CONSULTING CIVIL AND STRUCTURAL ENGINEERS

60 KEYMER ROAD, HASSOCKS

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

JANUARY 2025

Ref: 16002/02/HOP/RPT/01

HOP Consulting Limited
HOP House, 41 Church Road
Hove, BN3 2BE
Registered 4402211 England
T: +44 (0)1273 223900
E: ask@hop.uk.com
W: www.hop.uk.com

FS553582

CONTENTS

APPENDICES

Client : Star Garages (Brighton) Ltd

Prepared by	Checked by	Approved by	Revision
Piran Armes	**Andrew Keen**	**Andrew Keen**	**V1.0 13.12.2024**
Piran Armes	**Andrew Keen**	**Andrew Keen**	**V1.1 17.12.2024**
Piran Armes	**Andrew Keen**	**Andrew Keen**	**V1.2 20.01.2025**
Tom Butler	**Andrew Keen**	**Andrew Keen**	**V1.3 01.05.2025**

1.0 INTRODUCTION

1.1 HOP Consulting Limited (HOP) has been instructed by the Client, Star Garages (Brighton) Ltd, to prepare a Flood Risk Assessment (FRA) for a new mixed use residential and commercial development proposed at 60 Keymer Road, Hassocks.

1.2 The site lies entirely within Flood Zone 3, as classified by the Environment Agency (EA), and a site-specific FRA is required to accompany the planning application for the proposed development.

1.3 This report has been undertaken in accordance with guidance and information provided by the Mid Sussex District Council (MSDC) Strategic Flood Risk Assessment (SFRA) produced by MSDC in 2015 and is in line with the guidance on Development and Flood Risk, as laid out in the National Planning Policy framework (NPPF) and its associated Planning Policy Guidance. Site details and proposals have been provided by the Client and their agents, to show the extent of the development and confirm the existing site layout.

1.4 Information in this report has been received from a number of external parties and HOP does not accept liability for the accuracy of this information. Should there be a material change to the development proposals or a change in end use, this report will need to be revised accordingly.

Figure 1.1 - Site Location Plan

2.0 SITE DESCRIPTION AND LOCATION

2.1 The site is located in the centre of Hassocks, on the corner of Keymer Road and Dale Avenue, approximately 400m east of Hassocks railway station. The site is broadly rectangular in plan, bounded by Keymer Road to the north, Dale Avenue to the east, and residential properties to the south and west. The wider area is characterised by a mixture of commercial and residential land use. A site location plan is included in Appendix A, with a location map shown in Figure 1.1.

2.2 The site is currently occupied by a car servicing business. The single storey building housing garages and offices, occupies the majority of total site area, with areas of external hardstanding along the northern and eastern boundaries. The entire site area is currently impermeable.

2.3 The site can be accessed from the north via Keymer Road or the east via Dale Avenue. It is proposed that the site entrance from Dale Avenue will be maintained following the development.

2.4 A topographical survey was completed by SE Surveying in March 2021 and is included in Appendix B. This survey has been referenced to levels above Ordnance Datum (AOD). The site is shown to be generally flat with a slight fall in topography from south-east to north-west. The highest point on the pavement in the south-eastern corner of the site is approximately 43.69m AOD and the lowest in the north-western corner is approximately 42.90m AOD.

2.5 Based on the British Geological Survey (BGS) online mapping, the underlying geology is indicated as being Folkestone Formation (sandstone) bedrock, with no overlying superficial deposits recorded.

2.6 According to EA online map data, the site does not lie within a groundwater Source Protection Zone (SPZ).

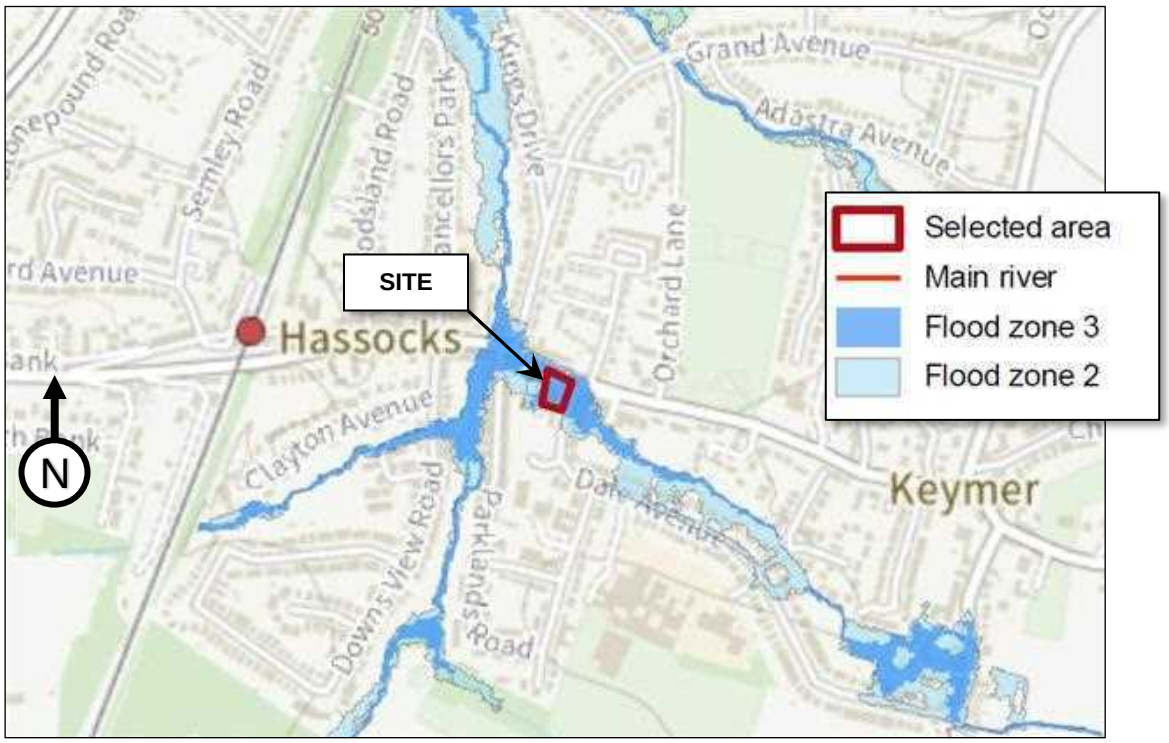
2.7 The nearest surface water feature is the Herrings Stream running through the centre of Hassocks from south to north approximately 100m to the west of the site at its closest point. Hassocks has a network of culverted watercourses that feed into the Herrings Stream and the routes of these culverted watercourses run close to the development site.

2.8 The development proposals comprise demolishing the existing building, clearing the site and redeveloping with mixed-use residential units and commercial space, including a library. Architectural proposals are included in Appendix C and are discussed in more detail in Section 4.0 of this report.

3.0 FLOOD HAZARD AND PROBABILITY

Fluvial Flooding

3.1 Detailed flood risk modelling data has been obtained from the EA which is included in Appendix D. An extract of the Flood Zone Map is shown in Figure 3.1. All data is taken from the Hassocks modelling, completed in 2013 and Hassocks Climate Change Allowances 2016, both completed by JBA Consulting.



Contains Environment Agency information © Environment Agency and database right.

Figure 3.1 EA Flood Zone Map

3.2 It can be seen in Figure 3.1 and data provided by the EA that the site lies entirely within Flood Zone 3 (FZ3) and does not benefit from the protection of flood defences.

3.3 Flood levels have been modelled at nodes local to the site as shown in Figure 3.2; with corresponding flood levels including the 1% (1 in 100 year) annual exceedance probability (AEP) and 0.1% AEP (1 in 1000 year) undefended scenarios shown in Table 3.3.

Figure 3.2 Modelled Node Locations from EA

Table 3.3 Flood Levels: Fluvial Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD Undefended Annual Exceedance Probability					
	Eastings	Northings	5%	1%	1%+CC (35%)	1%+CC (45%)	1%+CC (105%)	0.1%
1	530806	115478	-	42.61	42.63	42.63	42.65	42.64
2	530832	115465	-	43.15	43.18	43.18	43.20	43.20
3	530802	115456	-	43.26	43.27	43.28	43.29	43.29
4	530827	115446	43.22	43.30	43.36	43.37	43.42	43.41
5	530800	115438	-	43.36	43.39	43.40	43.42	43.41
6	530821	115430	-	43.39	43.43	43.46	43.49	43.48
7	530815	115453	-	43.28	43.32	43.33	43.37	43.36

Table 3.4 Flood Depths: Fluvial Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD Undefended Annual Exceedance Probability					
	Eastings	Northings	5%	1%	1%+CC (35%)	1%+CC (45%)	1%+CC (105%)	0.1%
1	530806	115478	-	0.01	0.02	0.03	0.04	0.04
2	530832	115465	-	0.04	0.06	0.07	0.09	0.08
3	530802	115456	-	0.01	0.01	0.01	0.02	0.02
4	530827	115446	0.01	0.10	0.16	0.17	0.22	0.21
5	530800	115438	-	0.04	0.06	0.07	0.09	0.09
6	530821	115430	-	0.01	0.03	0.06	0.08	0.08
7	530815	115453	-	0.03	0.06	0.07	0.11	0.10

3.4 As can be seen in Tables 3.3 & 3.4, flood levels are provided for undefended scenarios, including increases in flow due to climate change. Nodes 1, 2 & 4 are located within the proposed commercial units and residential block entrance. The maximum predicted water level occurs at Node 6 for the 1% AEP + 105% CC level at which is shown at 43.49mAOD, and is considered to be the the flood level for flood volume storage compensation.

3.5 The flood modelling as detailed above considers the primary risk of fluvial flooding to the site. Other sources of flood risk are considered below with information taken from the EA's online mapping service and MSDC's SFRA.

3.6 A plan has been produced to illustrate the existing and proposed flood extent (see Appendix I). The identified flood level of +43.49mAOD has been applied to identify zones of flooding and conclude that by allowing the lower level car park to partially flood, the new layout will provide the same flood storage volume as the existing arrangement, thereby not increasing risk of flooding to any of the surrounding buildings or properties due to a fluvial flood event. This provides evidence that adequate flood storage compensation has been allowed for in the proposed development. This is a key principle of the flood risk mitigation strategy.

Tidal Flooding

3.7 Detailed flood risk data has been obtained from the EA. This states that the site is unaffected by tidal modelling scenarios. Risk of tidal flooding is therefore considered to be very low.

Groundwater Flooding

3.8 The SFRA states that 'the majority of the district is considered to have medium potential for groundwater flooding, however a small area within the South Downs National Park is considered to have high potential for flooding from this source.'

3.9 Nearby BGS borehole scans do not show records of groundwater, however the site is underlain by Folkestone Formation Sandstone, which is classified as a Principal Aquifer. These are defined by the EA as rocks with 'high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale'.

3.10 Risk of groundwater flooding is considered to be moderate.

Reservoir Flooding

3.11 EA maps show that the site is outside any flood risk zone associated with reservoirs or any other artificial sources of flooding. Therefore, the risk from this source is considered to be low.

Surface Water and Sewer Flooding

3.12 There are no public sewers within the site boundary, with the closest being a foul water sewer in the adjacent road to the east beneath Dale Avenue, and to the north beneath Keymer Road (refer to Figure 5.1).

3.13 The local arrangement of surface water culverts, which have been historically constructed to allow development close to former open watercourses, are indicated in Figures 3.3 and 3.4. None are shown within the development site boundary, however, it should be noted that the developer has recently acquired the lane to the west of the development site, though which the culverted watercourse runs. A drainage survey has been undertaken at the existing property and has demonstrated that surface water runoff from the site currently discharges to the culvert running south to north beyond the western boundary.

Figure 3.3 Surface water culvert network from MSDC.

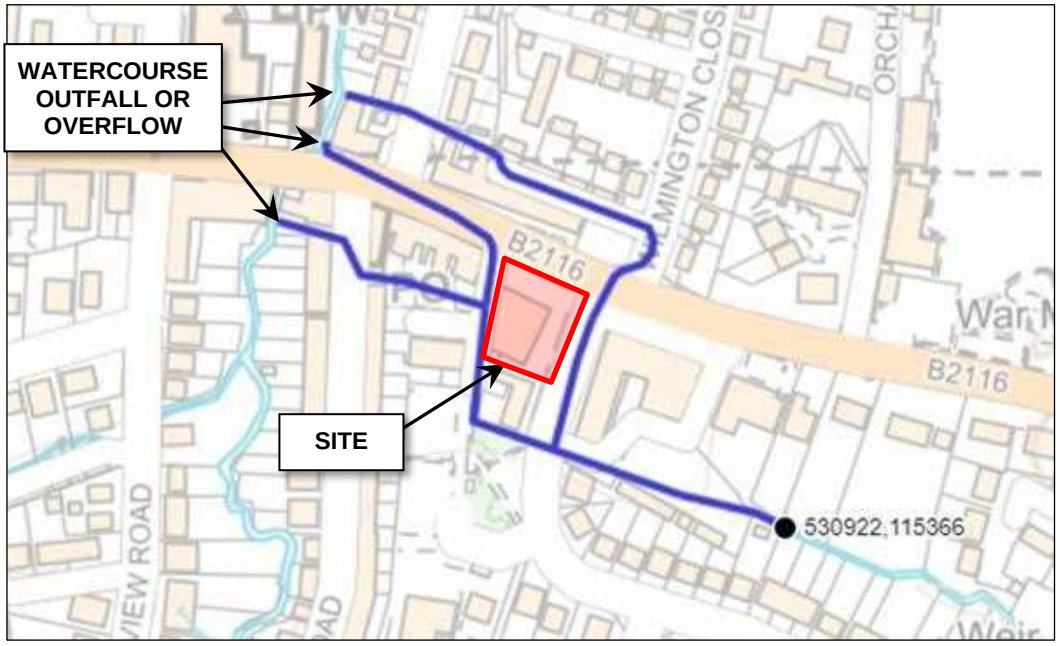


Figure 3.4 Wider surface water culvert network connectivity from MSDC.

3.14 As can be seen in Figure 3.5, the EA's surface water flood mapping shows the level of risk on-site to generally be 'medium', with a small 'high' risk area to the east of the building. Surface water flows are shown to travel northwards along Dale Avenue, before joining Keymer Road and flowing to the west towards the Herrings Stream, which represents the topographic low spot in central Hassocks. The EA surface water flood map shows flood waters to be contained within the local highway extents during the 'low' risk scenario.

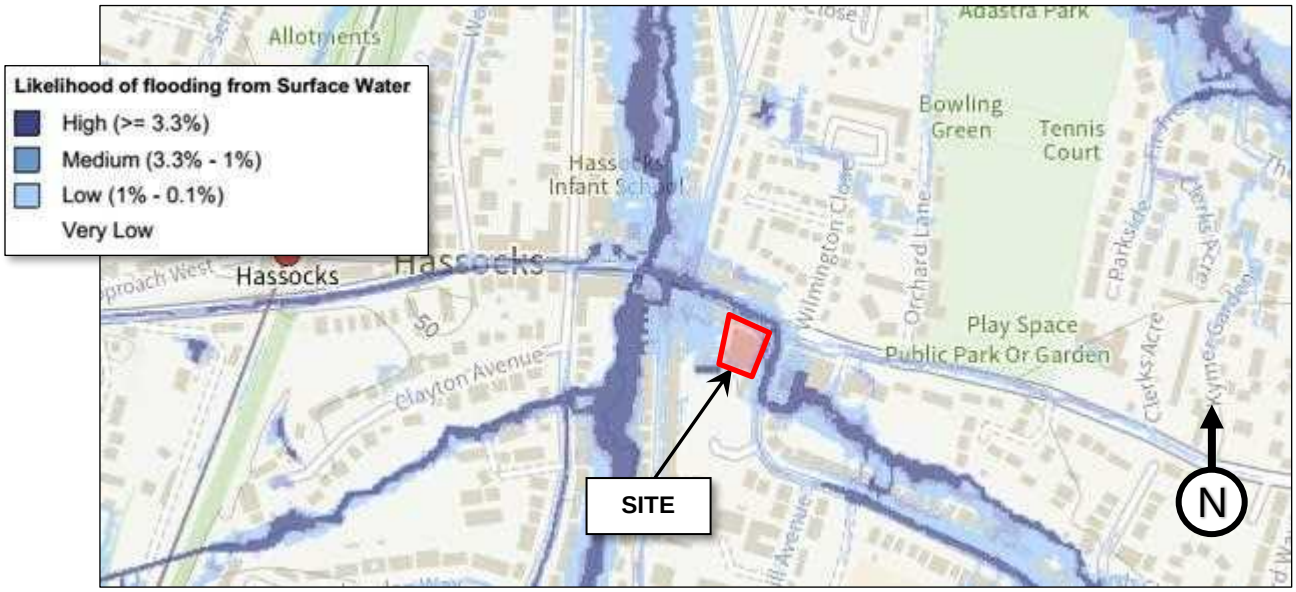


Figure 3.5 EA Surface Water Flood Map

3.15 The site is shown to be at a slightly higher level than the adjacent roadway, with site ground levels falling towards Keymer Road to the north. The new development is proposed to have residential accommodation from first floor up. Only commercial space is proposed on the ground floor, which will have a floor level elevated above the design flood level, further reducing the risk of flooding from localised surface water runoff from private drainage networks or overland flow. Levels around the new building should be engineered so that runoff is directed away from the building openings.

3.16 With the redevelopment of the site, the opportunity is presented to provide a drainage system to manage surface water runoff at source through Sustainable Drainage Systems (SuDS) to ensure surface water runoff from the developed site does not increase the risk of flooding to the site or neighbouring and downstream properties. SuDS methods suitable for the site are discussed in Section 5.

4.0 DETAILED DEVELOPMENT PROPOSALS

4.1 The development proposals involve demolishing the existing building, clearing the site and redeveloping with mixed-use residential units and commercial space including a public library.

4.2 The residential element of the development will comprise 27No. apartments and 1No. guest room from the first floor up. 2No commercial units will be located at ground floor level adjacent to Keymer Road, totalling 188m^2 of commercial floor space.

4.3 28No. undercroft car parking spaces, 4No. mobility scooter spaces and a two tier bike rack (14 No. bikes) will be provided beneath the flats at ground level. Vehicular access will be afforded directly from Dale Avenue on the eastern boundary. The Architect's proposed site layout plan is included as Appendix C, with an extract shown in Figure 4.1.

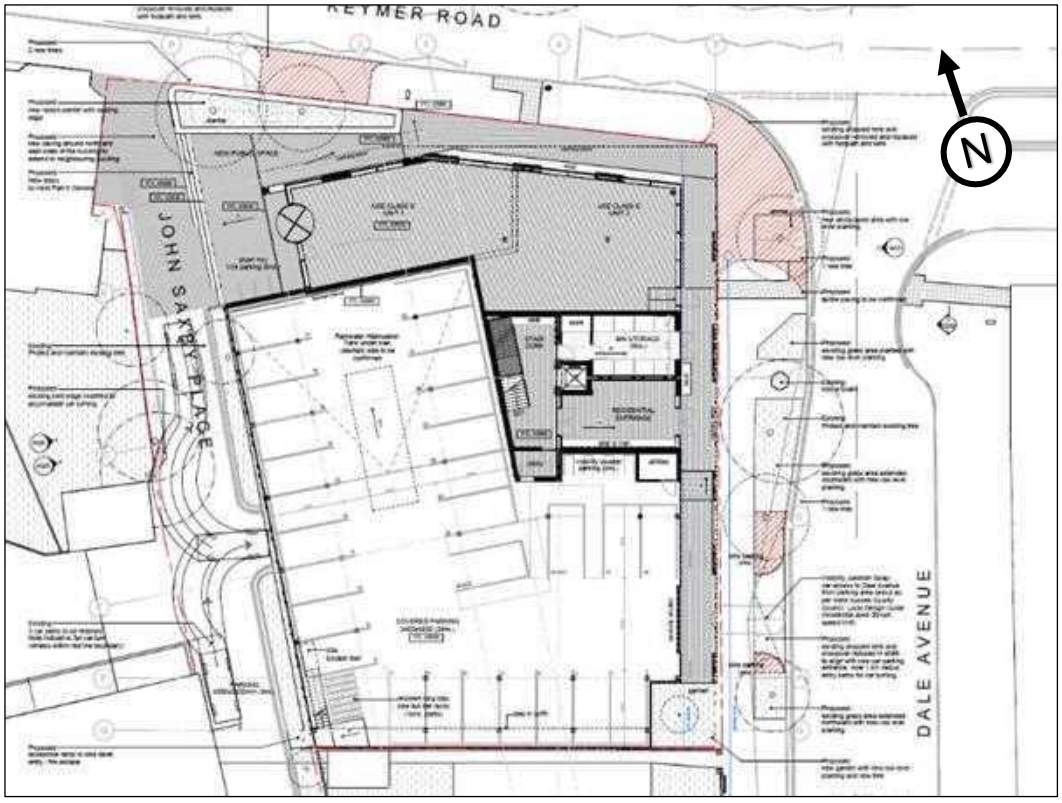


Figure 4.1 Proposed Site Layout Plan

4.4 As discussed in Section 3, the flood level for storage compensation has been modelled at 43.49mAOD which considers an allowance for 105% CC. This design considers the upper end allowance, which is 1% AEP + 45%CC. This gives a maximum flood level at Node 6 (ref Figure 3.2 and Tables 3.3 & 3.4) of +43.46mAOD. The proposed building will comprise commercial premises only on the ground floor, with residential from the first floor and above.

4.5 It is proposed to set the ground floor communal stairway and utilities at 43.68mAOD, which allows for a 220mm 'freeboard' above the design flood level. Habitable accommodation not proposed on the ground floor being located on the first floor and above, which is significantly higher than the design flood level.

4.6 Safe egress from the residences is via this stairwell, walking south along the frontage of the building and onto the pavement of Dale Road which has a level of 43.52mAOD to 43.69mAOD at the south of the site. Dale Road then rises further south providing wider safe egress from the area.

4.7 The commercial units are located to the north of the site, closer to the EA Nodes 1 and 2 with 1%+CC (105%) flood levels of 42.65mAOD and 43.20mAOD respectively. The FFL's of these units are set at 43.53mAOD providing 330m freeboard above the higher flood level at Node 2.

4.8 For clarity, the development proposals are based on the following architectural levels;. The entrance to the residential entrance is 43.680 AOD, which is 190mm above the 1%+CC (105%) Flood Level for Dale Avenue (43.490mAOD at Node 6). Additionally, these levels place the ground floor above the currently modelled 0.1% extreme Flood Levels for all nodes.

Sequential Test

4.9 The Sequential Test requires the consideration of reasonably available alternative sites, however, in this instance, the developer can only be reasonably expected to develop land within their ownership. The Local Planning Authority are expected to take these factors into account when applying the Sequential Test to the development.

4.10 Guidance states that development should be considered sequentially within the site to ensure areas that are more vulnerable to flood risk are placed in compatible zones. As demonstrated above, this approach has been applied to the ground floor level of the proposed building, with ground floor levels set 300mm above the design flood level for the 1 in 100-year fluvial event over the lifetime of the development.

4.11 Residential properties are considered in Table 2 of the Planning Practice Guidance to the NPPF as 'More Vulnerable' development, with commercial space classed as 'Less Vulnerable'. The site lies within Flood Zone 3, therefore the Exception Test will need to be applied.

4.12 Additional details regarding the application of the Sequential Test have been provided by Lewes & Co. Planning Consultants, as follows;

> *As part of their evidence for the Council's emerging District Plan 2021 – 2039 the Council have undertaken a sequential test to consider all suitable sites. This work identified only 9 suitable sites wholly located within low flood risk areas, and therefore in order for local housing needs to be met further sites in areas of potential flood risk will need to come forward for development in a manner consistent with nationally policy requirements for flood risk. The Plan therefore includes allocations for sites which, like the application site, are not located in areas of lower flood risk on the basis that there are no suitable, reasonably available, lower risk sites to which development could be steered in order to to achieve wider sustainable development objectives for Mid Sussex*
>
> *The Council's emerging District Plan 2021 – 2039 does not allocate the site (SHELAA reference 375) on the basis that a policy compliant development can be achieved without allocation. It is therefore implied that the redevelopment of the site is capable of meeting the sequential and exceptions tests, with the Site Selection Paper concluding:*
>
> *"Site is within or adjacent to the Built-Up Area Boundary; it is therefore considered that a policy compliant development is possible without the need for the site to be allocated."*
>
> *The Council's emerging and adopted District Plan (2014 – 2031) also seek to maximise the use of previously developed land and buildings within the built-up area. However, the Council's Urban Capacity Study (2022) identifies very limited capacity across the district for additional housing delivery on these urban/brownfield sites. Despite this 'brownfield-first' approach to development, the Urban Capacity Study only identifies a potential future supply of 1,233 new homes on brownfield land.*
>
> *The Government's standard methodology for housing need identifies a local housing need of 1,356 new homes per annum and therefore brownfield sites will only be able to meet less than a single year's housing needs within Mid Sussex. Other sources of supply (primarily greenfield sites) are also constrained by environmental factors, with the Council's draft District Plan 2021 – 2039 adopting a capacity/supply-led housing requirement. On this basis, all suitable brownfield sites are required in order for the Council to meet local housing needs, as required by paragraph 11 (b) of the National Planning Policy Framework.*

Exception Test

4.13 The NPPF requires that, where it has not been possible to locate development in zones of lower flood risk probability, the Exception Test should be applied. For the Exception Test to be passed, the guidance states that;

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared; and
- a site-specific FRA must demonstrate that the development will be safe for its lifetime considering the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

4.14 It is considered that the first element of the Exception Test is passed, as the development meets housing demand within the district.

4.15 The second element of the Exception Test is demonstrated throughout this report in that the development plans do not represent an increase in the flood risk to the site, or to neighbouring or downstream properties. The proposal to raise ground floor levels to 300mm above the design flood level provides mitigation to the primary sources of flooding for the development's lifetime. Flood risk management measures, discussed in the following section, provide additional sustainability to the proposals.

4.16 Additional details regarding the application of the Exception Test have been provided by Lewes & Co. Planning Consultants, as follows;

> *The proposals would regenerate a vacant, brownfield site within the village centre. Paragraph 125 of the NPPF gives 'substantial weight' to the value of using such sites for the delivery of new homes and other identified needs.*
>
> *In addition to high-quality new homes and employment/community space in a sustainable village centre location, the redevelopment of the site will also regenerate a site identified within the Hassocks Village Townscape Appraisal as adversely impacting the sense of place within the Village Centre. The Appraisal is critical of the character, scale form, colour and facing materials of the existing site, which undermines local distinctiveness. The proposed design has the 'full support' of the Mid Sussex Design Review Panel and would provide a significant visual enhancement and public realm improvements in a key village centre location.*
>
> *The proposed building is highly sustainable, utilising prefabricated cross-laminated timber panels, renewable technologies, low embodied carbon and high energy and carbon performance. All proposed dwellings will be built to at least M4 (2) accessibility standards, exceeding the usual 20% requirement set out within policy. All parking spaces will feature electric vehicle charging and vehicle trips to/from the site are anticipated to reduce by over 40% compared to the lawful existing use.*

5.0 DRAINAGE STRATEGY

FOUL WATER

Existing

5.1 Southern Water sewer records have been obtained, which show an existing public foul sewer adjacent to the eastern site boundary beneath the pavement along Dale Avenue. This is shown to flow to the north-east where it joins a manhole before flowing to the north-west beneath Keymer Road. A foul water manhole is identified adjacent to the site entrance, with reference 8404. The Southern Water sewer records are included in Appendix E, with an extract shown below in Figure 5.1.

5.2 A CCTV drainage survey was undertaken by Aquatech Drain Services (ADS) as part of previous investigation works in May 2021. It is assumed that the arrangement has remained unchanged. This has identified the existing foul drainage to discharge to the east, where it connects to the public foul sewer adjacent to Dale Avenue, upstream of Southern Water manhole ref. 8404. The drain connecting to the public sewer was surveyed, and water was seen to flow freely proving the off-site connection. The CCTV survey has been included as Appendix F.

Figure 5.1 Southern Water Sewer Map extract.

Proposed

5.3 Refer to Appendix A for the Drainage Strategy Plan. Utilising Southern Water's Design Guidance, for the proposed 28No residential units an estimated peak foul water flow rate to the public sewer of 0.32 litres/second has been calculated. The occupancy per unit figure (3 persons) has been estimated as an average across the site. This calculation is shown in Table 5.2.

Table 5.2 Proposed peak foul flows.

General housing peak foul flow		
Number of properties, N	28	Units
Occupancy, O	3	Persons / unit
Per capita flow, G (L/D)	125	litres / head / day
Population, P (NxO)	114	People
Storm duration, SD	300	Minutes
Peaking Factor, PF	2.5	
Peak Flow	0.32	l/s

5.4 Foul water peak flows from the commercial accommodation is not considered to coincide with the peak flow period generated from the residential properties and will be at a significantly lower rate than domestic wastewater flows. It is therefore considered that design peak foul water flow rates, discharging to the public sewer can be based on the residential usage only.

5.5 It is considered feasible that foul water can continue to discharge via the existing connection to the public foul sewer infrastructure located in Dale Avenue.

5.6 In accordance with Building Regulations, new drainage at the site should be installed as separate foul and surface water networks. A Connection to a Public Sewer Section 106 application will be required in due course to discharge the foul water to the public sewer.

SURFACE WATER

Existing

5.7 The ADS CCTV drainage survey identified surface water to currently drain to a surface water culvert beneath John Saxby Place off-site to the west, which flows from south to north.

5.8 The total site area is currently entirely covered by impermeable surfacing. Rainwater downpipes and drainage channels convey surface water from the roofs and hardstanding to the surface water sewer via the on-site private drainage system. Existing surface water runoff rates have been calculated based on a drained hardstanding area of approximately 1,260m². The pre-development runoff for a range of design storms is shown in Table 5.3. Microdrainage results are presented in Appendix G.

Table 5.3 – Summary of Pre-Development Surface Water Peak Runoff Rates

Design Storm return period (years)	Pre-development surface water peak rate of runoff (l/s)
1	13.4
2	17.2
30	32.6
100	42.2

Proposed

5.9 Refer to Appendix A for the Drainage Strategy Plan. In line with Building Regulations Part H3, the consideration of the hierarchy of surface water disposal for the site is listed below;

a) **Discharge to soakaway** – There is a minimum requirement for soakaways to be 5m from structures, and the proposed building will occupy the entire site area. Therefore, the use of soakaways and infiltration at the site is not considered to be a feasible option for surface water management.

b) **Discharge to a watercourse** – A culverted watercourse is located approximately 10m to the west of the site. An existing surface water connection from the site has been proven through drainage survey investigations.

c) **Discharge to surface water sewer** – there are no public surface water sewers within the locality that would provide a point of connection via this means.

5.10 Based on a consideration of the SuDS hierarchy, the surface water drainage proposals are to maintain the existing off-site connection to the surface water culverted watercourse. The total impermeable area will not change following the development. SuDS policies recommend that discharge rates for development on brownfield land should be reduced to greenfield rates where practical.

5.11 It is proposed that a maximum discharge rate of 2.0 litres/second (l/s) should be established for the 100-year storm event (1% AEP) plus a 45% allowance. This is a reduction of 88% on the 2-year (50% AEP) design storm. To manage flows off-site, an attenuated SuDS scheme is proposed with surface water runoff being attenuated via storage crates beneath the central car park area beneath the building. This will subsequently discharge via a Hydrobrake to the

culverted watercourse beneath John Saxby Place. Attenuation volume calculations are presented in Appendix G.

5.12 Through the application of attenuation SuDS for the proposed development, surface water can be managed at source by using positive drainage through gullies, rainwater downpipes and conventional pipework directed to the attenuation tank.

5.13 In accordance with the Non-Statutory Technical Standards for SuDS, the surface water drainage system should be designed so that flooding does not occur on any part of the site for a 1 in 30 (3.3% AEP) year rainfall event; and so that flooding does not occur during a 1 in 100 (1% AEP) year event in any part of a building or in any utility plant susceptible to water.

5.14 Through utilising attenuation SuDS to accommodate the 1 in 100-year rainfall event (+45% allowance for climate change), it can be shown that no part of the site or downstream network is vulnerable to surface water flooding from the managed on-site runoff.

Water Quality

5.15 Both the SuDS Manual (CIRIA C753) and guidance from the EA, as outlined in the recently withdrawn Pollution Prevention Guidance 3 (PPG3), state that rainwater runoff from roof areas is considered to be at very low risk of containing contaminants and does not require any pollution control to be implemented prior to discharge, outside of the removal of gross solids and sediments only.

5.16 Further reference to Table 26.2 of the SuDS Manual shows that the proposed land use at the Keymer Road site comprises residential car parking which represent a low risk of pollution hazard level. The surface water management of the undercroft parking is considered in two separate areas. The wholly covered area to the south is expected to receive minimal surface water and is to be drained to the foul sewer owing to the greater likelihood of oils or cleaning agents entering the drainage system. The northern area is partially open above allowing a limited area of rainfall to enter to parking. The guidance for this level of risk is to use the simple index approach to pollution control requirements for discharging to a surface waters.

5.17 The notes to Table 26.2 state that extra measures may be required for discharges to protected resources, the guidance clarifies that in England and Wales, protected groundwater resources are represented by the catchment of an SPZ 1 classification. As discussed in paragraph 2.5, the development does not lie within an SPZ but is underlain by a Principal Aquifer. However as neither infiltration nor discharge to a watercourse is proposed, no additional pollution control measures are required in this regard.

5.18 The simple index approach is outlined in the SuDS Manual and provides pollution hazard indices for different land use classifications. An extract applicable to the development site is provided in Table 5.5.

Table 5.5 Extract of Table 26.2 from the SuDS Manual.

Pollution hazard indices for different land use classifications				
Land use	**Pollution hazard level**	**Total suspended solids (TSS)**	**Metals**	**Hydro-carbons**
Residential roofs	Very low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4

5.19 These hazard indices are to be compared against mitigation indices for individual SuDS components, as provided in Table 26.3 of the SuDS Manual, an extract of which showing the mitigation indices for permeable paving options is provided in Table 5.6.

Table 5.6 Extract of Table 26.3 from the SuDS Manual.

Indicative SuDS mitigation indices for discharges to surface waters			
	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

5.20 The SuDS Manual also allows for proprietary systems such as oil interceptors, smart filters, membranes and silt/debris traps to be utilised to minimise the risk of pollution. These products must demonstrate that they can address each of the contaminant types as described in Table 5.5. This area of car park is to be drained to the surface water network vial a channel drain and gully fitted with a smart sponge, providing sufficient pollution mitigation of for this small and low-flow area.

SuDS Maintenance and Management Plan

5.21 Details of SuDS operation and maintenance activities are provided within Chapter 32 of the SuDS Manual. A summary of typical key SuDS components is given in Table 5.7.

Table 5.7 Extract of Table 32.1 of the SuDS Manual

Typical key SuDS components operation and maintenance activities (for full specifications, see Chapters 11–23)

Operation and maintenance activity	SuDS component												
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter drain	Modular storage	Pervious pavement	Swale/bioretention/ trees	Filter strip	Green roofs	Proprietary treatment systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter and debris removal	■	■	■	■	□	■	■	□	■	■	■		□
Grass cutting	■	■	■	■	□	■	■	□	□	■	■		
Weed and invasive plant control	□	□	□	□		□	□		□		□	■	
Shrub management (including pruning)	□	□	□	□					□	□	□		
Shoreline vegetation management	■	■	□										
Aquatic vegetation management	■	■	□										
Occasional maintenance													
Sediment management[1]	■	■	■	■	■	■	■	■	■	■	■		■
Vegetation replacement	□	□	□	□						□	□	■	
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation /repair	□	□	□	□	□	□	□	□	□	□	□	□	
Infiltration surface reconditioning				□	□	□	□		□	□	□		

Key

■ will be required

□ may be required

Notes

1 Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

5.22 As can be seen, all SuDS components require regular inspection and for the first year the guidance states that monthly inspections are carried out and documented to inform the ongoing maintenance regime of the site drainage. SuDS components at the site are not to

be adopted and will be maintained for their lifetime by the managing company of the development.

5.23 The key maintenance procedure for the attenuation tank and Hydrobrake is the management of sediment. The risk of sedimentation to these features can be mitigated through the use of silt traps prior to gullies discharging to the system and regular sediment removal.

5.24 Further operational activities for the SuDS components described for the site include regular litter and debris removal to reduce the risk of the drainage systems becoming blocked.

5.25 Contractors should protect SuDS components from adverse sediment runoff during the construction phase and an initial pre-handover inspection as required to ensure that the drainage system has been constructed as designed. A SuDS Maintenance and Management Plan is included as Appendix H.

6.0 FLOOD RISK MANAGEMENT MEASURES

6.1 The ground levels for the development should be designed so that potential overland conveyance routes direct water around and away from the building to less vulnerable areas. Existing levels show that surface water runoff in a flood event would be directed via the site topography, beyond the site's northern boundary.

6.2 Road levels to the north are lower than the external site levels, therefore flood risk from surcharging of the public sewer in Keymer Road is considered to be low, as overland flows would be constrained by the highway extents and directed to lower lying areas to the west.

6.3 Surface water runoff is to be managed through attenuation SuDS, with a continued discharge to the surface water sewer beneath John Saxby Place, at a restricted flow rate of 2.0 l/s. SuDS features have been designed to accommodate the 1 in 100-year storm event with an allowance of an additional 45% increase in rainfall intensity to mitigate the predicted effects of climate change. This will minimise the risk of surface water flooding at the site by ensuring that surcharged pipework does not manifest in surface flooding up to this storm design parameter.

6.4 Detailed drainage design is outside the scope of this report and it is assumed that connection approvals will be sought for the foul water connection to the public sewer in due course and that Infrastructure Charges imposed by the sewerage undertaker should ensure sufficient capacity in the local sewerage network to accommodate the foul flow from the development.

6.5 All ground floor levels are to be set a minimum of 300mm above the 1% AEP flood level to mitigate the risk from overland flows entering the building. No runoff from external areas should be directed towards the building entrance. Mitigation of residual risk could be built into the building fabric by proposing raised electrical wall sockets, telescopic air vents, concrete or tiled ground floor finishes and flood resistant doors for the finished building.

6.6 The new layout will provide the same flood storage volume as the existing arrangement (see Section 3.6), thereby not increasing risk of flooding to any of the surrounding buildings or properties due to a fluvial flood event. This provides evidence that the flood storage compensation has been allowed for in the proposed development. This has considered a flood level of 1% AEP + 105% CC.

6.7 Future owners and residents should be signed up to the EA's Floodline Warnings Direct Service, which aims to provide forewarning of potential flooding. The town of Hassocks falls within an area covered by a Flood Plan, and as the primary source of flooding is associated with the nearby stream it may be possible to provide the future occupants of the property with precautionary advice regarding potential flooding ahead of the event, in order for appropriate procedures to be initiated.

7.0 OFF SITE IMPACT

7.1 As discussed in Section 4, the development is considered to provide a significant betterment in surface water runoff over the existing situation, due to the proposed use of attenuation SuDS to manage surface water runoff with a Hydrobrake to restrict the rate of discharge to the adjacent culverted watercourse. Therefore, the development is not considered to adversely affect neighbouring properties in terms of flood risk.

7.2 Overland flow paths are currently established through the site. Allowance in the design has been made to maintain these flow paths, refer to Section 3.6.

7.3 Detailed drainage design is outside the scope of this report and it is assumed that the management of the foul water discharge using existing or new infrastructure is an appropriate means of communicating foul flows from the proposed development to the public sewer.

7.4 Through the use of SuDS to manage surface water runoff at source, the peak rate of runoff from the site to the surface water sewer will be reduced by 88%. These proposed measures ensure the long-term sustainability of the development, and that flood risk to neighbouring and downstream properties will not be adversely affected.

8.0 RESIDUAL RISK

8.1 Residual risk is primarily concerned with a fluvial flood event exceeding the capacity of the local river network. This risk is mitigated through the ongoing maintenance and inspection programme undertaken by the EA and the Floodline Warnings Direct scheme which advises of potential flood risk to which the future owners of the property should be signed up.

8.2 Further residual risk is generated by potential drainage infrastructure blockage or failure, or from a storm event exceeding the design parameters for the design life of the development. As discussed in Section 3.6, allowance for storage of the equivalent flood water to that already existing has been allowed for in the design and therefore any exceedance case would be no worse than the current arrangement.

8.3 The main mitigation from residual risk is addressed through placing habitable accommodation from the first floor up and designing the commercial units at ground floor with finished floor levels 300mm above the modelled design flood level.

9.0 CLIMATE CHANGE

9.1 Increased rainfall intensity, longer storm durations and rising sea levels are all attributed to global climate change. The effects of climate change have been considered when sizing SuDS features by allowing for an additional 45% in rainfall intensity as required by the Planning Practice Guidance to the NPPF. Peak river flow increases of 105% have been considered in the calculations presented for compensatory flood storage volumes.

10.0 CONCLUSIONS

10.1 The site lies within Flood Zone 3 and this site-specific FRA is required to accompany the Planning submission. This report has been produced in compliance with the NPPF and its accompanying Planning Practice Guidance concerning development and flood risk.

10.2 Primary flood risk at the site has been shown to be from the Herrings Stream located approximately 100m to the west. The proposed building will comprise of commercial premises on the ground floor, with residential from the first floor up. It is proposed that the commercial ground floor level is set at 43.53mAOD and the access stairwell to the residential accommodation set at 43.68mAOD to mitigate flood risk. Habitable accommodation is sited on the first-floor level and above, well in excess of the design flood level for the site.

10.3 Compensatory flood volumes have been demonstrated to be achieved through the level strategy at the site, accommodating a like-for-like volume within the site boundary to match the existing modelled scenario for the 1 in 100 year event plus allowance for CC.

10.4 Risk from a fluvial flood event may be forewarned and prepared for with future occupants signed up to the EA's Floodline Warnings Direct service. The proposed development has allowed for fluvial flood water to continue to be conveyed through the site as per the existing arrangement, with the less vulnerable undercroft parking area at risk of managed inundation.

10.5 Risk of groundwater flooding is considered to be moderate and mitigated though natural flow paths in the local topography conveying any flow generated from this source away from the building entrances. Risks from other sources of flooding are considered to be low or very low.

10.6 Surface water runoff is proposed to drain to an 84m^3 attenuation tank beneath the central car park area of the building, with a Hydrobrake restricting the discharge rate to achieve an 88% reduction in peak flows off-site at a rate of 2.0 l/s. SuDS features have been designed to accommodate the 1 in 100-year storm event plus an allowance of an additional 45% increase in rainfall intensity due to climate change.

10.7 Foul drainage has been shown to currently connect to the public foul sewer in Dale Avenue, which will be maintained. Flows from the proposed development will be subject to a Section 106 connection agreement with Southern Water.

10.8 This report highlights the potential flood issues at the Keymer Road site and how the development proposals mitigate the risk to people and property from an extreme flood event. This report has shown that development proposals can be considered appropriate for the site and the designated Flood Zone classification.

10.9 In light of the above, it is considered that the proposed development is safe and does not increase the flood risk at the site or to neighbouring or downstream properties. It has been shown that the proposals for a mixed-use residential and commercial development can be successfully implemented and managed to provide comfort and safety to residents in regard to flood risk for the lifetime of the development, thereby demonstrating compliance with the second element of the Exception Test.