volume is calculated to be 1809.537m³ (Based on FEH, SPR of 30.00%).

- **Sompting South (excluding Phase 1)**

- Greenfield runoff rate (Q_{bar}) has been calculated to be 56.7 /s ($Q_1=48.2l/s$, $Q_{30}=128.50l/s$ and $Q_{100} = 180.8l/s$)
- The Greenfield run-off volume is calculated to be 5,944.780m³ (Based on FEH, SPR of 30.00%).

1.4.3 Foul Water:

- The Southern Water public sewer records (Appendix B) show there are existing public foul water sewers located within close proximity of the site. A 225mm dia. foul water sewer is present, crossing land within the bounds of the site to the north-east of Sompting South. This sewer connects to a 450mm dia. sewer which runs parallel to the watercourse(s) to the east of Sompting South, before crossing the railway to the south of the site. In addition to this, there is a further public foul water sewer which runs from north to south to the west of Sompting South, crossing adjacent land which is also under the control of Persimmon Homes, although not earmarked for this development. This is initially a 225mm dia. pipe, although increases to 525mm dia. and then 600mm dia. before linking with sewer which crosses the railway to the south of the site. There are two public foul water sewers located within the vicinity of Sompting North; one to the west and the other to the east of the site boundaries, both of which are 150mm dia. in size, and running in a southerly direction.

It is understood that the site does not have any existing connections to either of the two public foul water sewers mentioned above.

1.4.4 Highway Drainage:

- Sections of West Street appear to be drained with the aid of trapped road gullies, although the outfall of these is currently unknown. It is believed that surface water is also drained 'over the edge', following naturally occurring overland flow routes. WSCC have also confirmed in a written response that local roads adjacent to the site have positive highway drainage in the form of gullies and carrier drains, whilst no provisions are currently in place to improve this infrastructure.

2 PROBABILITY

2.1 Sources of Information

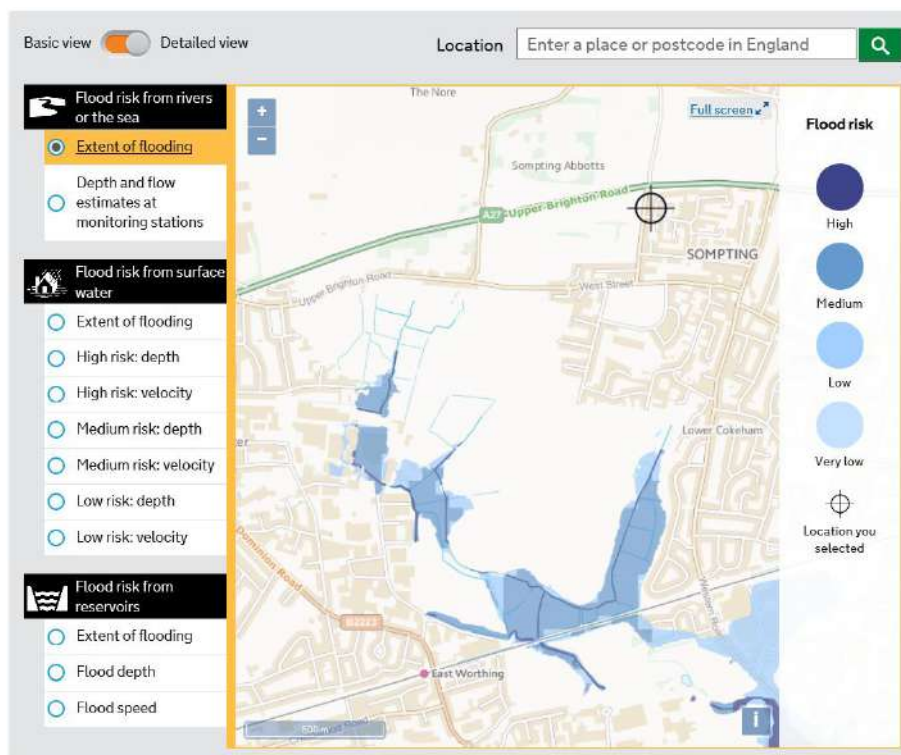
2.1.1 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwater, Sewers and Man-made reservoirs/canals.

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

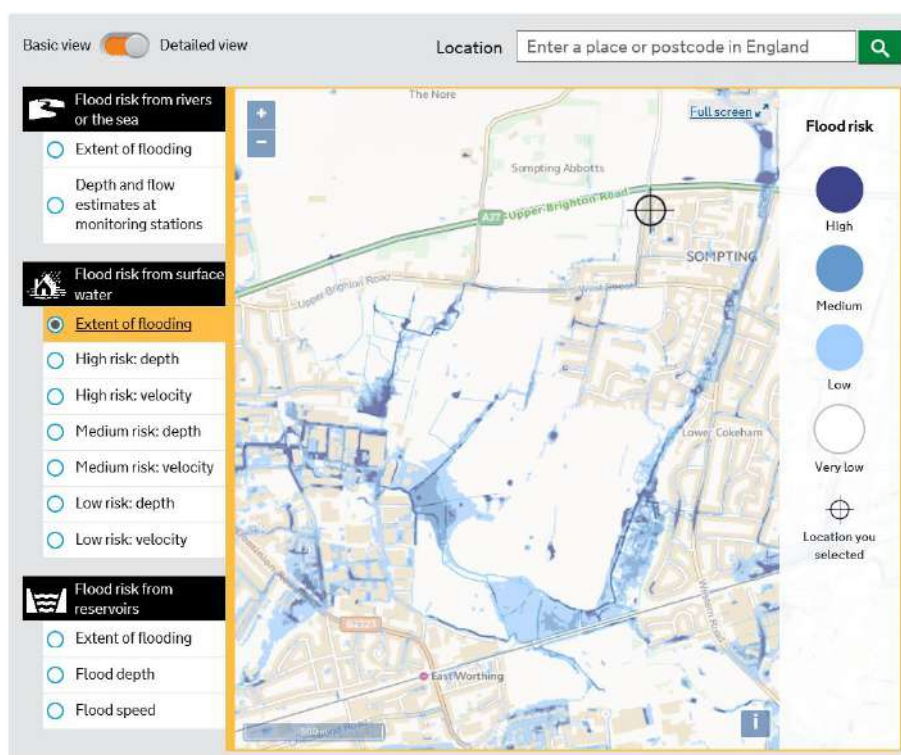
- Environment Agency Flood Maps for Planning
- Long Term Flood Risk Assessment Surface Water Flood Risk Maps
- Long Term Flood Risk Assessment Reservoir Flood Risk Maps
- Local Authorities Strategic Flood Risk Assessment
- Consultation with Local Authority/Lead Local Flood Authority
- Topographic Survey

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 partially within Flood Zones 2 & 3 (fluvial). This is also confirmed by information and mapping obtained from The Environment Agency. Sompting North falls entirely within Flood Zone 1, however, the south-east corner of Sompting South has been identified as falling within Flood Zones 2 and Flood Zone 3. The area of Sompting South earmarked for Phase 1 falls entirely within Flood Zone 1. This is demonstrated by the mapping contained within **Appendix D**, as well as in the extract, below.

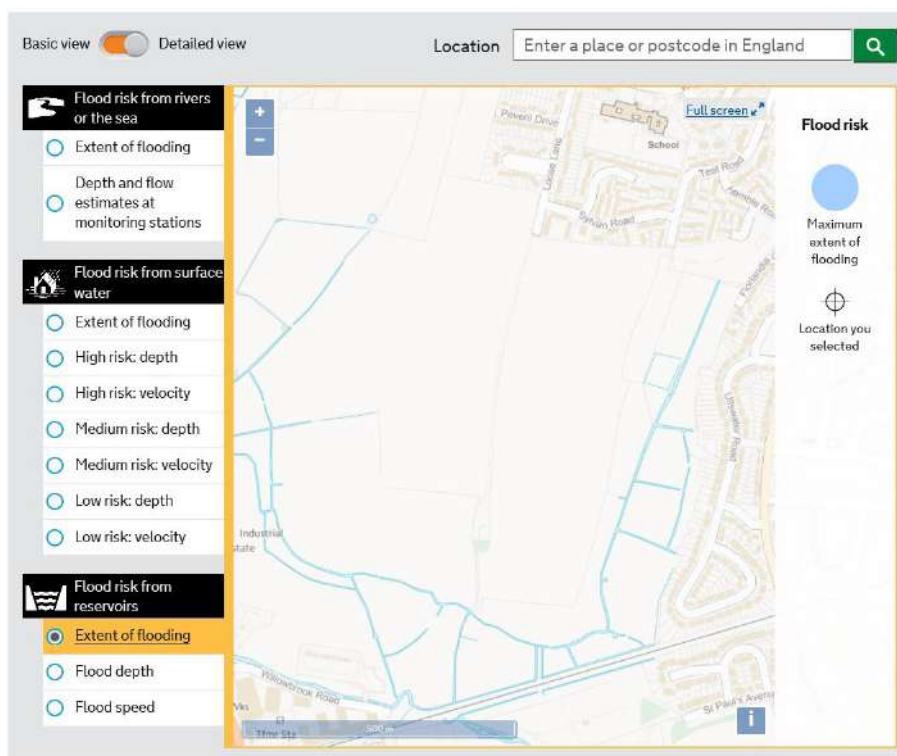


2.2.2 The Long-Term Flood Risk Map for Surface Water show that the site is at varying levels of susceptibility to surface water flooding. Sompting North is largely recognised as being at low risk of surface water flooding, with a small area in the centre of the site, near the northern boundary being identified as susceptible. Parts of Sompting South are susceptible to surface water flooding, ranging from low to high. The area to the east of Sompting South, whereby Flood Zones 2 and 3 are specified to extend to, are seen as being susceptible to surface water flooding, whilst areas near the centre of the site to the south and west boundaries are also identified as being at risk. An area to the south-western extent of the area relating to Phase 1 is shown to be at medium risk of surface water flooding.



2.2.3 Following the intrusive geotechnical study conducted at the site, it has been confirmed that groundwater is present at depths ranging from 1.20m to 4.00m bgl. WSCC has confirmed that the site lies in an area designated as being of high groundwater vulnerability in view of current JA groundwater mapping. As stated in 1.3.8, groundwater was experienced at depths ranging from 1.20-4.00m bgl, although generally exceeding 2.20m bgl as reported within the intrusive geotechnical study.

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.

2.3.3 ADC/WBC has also published a SFRA which does make reference to the development site, extracts of which are included in **Appendix E**.

2.4 Historic Flooding

- 2.4.1 The SFRA, Local Authorities & The Environment Agency have all confirmed that they are not aware of any historical flooding within the confines of the site. It has been confirmed that the junction of West Street and Church Lane often has a spring emerging on it. The spring is believed to run east along West Street, although the extent is unknown. WSCC has also confirmed that flooding issues relating to the existing Teville Stream – to the South of Sompting South, have been reported historically. It has been confirmed, however, that the Arun and Rother Rivers Trust (ART) are currently working on a river improvement project for the existing Teville Stream.

2.5 Summary of Flood Risk

- 2.5.1 The potential sources of flooding are:

Source of Flooding	Level of Risk
Rivers and Watercourses	Low – Sompting North Low – Phase 1 Medium/High – Sompting South (Areas to the east of Sompting South nearby to the watercourse located within the bounds of the site is shown to be at varying risk, ranging from medium to high)
The Sea	Very low
Surface water	Low/Medium (Phase 1. A small area to the south-western extent of the Phase 1 development area is shown to be at medium risk of surface water flooding. The rest is shown as low risk) Low – Sompting North Medium (Sompting South at the south-eastern extent of the site) High (Sompting South at the south-eastern extent as well as small pockets across the site to the south and west)
Groundwater	Low/Medium – Despite JBA groundwater mapping suggesting the risk of groundwater flooding is high, the intrusive geotechnical study confirmed precise depths of groundwater across the site which qualify the risk as being lower.
Sewers (*)	Low
Artificial Sources	None

3 PROPOSED DEVELOPMENT

3.1 Description of Development

- 3.1.1 The site is subject to a Hybrid planning application. (1) Outline planning permission (all matters reserved with the exception of access) for the erection of up to and including 520 dwellings, community orchard/growing space, non-vehicular links between the site and Worthing, traffic calming measures, associated landscaping, open space / recreation areas, provision of formal playing pitches, ecological enhancements including improvements and extension to Cokeham Brooks Local Wildlife Site, and all other associated development works. (2) Full planning permission for 100 dwellings (part of the overall 520 dwellings comprising 9 no 1-bed, 44 no. 2-bed, 37 no. 3-bed and 10 no 4-bed homes, including 30% affordable housing) and all other associated development works (Phase1).
- 3.1.2 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).
- 3.1.3 The community farm and nature trail is proposed for the eastern corner of Sompting South. The vulnerability of this element of the proposal appears to sit between Less and More Vulnerable classification. The proposed arrangement of this area has not yet been finalised, however, will be set out sequentially to ensure that those aspects which are classified as More Vulnerable are located within the area(s) which present the lowest possible level of risk (Flood Zone 1).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test Required	✓	✓	✓
Flood Zone 3a ⁺	Exception Test Required ⁺	✗	Exception Test Required	✓	✓
Flood Zone 3b [*]	Exceptions Test Required [*]	✗	✗	✗	✓*

✓ = Development is appropriate
✗ = Development should not be permitted

- 3.1.4 The proposed development encompasses land which is currently an un-developed greenfield site which has little in the way of existing impermeable areas (771m²). The proposed development involves the creation of new impermeable areas and will therefore increase the rate or volume of run-off generated by the site. The overall post-development impermeable area(s) are yet to be confirmed, however the impermeable area for Phase 1 has been determined to be 17,898m² (1.79Ha) – or 18,255m² (1.83Ha) inclusive of an allowance of 2% for urban creep (refer to **Section 4.5**). The inevitable 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 (where conditions and constraints allow) within the bounds of the site. Following on-site investigation, it appears that infiltration is a possibility in view of the underlying soil composition. Further to this, additional surface water could be discharged to the existing watercourse(s) at a restricted rate as so not to exacerbate existing flow rates, to ensure that the development does not increase the risk of flooding both on and off of the site. Further attenuation features could also be introduced in the form of retention ponds as well as swales.
- 3.1.5 The proposed masterplan for the site is shown on drawing PERW3018-3000 Rev. D whilst the proposals for Phase 1 are shown on drawing PERW3018-5001 Rev. D, both contained within **Appendix A**, prepared by Turley.

- 3.1.6 A separate Planning Application has been registered (reference AWDM/1265/17) and validated on 23 August which proposes the restoration and improvement of the upper section of the Broadwater Brook tributary of the Teville Stream, immediately to the south of Sompting South. This proposal aims to re-route the course of the Teville Stream watercourse across adjacent land to the proposed development site pertinent to this report. As well as the proposed re-routing works, it is also proposed that three silt traps will be constructed to remove silt and water based contaminants, partial infill and restoration of surrounding land. This application was approved on 17 October 2017. Following review of both schemes, the development of Land at West Sompting will not hinder the works involved as per the Teville Stream Restoration Project, and both developments will work and co-exist in conjunction with each other.
- 3.1.7 In summary, the development of the Land at West Sompting will have no negative impact on the Teville Stream Restoration Project, whilst Persimmon Homes are in continuing talks with the applicant of the Teville Stream Restoration Project to co-ordinate both schemes.

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	No initial constraints but may not be suitable due to structural load and maintainability
Basins and Ponds		
- Constructed Wetlands	Yes	No current constraints exist limiting the use of such measures, although anticipated 'land take' should be considered.
- Balancing Ponds	Yes	
- Detention Basins	Yes	
- Retention Ponds	Yes	
Filter strips and swales	Yes	There are no current constraints which would limit the use of such techniques
Infiltration Devices		
- Soakaways	Yes	Infiltration rates have confirmed that such infiltration methods and techniques could be feasible.
- Infiltration trenches and basins	Yes	
Permeable surfaces and filter drains		
- Gravelled areas	Yes	Infiltration rates have confirmed that such infiltration methods and techniques could be feasible
- Solid paving blocks	Yes	
Porous paviers	Yes	
Tanked systems		
Oversized pipes	Yes	These techniques could be utilised with an outfall to the existing watercourse.
Cellular tanks	Yes	

- 4.1.2 Infiltration rates have been confirmed and indicate that infiltration methods and techniques could be implemented to dispense of the surface water run-off from the development.
- 4.1.3 As it has been established, there are no public surface water sewers located within the vicinity of the site to which a connection could be made in order to discharge surface water run-off to from the site.
- 4.1.4 In view of 4.1.2 and 4.1.3, it is proposed to use permeable paving across the site, primarily for private driveways, to cater for an increase in surface water run-off following development. 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.
- 4.1.5 It is proposed that all surface water collected by the roofs of the properties will be discharged to trench soakaways.
- 4.1.6 Additional surface water run-off which is not dealt with via infiltration methods could discharge to the existing water courses at a controlled rate as so not to increase the risk of flooding either on, or off of the site.
- 4.1.7 Attenuation features should also be explored as a wider consideration in view of the proposed development to further mitigate surface water run-off. It is proposed to employ two swales which outfall to up to two attenuation ponds; one located within the bounds of Sompting North, which will link to Sompting South to the south of the development area. It is proposed to link the attenuation pond associated with Sompting North to Sompting South. The outfall of this will be restricted to mimic existing greenfield run-off rates. The ultimate outfall at Sompting South to the existing watercourse to the south-east of the site will also be controlled at a rate as so not to worsen existing run-off rates. A culvert under West Street has been allowed for as a worst-case scenario to deal with exceeding flows along the general topography of the site. Owing to soil investigation and subsequent infiltration rates along with the location of the proposed works associated with Phase 1, this would not need to be implemented in order to support the first phase. The proposed culvert will require review and subsequent approval from WSCC.
- 4.1.8 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.
- 4.1.9 A dedicated drainage strategy has been prepared in view of Phase 1 of the development (**Drainage Strategy D1358/PHASE 1/DS/1.1**) which should be referred to in conjunction with this document.

4.2 Treatment

- 4.2.1 The use of permeable 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 It is also proposed to utilise swales across the site, which in turn will provide an additional level of treatment.
- 4.2.4 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).

4.2.5 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.

4.2.6 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.

4.2.7 The treatment afforded by the proposed outline surface water management strategy has been assessed based on the following components:

- Swale – TSS-0.5/M-0.6/H-0.6
- Permeable pavement – TSS-0.7/M-0.6/H-0.7
- Pond – TSS-0.7/M-0.7/H-0.5

4.2.8 In conclusion, the proposed swales, permeable pavement and ponds 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(s) located within close proximity of the site. Confirmation of levels will be required, as well as the ability for the existing foul sewers to cope with the increased capacity.

4.3.2 In view of this, a feasibility study has been instructed with Southern Water to establish this.

4.3.3 Based on the residual design guidance provided in Sewers for Adoption, the proposed foul flow will be 24.07l/s (based on 4,000 l/day Sewers for Adoption 7th Edition), subject to confirmation by Southern Water, further to feasibility study.

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 40%.
- 4.4.3 The proposed development involves the creation of additional impermeable areas, therefore rainfall increases need to be incorporated into the existing surface water drainage regime.
- 4.4.4 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.
- 4.4.5 It will be recommended that the site is set out sequentially so that new builds are constructed in areas of the site which represent lower risk(s) of flooding (Zone 1). Furthermore, overland flow – should it occur, should be directed away from the proposed buildings, whilst floor levels are set to ensure that the buildings are elevated beyond the level of supposed risk if constructed in Flood Zones posing a greater risk. These actions will provide a level of protection against the effects of climate change for the lifetime of the development.

4.5 Urban Creep

- 4.5.1 Based upon the assumption that there will be an urban creep on new developments through their lifetime, the impact of an additional 2% impermeable area has been considered, as per the guidance contained within West Sussex County Council's 'Policy for the Management of Surface Water' dated 27 November 2018.

5 RESIDUAL RISK AND MITIGATION

5.1 Residual Risk

- 5.1.1 Residual risks have been identified in relation to the proposed development site in the form of the presence of groundwater, surface water flooding, the overtopping of watercourses as well as the risk posed by flooding from sources such as rivers and/or the sea.

5.2 Mitigation

- 5.2.1 The proposed development should be laid out sequentially so that new dwellings are constructed within Flood Zone 1 where they would be at the lowest risk of flooding. As mentioned previously, Sompting North falls fully within Flood Zone 1 as does the area associated with Phase 1, whilst a portion of Sompting South is identified as falling within Flood Zones 2 and 3.
- 5.2.2 Finished floor levels should be set at a level whereby the property is elevated above the level of supposed risk, if located within areas of a greater risk of flooding from any source. In addition to this, overland flow routes should be directed away from any proposed new dwellings to further mitigate any potential risk of flooding.
- 5.2.3 The existing watercourse(s) could also be improved as part of the overall development of the site, with the possibility of re-profiling and re-grading the banks a realistic option and opportunity.

6 SEQUENTIAL AND EXCEPTION TESTS

6.1 Sequential Test

- 6.1.1 As detailed in Section 5, the site should be set out sequentially to ensure that all of the proposed properties are located within Flood Zone 1, which presents the lowest risk of flooding.
- 6.1.2 In view of the above, 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. If all dwellings are constructed in Flood Zone 1 an exception test is not required.

7 FLOOD RISK MANAGEMENT

7.1 Safe Access and Egress

- 7.1.1 The site should be set out sequentially with all habitable dwellings located within Flood Zone 1 meaning that access/egress routes are deemed to be dry and not offering any possible risk.

7.2 Maintenance

- 7.2.1 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.

- 7.2.2 Whilst the drainage system has been designed to operate with as little maintenance as possible, there are key operations that must regularly be undertaken to ensure that it remains in optimal condition, most of which are general housekeeping tasks that should be undertaken for any drainage system, but with additional attention to the catchpits upstream of the flow control devices and the permeable paving. These operations are summarised below together with recommended frequencies:

- Periodic desilting of catchpits, gully sumps and channel drains. These should be emptied at least as follows (but with an annual inspection and additional cleansing if required): On completion of drainage works, Year 1, Year 3, then every 5 years. The de-silting of these items is required to ensure the Hydrobrake flow control device operates as per the design and does not become blocked.
- Periodic jetting or rodding of pipework as required to clear blockages.
- Gratings on any gullies and channel drains to be kept clear of debris.
- Any manufacturer specific requirements for maintenance (i.e. for the Hydrobrake) should be added to the periodic maintenance.

7.2.3 Permeable Paving

- The areas of permeable paving will require additional maintenance measures to ensure they operate as designed. Failure to conduct required maintenance, could increase the risk of flooding. The areas of permeable paving are designed to allow infiltration of surface water run-off through the joints in the block paving surface course and into the sub-base below. The water is then collected and discharged into the positive drainage system.
- Periodic surface sweeping to reduce silt and debris accumulation. The permeable surfaces should be swept at least every 8 to 12 weeks with additional sweeps in the autumn to clear fallen leaves.
- Removal / management of weed growth, as required. Typically, once or twice a year for regularly used areas.

- Periodic silt removal from permeable surfaces as described by manufacturer. If any areas are showing signs of ponding, they shall be dealt with by raking out the joints and redressing. The entire surface shall be monitored and when there are signs of excessive siltation resulting in poor drainage over the whole area, the blocks shall be taken up and a replacement of bedding layer and geotextile shall be undertaken.
- Redressing of joints on the block paving as required.

7.2.4 Remedial/Repair Actions

- Significant storm events may cause significant damage to SuDS. As such it may be necessary to inspect and carry out essential recovery works to return the feature to full working order.
- Resetting of uneven blocks by lifting block area, removing bedding material and relaying to match original design.

7.2.5 Accidental Spillages

- It is not envisaged that any materials are to be stored onsite once the development is completed, which could cause major spills and potential pollution issues within the drainage system. If this situation alters in the future a specialist will be required to be contacted to confirm if any upgrades to the existing system are required.
- Minor spillages of fuels and oils from motor vehicles will be dealt with by the permeable paving and deep trapped gullies, by biodegrading / collecting the hydrocarbons respectively.

7.2.6 HydroBrake (Flow Control Chamber)

- A HydroBrake flow control system is self-activating, relying on upstream hydraulic head to generate an air-filled vortex within the centre of the casing. Once the vortex is initiated water drains down through a small opening in the back of the device at the designed restricted flow rate.
- The flow control device has two measures encase of emergency (i.e. blockage). The first is a door situated in the front of the unit itself, this can be operated from the surface by a release cable situated just under the manhole cover which closes under its own weight and does not require any mechanism to operate. The second is a high-level overflow pipe situated with the flow control manhole. Both measures allow the system to drain down freely, until the blockage can be cleared.
- The HydroBrake flow control chamber(s) will require additional maintenance measures to ensure it operates as designed. The additional measures are as follow:
- The sump within the flow control chamber(s) should be monitored for build-up of silts and should be emptied, as a minimum, on the same regime as specified for catchpits previously within this document

- The drain down door located on the centre of the unit(s) will require inspection and opening annually, to ensure it is operating as intended.

7.2.7 Future Alterations to the Development

- Any future alterations to the permeable paving should be confirmed by a specialist. Where possible any future services are to avoid being located through areas of permeable paving. If new services are required to run through areas of permeable paving, services should be installed below the permeable paving level with the permeable system reinstalled above.

7.2.8 It is anticipated that a management company will be responsible for the ongoing maintenance of the proposed surface water drainage system on the site. In view of this, 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.

7.2.9 If the site is to continue to rely on the existing watercourse network to convey surface water run-off it is important to remember that the riparian owner of a watercourse is responsible for its maintenance. This is likely to include ensuring all branches of the watercourse are free flowing and de-silted at periodic intervals. Failure to do so could result in an increased risk of flooding upstream and/or downstream of the site.

8 OFFSITE IMPACTS

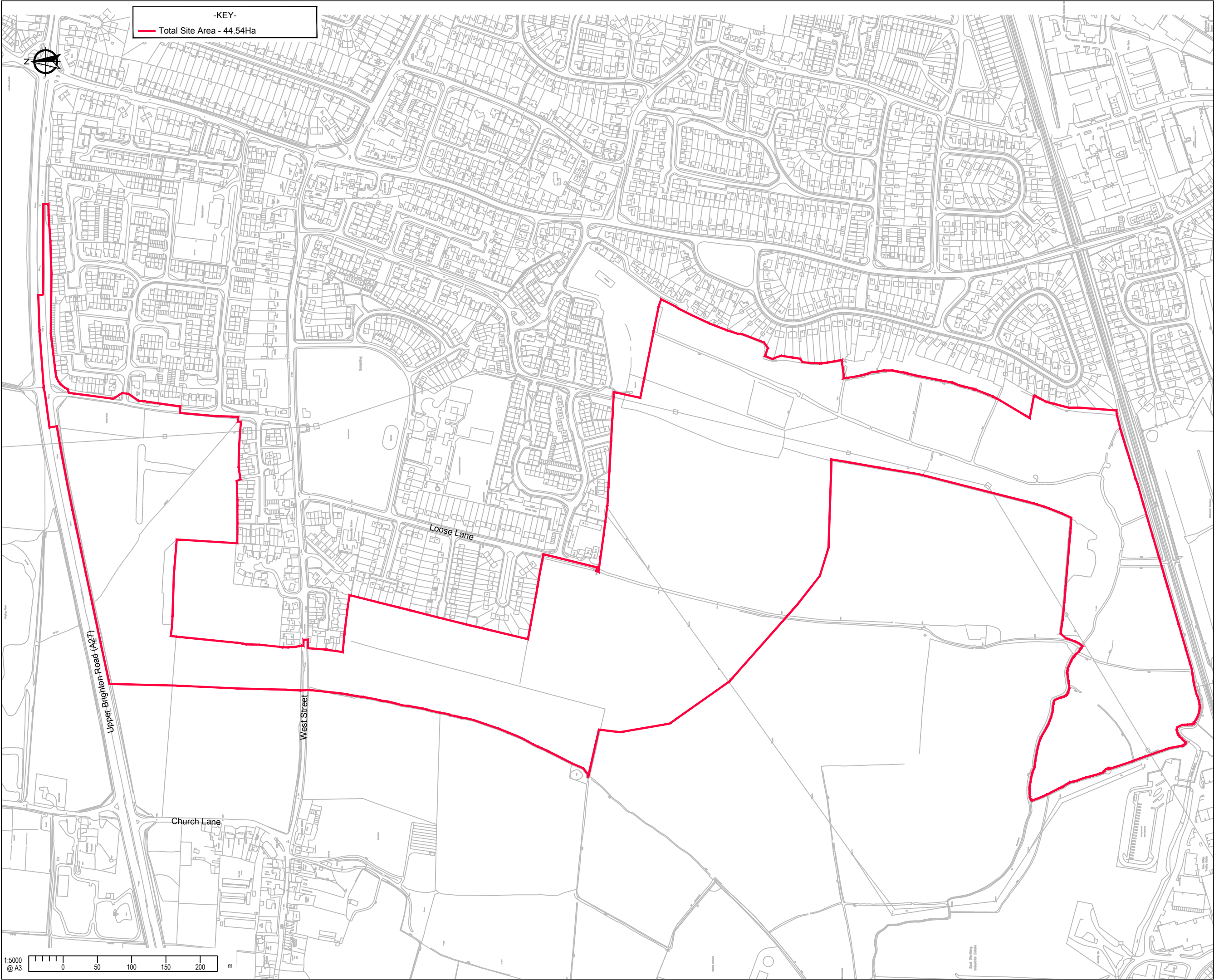
- 8.1.1 The proposed development will not have an impact on flooding issues off-site.
- 8.1.2 The effects of climate change should be considered in the design of the proposed surface water drainage system, to ensure there is no off-site impact.

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 an undeveloped greenfield site with minimal impermeable areas amounting to approximately 771m².
- 9.1.3 Sompting North lies at approximately 10.43m to 20.92m AOD with a steep fall from north to south, towards West Street which runs both east and westbound along the southern boundary. Sompting South lies at approximately 9.98m to 1.63m AOD and although falls largely from north to south, also demonstrates varying crossfalls across from site. There are no existing impermeable surfaces on the site.
- 9.1.4 The development lies within Flood Zone 1 and it is expected to remain unchanged for the duration of the development's life expectancy. The south-east corner of Sompting South is located in Flood Zone 2 and 3, however this area is not proposed for development.
- 9.1.5 The run-off from the site is believed to follow existing overland flow routes discharging to the existing watercourse located within the bounds of the site, as well as by infiltration.
- 9.1.6 Post-development surface water run-off will be managed through sustainable means; through the use of infiltration (permeable paving) as well as attenuation features (swales and ponds) with controlled outfalls to existing watercourses as so not to worsen the existing situation.
- 9.1.7 The wastewater from the proposed development will outfall to the existing public foul water sewer located within close proximity of the site, subject to confirmation of available capacity.
- 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 permeable paving) within the bounds of the site, meaning there will be no increase in the rate of surface water run-off leaving the site. Additional overland flow will be discharged to the existing watercourse at a restricted rate of 5l/s as so not to increase potential flooding both on and off of 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 The nature of the development does not permit the sequential test to be applied but this FRA shows that the elements of the Exception test can be passed.
- 9.1.11 In conclusion, from a flood risk point of view the proposed development is suitable.

DRAWINGS

SK100 Site Location Plan
SK101 Topographical Survey with Contours
SK102 LiDAR Banding
SK300 Drainage Strategy (Phase 1)
SK301 Preliminary Drainage Strategy (Sompting North)
SK302 Preliminary Drainage Strategy (Sompting South)
SK1000 Flood Risk Constraints Map (Sompting North)
SK1001 Flood Risk Constraints Map (Sompting South 1 of 2)
SK1002 Flood Risk Constraints Map (Sompting South 2 of 2)



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.

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A	28/09/2017	Revised site boundary	SPB
-	31/08/2017	Original Issue	SPB
Rev.	Date	Amendments	Drawn



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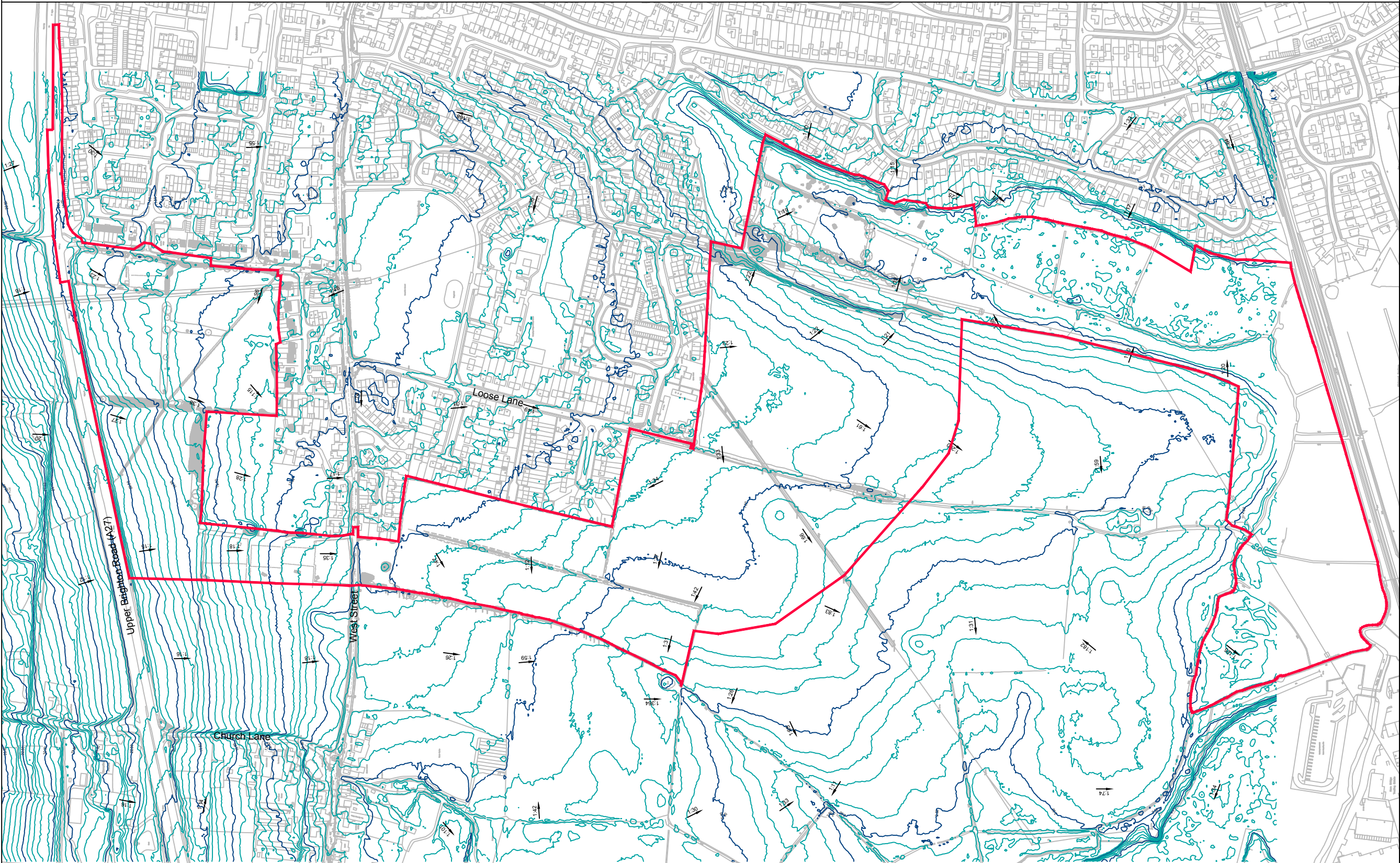
Drawing Title
Site Location Plan

Scale	1:5000	Drawn By	SPB	Checked By	LDF	Approved By	LDF
Date	Sept 2017	Drawing No.	2017-D1358-SK100	Rev.	A		



-KEY-

- Total Site Area - 44.54Ha
- Major Contour
- Minor Contour
- 134.11 Existing Contour Level



1:5000
@ A3

NOTES

A3

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Drawing Title
Topographical Survey
With Contours

Scale	1:5000	Drawn By	SPB	Checked By	LDF	Approved By	LDF
Date	Sept 2017	Drawing No.	2017-D1358-SK101	Rev.	A		