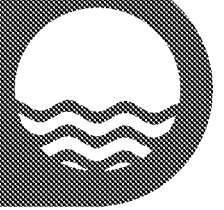


FloodSmart Plus



Flood Risk Assessment

Site Address

25 River Road
Littlehampton
BN17 5BZ

Date

2021-05-04

Report Status

FINAL

Grid Reference

E 502427 N 102102

Site Area

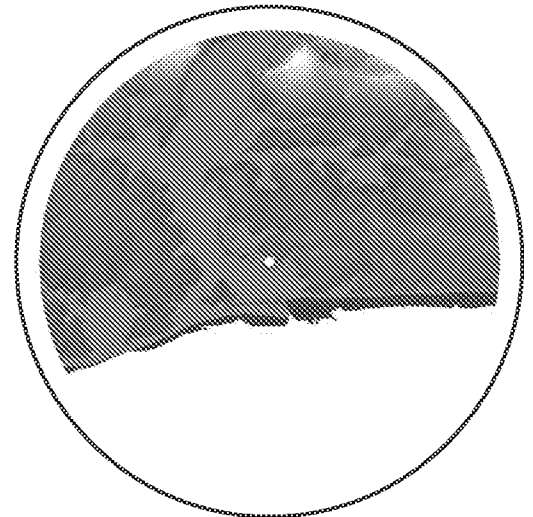
321 m²

Report Prepared for

Hall Homes
1 Rooks Acre Cottages
West Street Sompting
Lancing
Sussex
BN15 0AX

Report Reference

74499R2



RISK - Medium

The Site is located within a tidal Flood Zone 1, 2 and 3 (Low to High probability). Taking into consideration the presence of defences, the risk of flooding from rivers and sea is classed as Medium. The Site is at a Very Low risk of pluvial flooding and a Moderate risk of groundwater flooding. Proposed flood mitigation measures including raising of Finished Floor Levels to 5.27 mAOD, will reduce the risk of flooding from medium to low.

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1. Executive summary

A review has been undertaken of national environmental data sets to assess the flood risk to the Site from all sources of flooding in accordance with The National Planning Policy Framework (NPPF) (2019) and National Planning Practice Guidance (NPPG) (2014). A site-specific flood risk assessment, to assess the flood risk to and from the development Site, is provided within this concise interpretative report written by an experienced GeoSmart consultant. Baseline flood risk and residual risks that remain after the flood risk management and mitigation measures are implemented are summarised in the table below.

Site analysis

Source of Flood Risk	Baseline	After Mitigation
Sea (coastal/tidal) and River (fluvial) flooding	Medium	Low
Surface water (pluvial) flooding	Very Low	N/A
Groundwater flooding	Moderate	Negligible to Low
Other flood risk factors present	Yes ¹	Yes
Is any other further work recommended?	Yes	No

N/A = mitigation not required.

¹A risk has been identified from sewers, although the level of risk could not be determined.

Summary of existing and proposed development

The Site is currently comprised of a single-storey garage and workshop, including tarmac/concrete forecourts in the south and east of the Site.

Development proposals comprise the demolition of on-Site structures and the erection of a three-storey residential building comprised of ground and first floor residential levels and lower ground (undercroft) for parking, bin and bike storage.

The ground and first floor levels will contain five residential units and finished floor levels will be set at a minimum level of 5.27 mAOD (confirmed within plans in Appendix A). Garden areas, additional bike storage and three units are proposed for the ground floor and two units are proposed on the first floor.

The parking, bin and bike storage proposed for the undercroft (lower ground floor) area will be floodable. Access and egress from the Site can be achieved via two routes, the first is along

River Road to the south and the second is to the east to Terminus Place, both of which require occupants to head north towards Terminus Road where train and vehicular transport are available.

Summary of flood risks

The flood risks from all sources have been assessed as part of this report and are as follows:

- The Site is located 50 m from The River Arun, a tidally affected river with the The English Channel 900 m to the south east.
- According to the Environment Agency's (EA) Flood Map for Planning Purposes, the Site is located within a fluvial and coastal Flood Zone 1, 2 and 3 (Low to High Probability).
- Formal flood defences are mapped approximately 50 m to the south of the Site, the EA's flood defences dataset indicates these are in good condition.
- The Beachy Head to Selsey Bill Shoreline Management Plan (SMP2) (South Downs Coastal Group, 2006) designation for defence lines at Littlehampton (Unit 18) is to "Hold the Line" over the long term period to 2105 which means that the proposals will remain protected by flood defences currently and over the lifetime of the development.
- According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map, which considers the type, condition and crest height of flood defences, the Site has a Medium risk of flooding from Rivers and the Sea.

Modelled flood data obtained from the EA has been analysed in line with the most up to date guidance on climate change (EA, 2020), to confirm a maximum "design" flood level at the Site. This confirms during the 1 in 200 year (0.5% AP) (2121 scenario) coastal flood event (accounting for the maximum impacts of sea level rise, wave action and surge) over the projected 100 year lifespan of the development, **the flood level at the Site would be 4.67mAOD.**

Finished floor levels of proposed living accommodation and ground and first floor levels, will be set at a minimum level of 5.27 mAOD (confirmed in plans in Appendix A), which is 600mm above the maximum flood level.

The existing building footprint is 260 m². The proposed non-floodable building footprint is 178 m² with 107 m² being floodable under croft parking areas. Floodplain compensatory storage is therefore not required as there is a decrease in building footprint.

In the event of a flood, safe refuge can be taken on the ground and 1st floor levels, but emergency evacuation routes (to be used in preference) are available along Terminus Place to the north.

- According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site has a Very Low risk of pluvial flooding.
- Groundwater Flood Risk screening data indicates there is a Moderate risk of groundwater flooding at the surface in the vicinity of the Site during a 1 in 100 year event.

A site-specific assessment confirms that as the living accommodation will be set at ground and first floor level and impermeable coverage at the Site and surrounding area would limit the emergence potential at the Site and along evacuation routes, the groundwater risk to future occupants is therefore considered to be negligible to low.

- The risk of flooding from artificial (man-made) sources such as reservoirs, sewers and canals has been assessed:
 - The EA's Risk of Flooding from Reservoir map confirms the Site is not at risk of reservoir flooding.
 - Ordnance Survey (OS) data confirms there are no canals near to the Site.
 - A sewer flooding history search was undertaken using the Strategic Flood Risk Assessment (JBA Consulting, 2016). This confirms 22 incidences or modelled incidences of flooding as a result of surcharging sewers within the BN17 5 postcode, although this covers a wide area and is not specific to the Site.

A risk has been identified from sewers, although the level of risk could not be determined.

- The risk to the development has been assessed over its expected 100 year lifetime, including appropriate allowances for the impacts of climate change. More extreme weather events could increase the risk to the Site from sea level rise. Site specific assessment indicates risk to the Site will increase significantly and appropriate mitigation measures are proposed.

Proposed flood mitigation

- As there is a risk of flooding from both fluvial and coastal sources, Finished Floor Levels (FFL) of the proposed ground floor of the development will be set to 5.27 mAOD¹. Standard flood resilient design measures will also be incorporated above this level to provide further protection in the event that the flood defences are not maintained in line with current policy or if the 1 in 1000 year event occurred and affected the Site.

Recommendations

Further recommendations are provided below, based upon the proposed development and the flood risk identified at the Site.

- As there is a risk of flooding from groundwater sources, surrounding ground levels and ground levels should slope away from buildings. Risk to buried infrastructure should be considered along with standard flood resilient design and non-return valves on the sewer outlet.
- A Flood Warning and Evacuation Plan (FWEP) is recommended to ensure persons using the Site can evacuate safely on receipt of a Flood Warning.

¹ 0.6 m above the 1 in 200 year plus climate change flood level of 4.67 mAOD in line with mitigation requirements set out within the SFRA (2016).

- Occupants of the Site should be signed up to receive EA Flood Alerts and Flood Warnings.
- A Sustainable Drainage Strategy (SuDS) should be developed for the Site, for effective management of surface water runoff over the lifetime of the proposed development.

GeoSmart recommend the mitigation measures discussed within this report are considered as part of the proposed development where possible and evidence of this is provided to the Local Planning Authority as part of the planning application.

2. Introduction



Background and purpose

A site-specific flood risk assessment has been undertaken, to assess the flood risk to and from the development Site. This assessment has been undertaken by firstly compiling information concerning the Site and the surrounding area. The information gathered was then used to construct a 'conceptual site model', including an understanding of the appropriateness of the development as defined in the NPPF (2019) and the source(s) of any flood risk present. Finally, a preliminary assessment of the steps that can be taken to manage any flood risk to the development was undertaken.

This report has been prepared with reference to the NPPF (2019) and NPPG (2014).

"The National Planning Policy Framework set out the Government's planning policies for England and how these are expected to be applied" (NPPF, 2019).

The NPPF (2019) and NPPG (2014) promote a sequential, risk based approach to the location of development. This also applies to locating a development within a Site which has a variable risk of flooding.

"This general approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim should be to keep development out of medium and high risk flood areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible" (NPPG, 2014).

The purpose of this report is to provide clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at the Site.

Report scope

In accordance with the requirements set out within NPPG 2014 (Paragraph: 030 Reference ID: 7-030-20140306), a thorough review of a commercially available flood risk report and EA supplied data indicating potential sources of flood risk to the Site from rivers and coastal sources, surface run-off (pluvial), groundwater and reservoirs, including historical flood information and modelled flood extent. Appropriate measures are recommended to manage and mitigate the flood risk to the property.

Information obtained from the EA and a review of the Arun District Council Strategic Flood Risk Assessment (SFRA) (JBA Consulting, 2016) and the Beachy Head to Selsey Bill Shoreline Management Plan (South Downs Coastal Group, 2006) is used to ascertain local flooding issues and, where appropriate, identify information to support a Sequential and/or Exception test required as part of the NPPF (2019).

The existing and future flood risks to and from the Site from all flood sources is assessed in line with current best practice using the best available data. The risk to the development has been assessed over its expected lifetime, including appropriate allowances for the impacts of climate change. Residual risks that remain after the flood risk management and mitigation

measures are implemented, are considered with an explanation of how these risks can be managed to keep the users of the development safe over its lifetime.

An indication of whether the Site will potentially increase flood risk elsewhere is provided, including where the proposed development increases the building footprint at the Site. A drainage strategy to control runoff can be commissioned separately if identified as a requirement within this report.

Report limitations

It is noted that the findings presented in this report are based on a desk study of information supplied by third parties. Whilst we assume that all information is representative of past and present conditions, we can offer no guarantee as to its validity and a proportionate programme of site investigations would be required to fully verify these findings.

The basemap used is the OS Street View 1:10,000 scale, however the Site boundary has been drawn using BlueSky aerial imagery to ensure the correct extent and proportion of the Site is analysed.

This report excludes consideration of potential hazards arising from any activities at the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

Datasets

The following table shows the sources of information that have been consulted as part of this report:

Table 1. Datasets consulted to obtain confirmation of sources of flooding and risk

Source of flooding	Datasets consulted			
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency (Appendix B)	OS Data
Historical	X	X	X	
River (fluvial) / Sea (tidal/coastal)	X	X	X	
Surface water (pluvial)	X	X	X	
Groundwater	X	X		
Sewer		X		
Culvert/bridges		X		X
Reservoir		X	X	

*Local guidance and policy, referenced in Section 6, has been consulted to determine local flood conditions and requirements for flood mitigation measures.

3. Site analysis



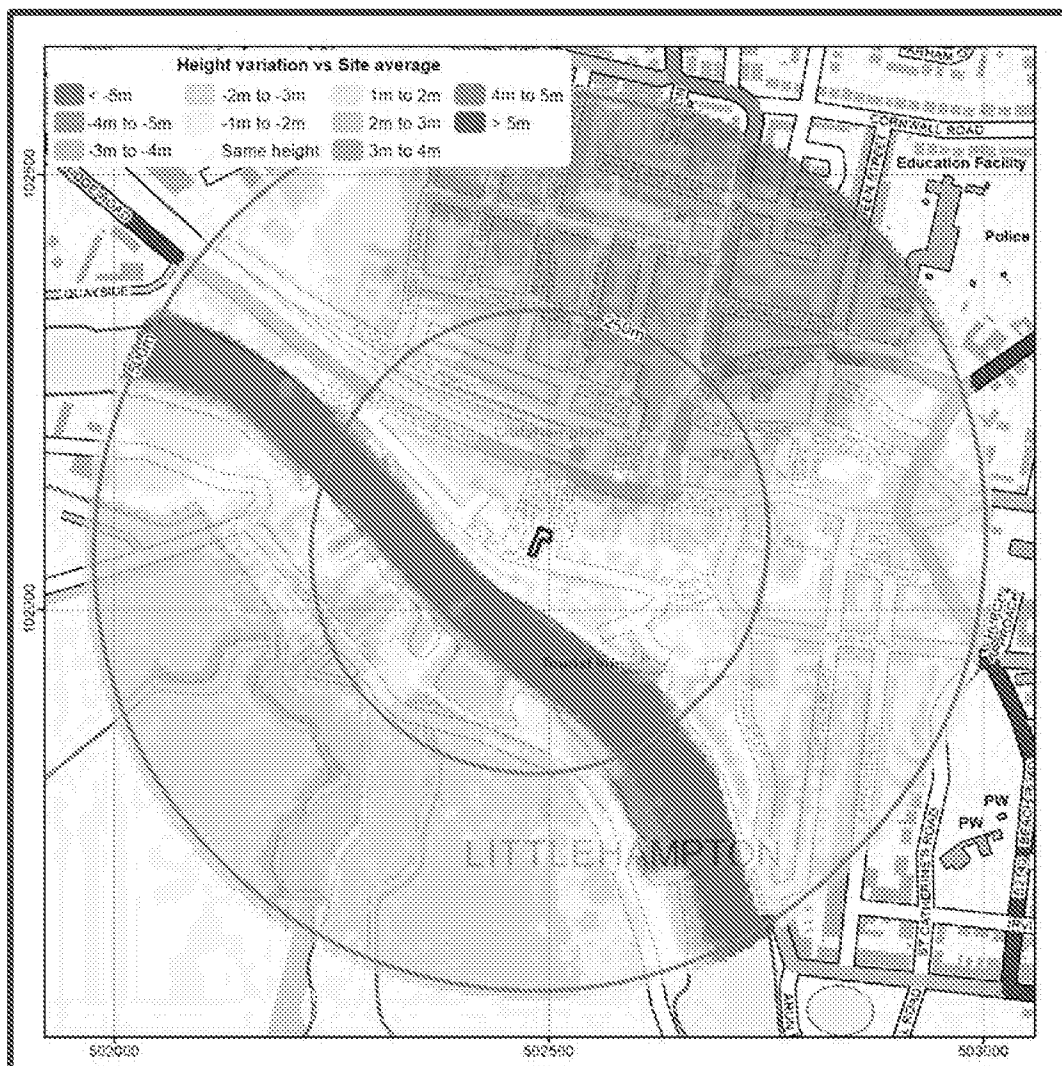
Site information

The Site is located in Littlehampton in a setting of commercial and residential land use at National Grid Reference TQ 02427 02102. Site plans and drawings are provided in Appendix A.

According to OS data, using a 500 m buffer around the Site, the area is on a gentle slope (Figure 1). It is noted that to the north land rises to c. 5.7 m above Ordnance Datum (AOD). To the west land falls to c. 2.0 mAOD, to the east land rises to c. 3.7 mAOD and to the south falls to c. 1.9 mAOD.

The general ground levels on the Site are between 3.29 and 4.07 mAOD with the Site falling gradually in a southerly direction. This is based on EA elevation data obtained for the Site to a 1 m resolution with a vertical accuracy of ± 0.15 m (Appendix C).

Figure 1. Site Location and Relative Elevations (GeoSmart, 2021).



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Development

The Site is currently comprised of a single-storey garage and workshop, including tarmac/concrete forecourts in the south and east of the Site.

Development proposals comprise the demolition of on-Site structures and the erection of a three-storey residential building comprised of ground and first floor residential levels and lower ground (undercroft) for parking, bin and bike storage.

The ground and first floor levels will contain five residential units and finished floor levels will be set at a minimum level of 5.27 mAOD (confirmed in plans in Appendix A). Garden areas, additional bike storage and three units are proposed for the ground floor and two units are proposed on the first floor.

The parking, bin and bike storage proposed for the undercroft (lower ground floor) area will be floodable. Access and egress from the Site can be achieved via two routes, the first is along River Road to the south and the second is to the east to Terminus Place, both of which require occupants to head north towards Terminus Road where train and vehicular transport are available. Site plans are included within Appendix A.

The effect of the overall development will result in an increase in number of occupants and/or users of the Site and will result in the change of use, nature or times of occupation. According to Table 2 of the NPPG (2014), the vulnerability classification of the existing development is Less Vulnerable and proposed development is More Vulnerable. The estimated lifespan of the development is 100 years.

Proximity to relevant infrastructure

A tributary of the River Arun is culverted 345 m to the south west and 230 m, 250 m to the south.

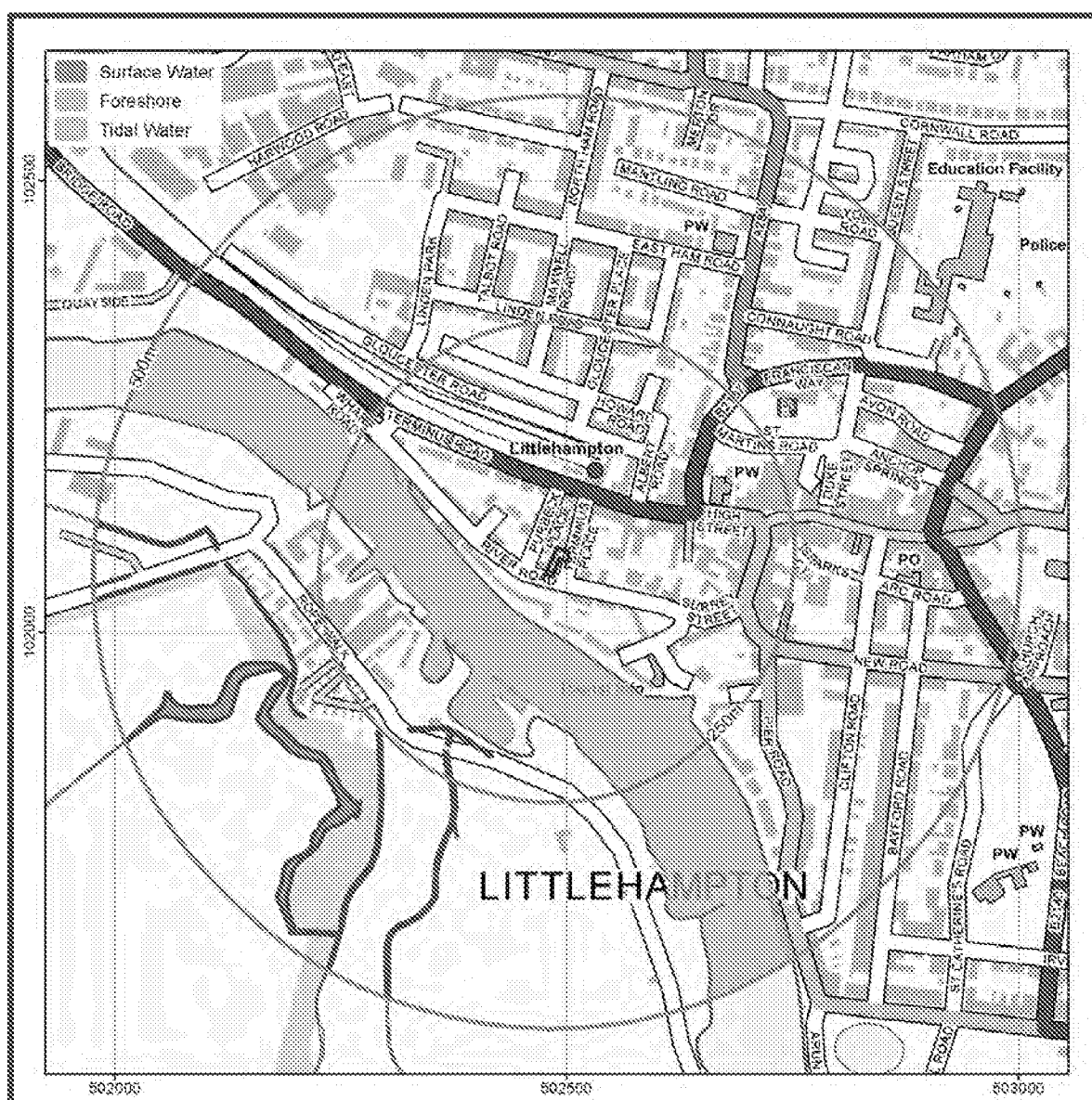
A train station is located north of the Site on Terminus Road.

Hydrological features

The River Arun is approximately 50 m south at a lower elevation than the Site.

The English Channel is 900 m to the south east of the Site.

Figure 2. Surface water features (EA, 2021)

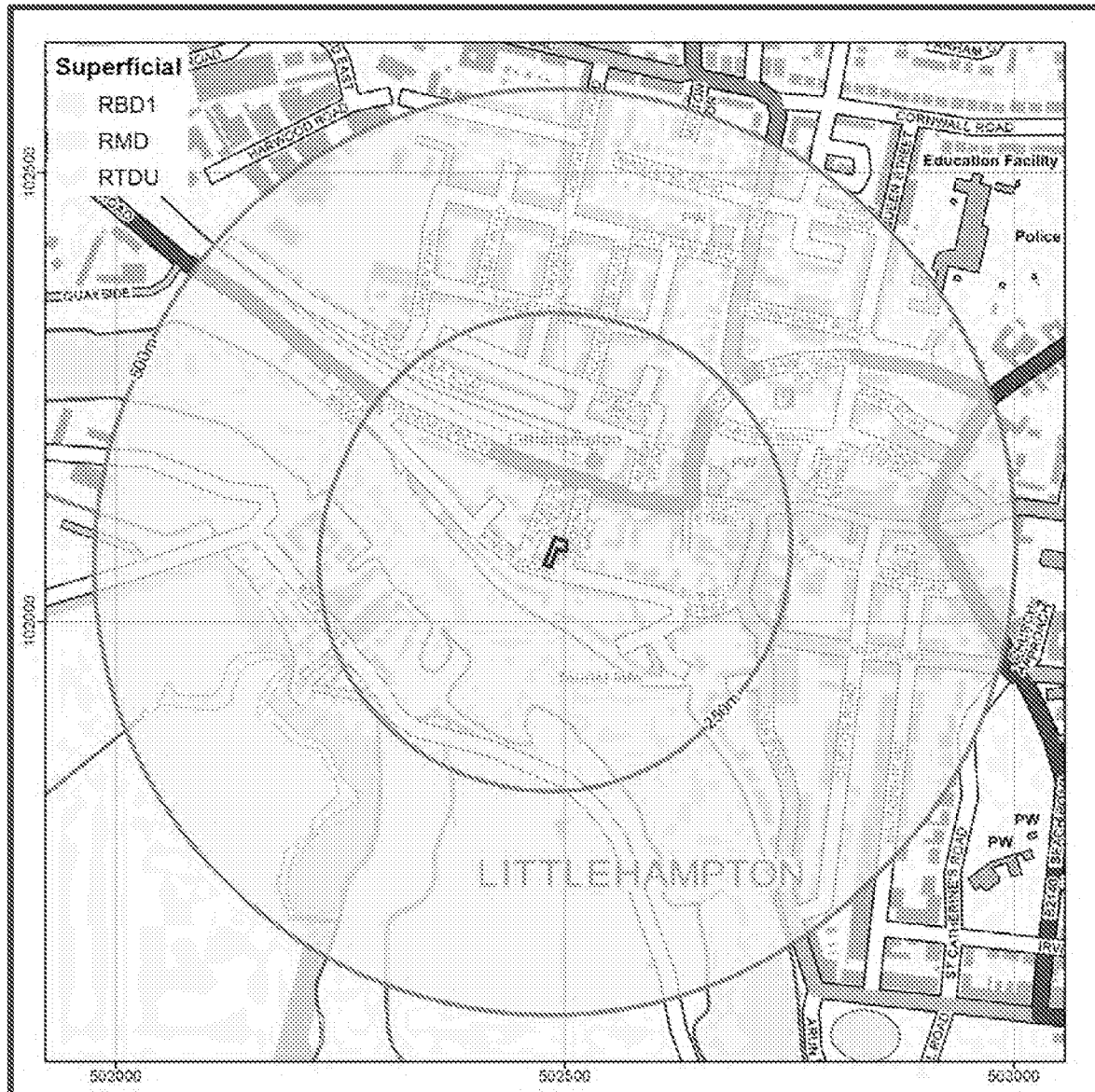


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Hydrogeological features

British Geological Survey (BGS) mapping indicates the underlying superficial geology (Figure 3) consists of Raised Beach Deposit (RBD1) (sand and gravel) (BGS, 2021) and is classified as a Secondary (A) Aquifer (EA, 2021).

Figure 3. Superficial Geology (BGS, 2021)



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Contains British Geological Survey materials © NERC 2021

BGS mapping indicates the underlying bedrock geology (Figure 4) consists of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation And Portsdown Chalk Formation (undifferentiated) (LPCK) (chalk) (BGS, 2021) and is classified as a Principal Aquifer (EA, 2021). The Site does not lie within a groundwater Source Protection Zone (SPZ) (EA, 2021).

4. Flood risk to the development

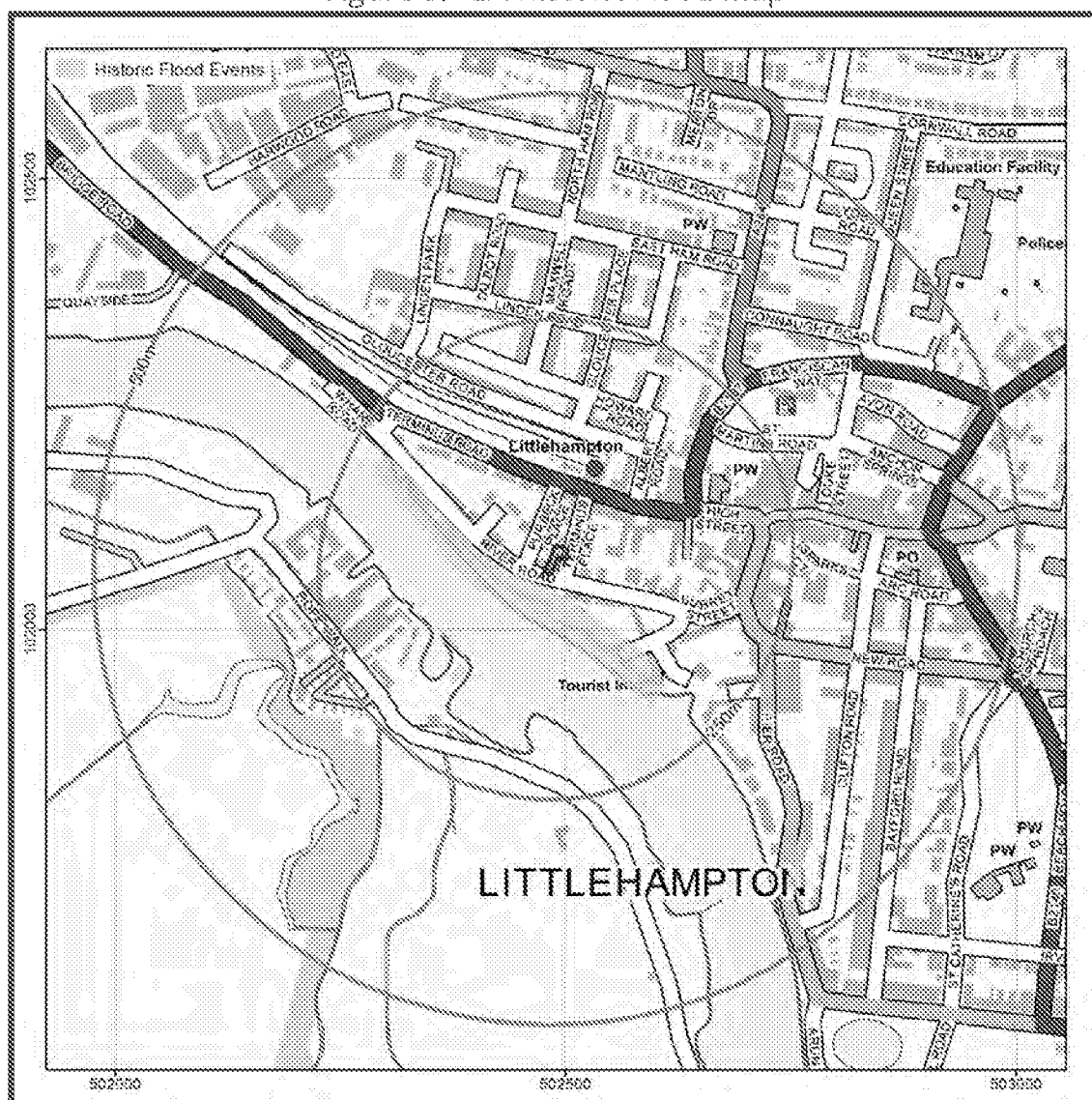


Historical flood events

According to the EA's Historical Flood Map (Figure 5) (EA, 2021) and the SFRA (JBA Consulting, 2016) no historical flood events have been recorded at the Site. Historical flooding has been recorded to the south of the Site. According to the SFRA (JBA Consulting, 2016), 150 properties flooded in February 1983 in Littlehampton as a result of tidal surge, although the Site itself was not known to have been affected in this event.

The purpose of historical flood data is to provide information on where and why flooding may have occurred in the past. The absence of any recorded events does not mean flooding has never occurred on-Site or that flooding will never occur at the Site.

Figure 5. EA Historic Flood Map



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Rivers (fluvial) / Sea (coastal/tidal) flooding

The Site is located in a coastal location (900 m from the English Channel) and is located proximal to the River Arun, a tidally influenced river. The predominant risk at the Site is from flooding from the sea, termed as coastal and/or tidal processes.

Coastal flooding is caused by extreme tidal conditions that occur because of three main mechanisms, either individually or in combination. These are:

- High tide levels – variations in tidal levels due to gravitational effects of the sun and moon can result in higher sea levels – there is an approximate twice daily variation between high and low tide, onto which is superimposed a spring-neap tide cycle when extra high and low tides occur.
- Surge – an increase in sea level above tidal level caused by low atmospheric pressure which may be exacerbated by the wind acting on the sea.
- Wave action – dependent on wind speed and direction, local topography and exposure.

According to the EA's Flood Map for Planning Purposes (Figure 6), the Site is located within fluvial and coastal Flood Zone 1, 2 AND 3 and is therefore classified as having a Low to High probability of fluvial and tidal (coastal) flooding from the River Arun and the English Channel.

Approximately 65 % of the Site in the south is within Flood Zone 3, 25 % of the Site in the north is within Flood Zone 2 and 10 % is within Flood Zone 1 within the north western corner. The development is within Flood Zones 2 and 3, and the proposed access to the south and east is within Flood Zone 3.

Guidance

As defined in the NPPF (2019):

Ignoring the presence of any defences, land located in a Flood Zone 3 is considered to have High probability of flooding with a 1 in 100 year or greater annual probability of fluvial flooding or a 1 in 200 or greater annual probability of coastal flooding in any one year.

Development of "Water-Compatible" and "Less Vulnerable" land uses are suitable for this zone with "More Vulnerable" and "Essential Infrastructure" requiring an Exception test to be passed prior to development taking place. (see glossary for terminology).

Ignoring the presence of any defences, land located in a Flood Zone 2 is considered to have a Medium probability of flooding, with between a 1 in 100 and 1 in 1000 annual probability of fluvial flooding or between a 1 in 200 and 1 in 1000 annual probability of coastal flooding in any one year.

Development of "Water-Compatible", "Essential Infrastructure", "Less Vulnerable" and "More Vulnerable" land uses are suitable for this zone with "Highly Vulnerable" land uses requiring an Exception Test to be passed prior to development taking place.

Ignoring the presence of any defences, land located in a Flood Zone 1 is considered to have a Low probability of flooding, with less than a 1 in 1000 annual probability of fluvial or coastal flooding in any one year.

Development of all uses of land is appropriate in this zone (see glossary for terminology).

Figure 6. EA Flood Map for Planning Purposes (EA, 2021)



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Flood defences

Guidance

Sites that are located close to flood defences are likely to be zones where rapid inundation will occur in the event of the flood defences being overtopped or breached. A Site located close to flood defences (within 250 m) may require a more detailed FRA subject to local topography.

- The Site is in an area which benefits from flood defences, but is not within the EA's ABD.
- Flood wall defences (asset ID: 154862) are 50 m to the south, with an upstream crest level of 3.94 mAOD and a downstream crest level of 3.39 mAOD.
- Information from the EA relating to the flood defences is outlined below.

The EA inspects the defences twice a year and classifies their current condition as "Fair (Condition Grade: 3)".

The SFRA (JBA Consulting, 2016) confirms the defences were constructed to a 1 in 300 annual exceedance probability standard of protection, however approximately a 17 m gap in the defences close to 'Riverside Autos' in Littlehampton (NGR: 502397,102097) (80 m south west of the Site) is currently not to the 1 in 300-year standard of protection. It is confirmed that the Environment Agency have arrangements in place to deploy temporary barriers when necessary, until the defence line has been completed. The new defences are under the responsibility of the private owners to maintain.

The Beachy Head to Selsey Bill Shoreline Management Plan (SMP2) (South Downs Coastal Group, 2006) designation for defence lines at Littlehampton (Unit 18) is to "Hold the Line" over the long term period to 2105 which means that the proposals will remain protected by flood defences currently and over the majority of the lifetime of the development². It is assumed the defences will continue to be maintained thereafter until 2121, but freeboard will be provided to provide an allowance, should the defence policy change between 2105 and 2121.

Model data: Arun to Adur Coastal Modelling (JBA Consulting, 2017)

As the Site is located within the EA's fluvial and coastal floodplain, modelled flood elevation data was obtained from the EA. This data is more up to date than that which is included in the Arun District Council SFRA (2016) and has been used to assess flood risk and to provide recommendations for mitigation for the proposed development.

² A Shoreline Management Plan (SMP) is a large-scale report, assessing the risks associated with coastal processes. It aims to help reduce these risks to people, property and the historic and natural environment. The main objective of a SMP is to identify sustainable long-term management policies for the coast.

Modelled defended flood data from the Arun to Adur Coastal Modelling Study (JBA Consulting, 2017) has been extracted from the two 2D node points located on-Site and have been used to assess flood risk³. The data is provided in the tables below and is included within Appendix B. Undefended data has also been provided by the EA.

Modelled flood outlines and data provided show the Site is affected during all modelled **undefended** events:

- 1 in 200 year (0.5% AEP) **undefended** 2012, 2070 and 2115 scenario; and
- the 1 in 1000 year (0.1 % AEP) 2012 **undefended** scenario events.

Modelled flood outlines and data provided show the Site is protected during some modelled **defended** events, but would be flooded in the following event:

- 1 in 200 year (0.5% AEP) **defended** 2115 scenario.

The EA have confirmed the climate change allowances provided are not up to date (i.e. only provide up to 2115), and therefore in order to assess the full 100 year lifespan of the proposed development up to 2121, the EA's guidance on climate change impacts has been used.

In order to assess the higher central allowance, a 13.1 mm allowance has been added for each year (6 years) and an 18.2 mm allowance has been added for each year for the upper end allowance. A 10 % allowance for wave action has been included and an additional 2 mm a year (above the 2115 allowance) has been added for each year (6 years) to allow for storm surge.

The Beachy Head to Selsey Bill Shoreline Management Plan (SMP2) (South Downs Coastal Group, 2006) designation for defence lines at Littlehampton (Unit 18) is to "Hold the Line", therefore, a defended scenario has been considered for the Site.

Table 2. EA modelled flood level data for the defended scenario

Ground levels at the Site (mAOD)	Modelled Flood Levels (mAOD)				
	2012 0.5 % AEP	2115 0.5 % AEP	2121 0.5 % AEP *		0.1 % AEP
			Higher central	Upper end	
Lower Ground Floor					
3.29 and 4.07	N/A	4.55	4.64	4.67	4.03

³ The accuracy of the modelled flood levels are not known. These are dependent on the accuracy of input datasets such as LiDAR data, used to model the impacts of flooding within the 2D domain. Confirmation of the accuracy of the modelled flood data can be obtained separately from the Environment Agency.

Flood depths	No flooding anticipated	Up to 1.26 m	Up to 1.35 m	Up to 1.38 m	Up to 0.74 m
Ground Floor (finished floor level)					
5.27	N/A	4.55	4.64	4.67	4.03
Flood depths	No flooding anticipated	No flooding anticipated	No flooding anticipated	No flooding anticipated	No flooding anticipated

* Climate change allowances calculated using the most up to date Government guidance (EA, 2020), which include an allowance for sea level rise, wave action and surge increase.

The “Hold the Line” policy is in place until 2105 According to the SMP (2006). It is presumed the defences will be maintained after this. If the policy were to change in 2105, the maximum flood level on-Site for an undefended 1 in 200 year 2121 scenario could be up to 5.00 mAOD (Upper End allowance).

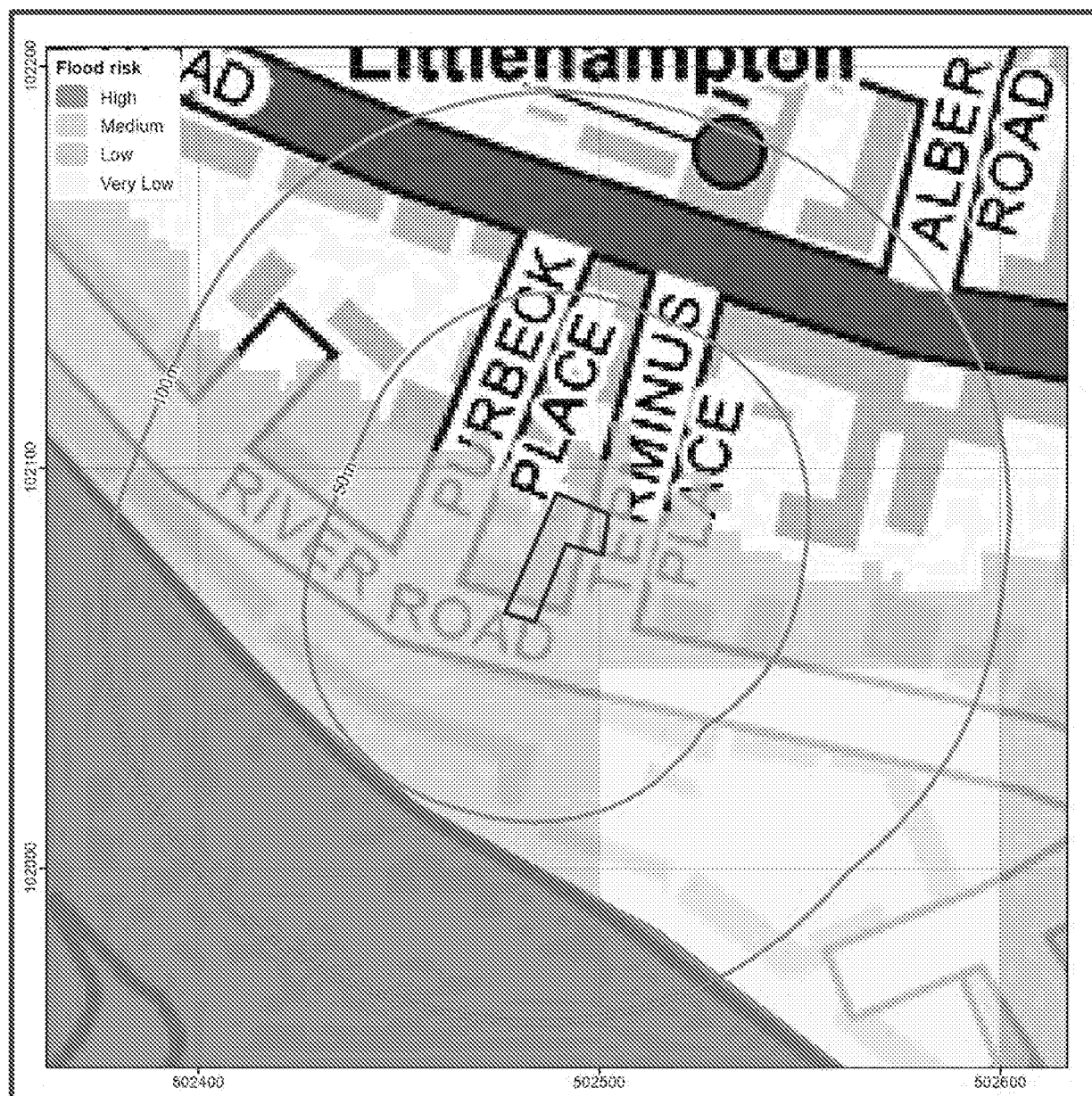
This is calculated on the basis of the undefended 2115 flood level of 4.88 mAOD, applying an additional climate change allowance for 6 years to 2121, which equates to 0.12m above the 2115 flood level, resulting in 5.00 mAOD. The proposed FFL’s of 5.27 mAOD will mitigate flooding in the unlikely event that the “hold the line” policy does not continue past 2105.

Flood risk including the benefit of defences

The type and condition of existing flood defences influence the 'actual' risk of fluvial flooding to the Site, albeit the long-term residual risk of flooding (ignoring the defences) should be considered when proposing new development.

According to the EA's Risk of Flooding from Rivers and the Sea (RoFRS) mapping (Figure 7), which considers the crest height, standard of protection and condition of defences, the flood risk from Rivers and the Sea is Medium.

Figure 7. Risk of Flooding from Rivers and Sea map (EA, 2021)



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Surface water (pluvial) flooding

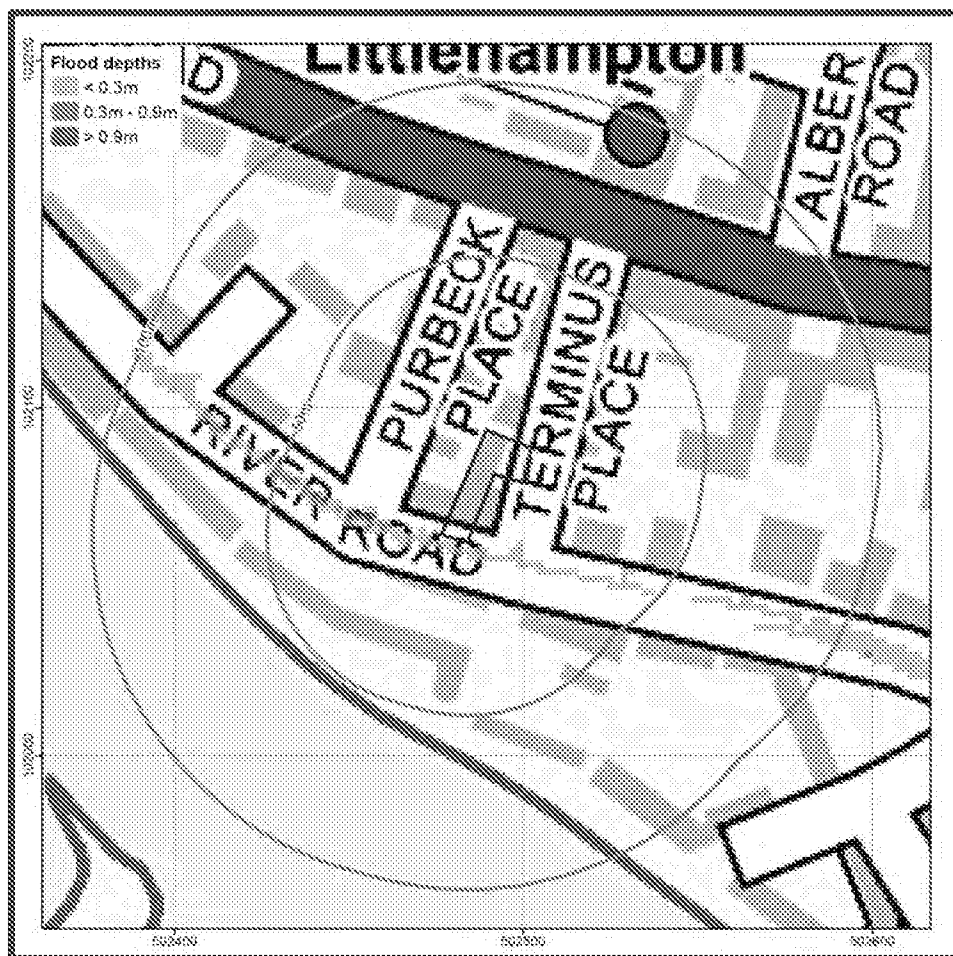
Surface water flooding occurs when intense rainfall exceeds the infiltration capacity of the ground and overwhelms the drainage systems. It can occur in most locations even at higher elevations and at significant distances from river and coastal floodplains.

According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site has a Very Low risk of pluvial flooding.

Guidance
According to EA's surface water flood risk map the following risk ratings apply: Very Low risk - chance of flooding of less than 1 in 1000 (0.1%).

The Site lies immediately adjacent to areas at Low to Medium risk along River Road, although flooding would be relatively shallow and is contained within the highway and unlikely to affect the Site. Figure 8 confirms the extent and depth of flooding during a 1 % AEP (1 in 100 year - Medium risk) event.

Figure 8. EA Medium surface water flood risk map (EA, 2021)



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Guidance

According to EA's surface water flood risk map the following advisory guidance applies to the Site:

Flood Depth

- 0.15 to 0.3 m - Flooding would: typically exceed kerb height, likely exceed the level of a damp-proof course, cause property flooding in some areas
- 0.3 to 0.9 m - Flooding is likely to exceed average property threshold levels and cause internal flooding. Resilience measures are typically effective up to a water depth of 0.6 m above floor level.

Analysis of OS mapping, ground elevation data and the EA's pluvial flow route mapping in the 1 in 1000 year (Low risk scenario) event confirms the Site is not located on a potential overland flow route.

The SFRA does not indicate reported incidents of historical surface water flooding within 100m of the Site and confirms the Site is not located within a Critical Drainage Area (CDA)⁴ (JBA Consulting, 2016).

Climate change may lead to an increase in rainfall intensity which affects river levels, land and urban drainage systems. Rainfall intensity for small and urban catchments may increase from 5 to 20 % (central estimate) or 10 % to 40 % (Upper estimate) over the period to 2115 (EA, 2021). The increase in surface water flood risk is best represented by the 1 in 1000 year pluvial flood extent but according to the mapping this is unlikely to impact the Site. On-Site surface water drainage systems should be designed appropriately to manage the run-off.

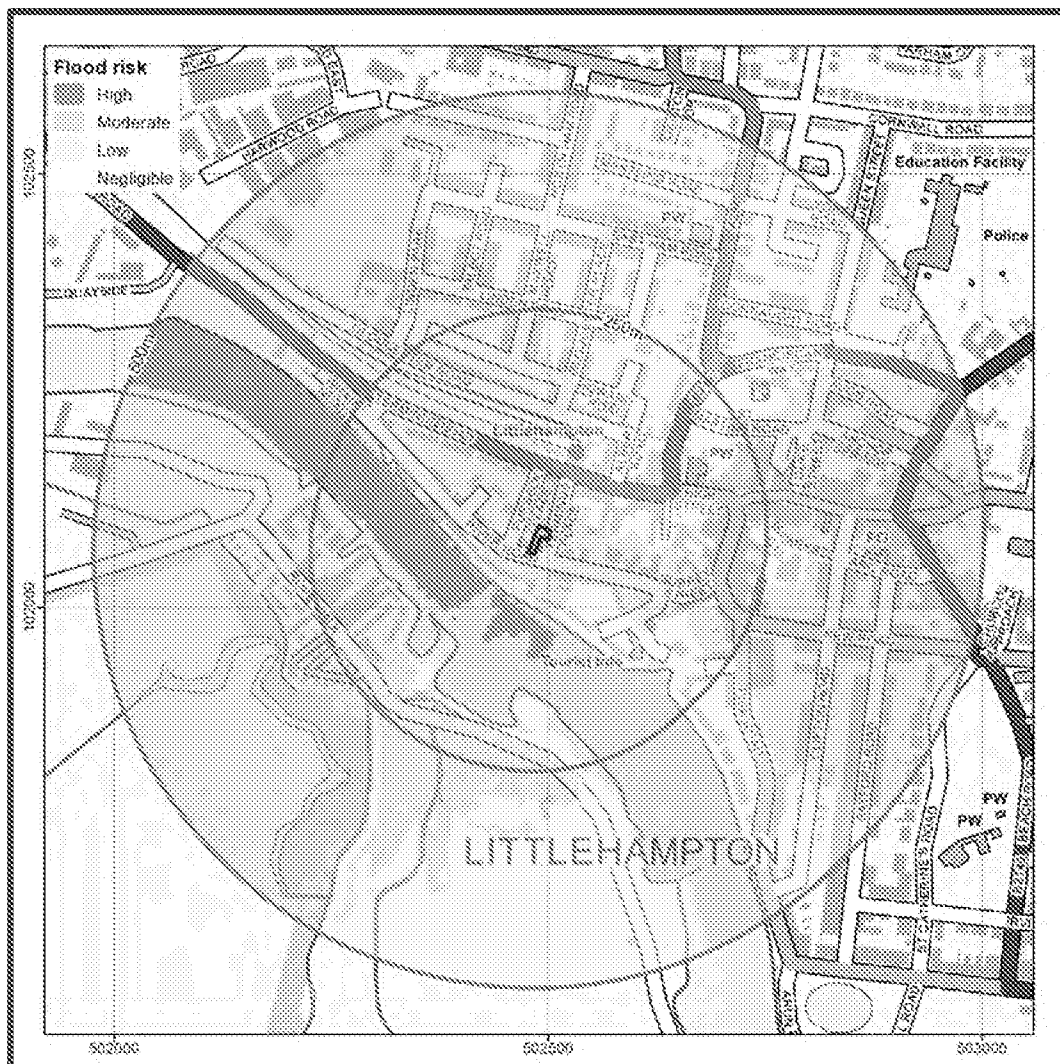
⁴ A Critical Drainage Area (CDA) is an area that has critical drainage problems and which has been notified to the local planning authority as such by the Environment Agency in line with the National Planning Policy Framework (NPPF, 2019). CDA's are specific to Flood Zone 1, defined as areas where runoff can and may have historically contributed to flooding downstream, although they are not necessarily areas where flooding problems may occur. Where a Site is located in Flood Zone 1 and within a CDA, a Flood Risk Assessment (FRA) is required and the Council may also request Sustainable Drainage Scheme (SuDS) features to be included within the proposed development.

Groundwater flooding

Groundwater flooding occurs when sub-surface water emerges from the ground at the surface or into Made Ground and structures. This may be as a result of persistent rainfall that recharges aquifers until they are full; or may be as a result of high river levels, or tides, driving water through near-surface deposits. Flooding may last a long time compared to surface water flooding, from weeks to months. Hence the amount of damage that is caused to property may be substantially higher.

Groundwater Flood Risk screening data (Figure 9) indicates there is a Moderate risk of groundwater flooding at surface in the vicinity from permeable bedrock and superficial during a 1 in 100 year event.

Figure 9. GeoSmart GW5 Groundwater Flood Risk Map (GeoSmart, 2021)



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Mapped classes combine likelihood, possible severity and the uncertainty associated with predicting the subsurface system. The map is a national scale screening tool to prompt site-specific assessment where the impact of groundwater flooding would have significant

adverse consequences. Mapping limitations and a number of local factors may reduce groundwater flood risk to land and property even where it lies within mapped groundwater flood risk zones, which do not mean that groundwater floods will occur across the whole of the risk area.

A site-specific assessment has been undertaken to refine the groundwater risk screening information on the basis of site-specific datasets (see Section 3) including BGS borehole data, and the EA's fluvial and coastal floodplain data (where available) to develop a conceptual groundwater model. The risk rating is refined further using the vulnerability of receptors including occupants and the existing and proposed Site layout, including the presence of basements and buried infrastructure. The presence of any nearby or on-Site surface water features such as drainage ditches, which could intercept groundwater have also been considered.

Based on a review of (limited) site specific data:

- A shallow water table has been identified potentially within 5 m of the ground surface. BGS borehole(ref: TQ00SW270 encountered groundwater at 4.5 m bgl and rose to 4.25 bgl after 20 minutes.
- Groundwater levels may rise in the bedrock and superficial aquifer in response to high river and coastal events.
- It is noted that groundwater flooding may also occur in response to prolonged high river levels even if overtopping of flood defences does not occur.
- Figure ADC_01 of Appendix F of the SFRA does not indicate reported incidents of historical groundwater flooding within 20 m of the Site but confirms the Site is in an area with a susceptibility to groundwater greater or equal to 75 % (JBA Consulting, 2016).
- Spring lines can in some instances give rise to groundwater seepage and overland flows, but in this instance a spring line has not been identified in the vicinity of the Site.
- Development proposals include ground and first floor living accommodation which will be set to at least 5.27 mAOD (confirmed by email).
- The site and surrounding areas are relatively urbanised and predominantly impermeable, which may limit the lateral migration of groundwater through the surface in those areas. Although buried drainage features and areas of green space in rear gardens and cracks within the surface hard-standings may provide routes for emergence.

Site specific assessment suggests that groundwater levels could reach the surface and appropriate mitigation is required. Although on the basis of the site-specific assessment and when considering mitigating features such as raised floor levels, the groundwater flood risk is considered to range between Negligible to Low. The risks are higher for buried infrastructure and soakaway systems which may be affected by high groundwater levels and where access routes from the Site cross groundwater emergence routes.

Guidance

Moderate Risk - There will be a significant possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.

Low Risk - There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.

Negligible Risk - There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.

Climate change predictions suggest an increase in the frequency and intensity of extremes in groundwater levels. Rainfall recharge patterns will vary regionally resulting in changes to average groundwater levels. A rise in peak river levels will lead to a response of increased groundwater levels in adjacent aquifers subject to the predicted climate change increases in peak river level for the local catchment. Sea level rises of between 0.4 m and 1 m are predicted by 2100, leading to a rise in average groundwater levels in the adjacent coastal aquifer systems, and potential increases in water levels in the associated drainage systems. The 'backing up' of groundwater levels from both coast and coastal estuary locations may extend a significant distance inland and affect infrastructure previously constructed above average groundwater levels.

The impact of climate change on groundwater levels beneath the Site is linked to the predicted risk in both peak river levels and sea levels and also the variation in rainfall recharge which is uncertain. Based on the available evidence the resulting increase to groundwater flood risk to internal areas of the proposed development will generally be reduced by the proposed mitigation measures.

Flooding from artificial sources

Artificial sources of flood risk include waterbodies or watercourses that have been amended by means of human intervention rather than natural processes. Examples include reservoirs (and associated water supply infrastructure), docks, sewers and canals. The flooding mechanism associated with flood risk from artificial sources is primarily related to breach or failure of structures (reservoir, lake, sewer, canal, flood storage areas, etc.)

Sewer flooding

Table 5-2 of the SFRA has identified 22 incidences or modelled incidences of flooding as a result of surcharging sewers within the BN17 5 postcode. However, it is recognised that this five digit postcode covers a large area and instances of flooding are not specific to the Site (JBA Consulting, 2016).

	Guidance
	Properties classified as “at risk” are those that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system either once or twice in the ten year reference period. Records held by the sewage utility company provide information relating to reported incidents, the absence of any records does not mean that the Site is not at risk of flooding.

Canal failure

According to Ordnance Survey (OS) mapping, there are no canals within 500 m of the Site.

Water supply infrastructure

Water supply infrastructure is comprised of a piped network to distribute water to private houses or industrial, commercial or institution establishments and other usage points. In urban areas, this represents a particular risk of flooding due to the large amount of water supply infrastructure, its condition and the density of buildings. The risks of flooding to properties from burst water mains cannot be readily assessed.

If more information regarding the condition and history of the water supply infrastructure within the vicinity of the Site is required, then it is advisable to contact the local water supplier (Southern Water).

Culverts and bridges

The blockage of watercourses or structures by debris (that is, any material moved by a flowing stream including vegetation, sediment and man-made materials or refuse) reduces flow capacity and raises water levels, potentially increasing the risk of flooding. High water levels can cause saturation, seepage and percolation leading to failure of earth embankments or other structures. Debris accumulations can change flow patterns, leading to scour, sedimentation or structural failure.

Culverts and bridges have been identified within 500 m of the Site; a tributary of the River Arun is culverted 345 m to the south west and 230 m, 250 m to the south.

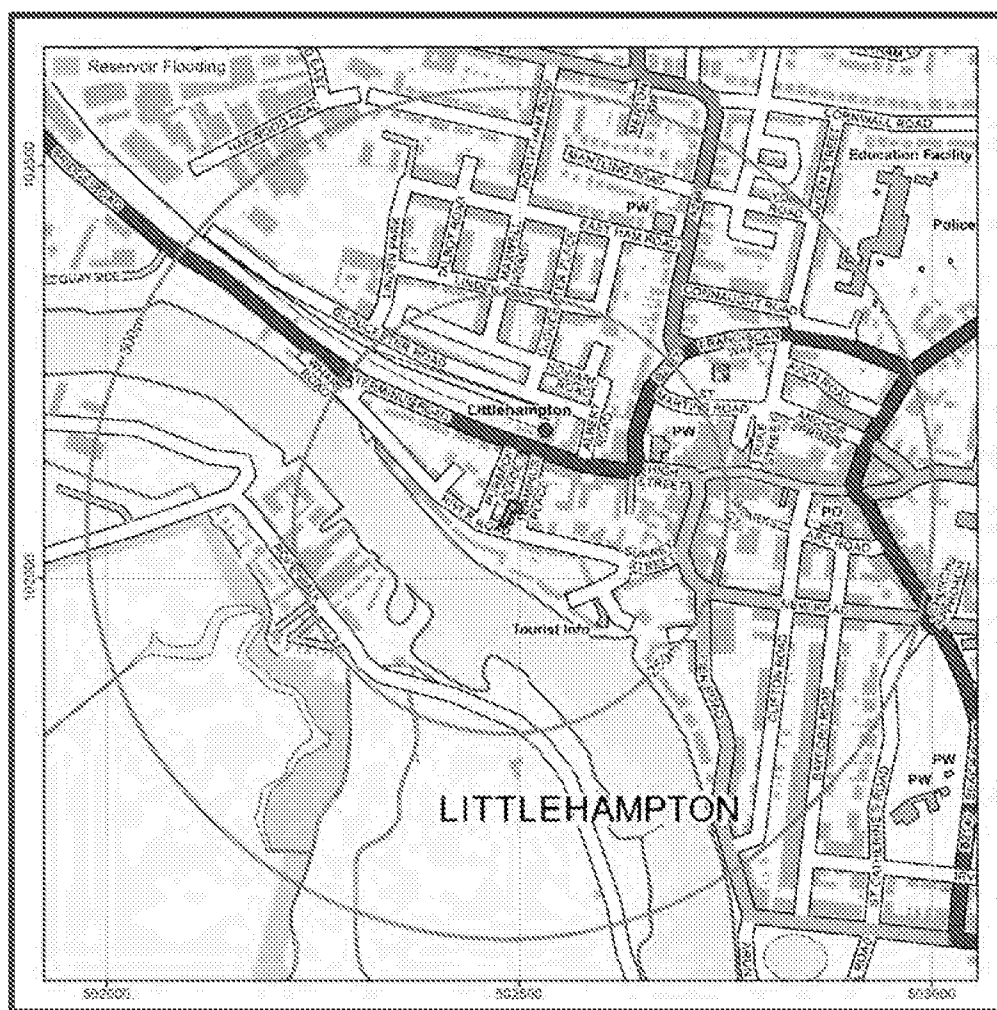
However, these structures are a significant distance from the Site on the southern bank of the River Arun and are unlikely to represent a flood risk to the Site in the event of a blockage.

The SFRA has not identified any historic drainage issues within the Site area (JBA Consulting, 2016).

Reservoir flooding

According to the EA's Risk of Flooding from Reservoir mapping the Site is not at risk of flooding from reservoirs (Figure 10) (EA, 2021).

Figure 10. EA Risk of Reservoir Flooding (EA, 2021)



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Guidance

The risk of reservoir flooding is related to the failure of a large reservoir (holding over 25,000 m³ of water) and is based on the worst-case scenario. Reservoir flooding is extremely unlikely to occur (EA, 2021).

5. Flood risk from the development



It is considered best practice to provide an overall improvement in flood risk, so improving flood storage and providing Sustainable Drainage (SuDS) features should be considered wherever possible.

Floodplain storage

The development is located within a fluvial and coastal Flood Zone and involves a decrease in the proposed building footprint. The existing building footprint is 260 m². The proposed non-floodable building footprint is 178 m² with 107 m² being floodable under croft parking areas. The Shoreline Management Plan (SMP) confirms the policy for defences over the next 100 years is to hold the line.

When a Flood Warning is issued, residents and users of the Site should be prepared to evacuate the Site and cars should be removed from the under croft parking as this is proposed to flood.

Drainage and run-off

The proposed development involves the demolition of on-Site structures and the erection of a three-storey building. An estimation of run-off is therefore required to permit effective Site water management and prevent any increase in flood risk to off-Site receptors from the Site.

The potential surface water run-off generated from the Site during a 1 in 100 year return period should be calculated using FEH 2013 rainfall data from the online Flood Estimation Handbook (FEH), developed by NERC (2009) and CEH (2016).

The NPPF (2019) recommends the effects of climate change are incorporated into drainage proposals and the recently updated climate change guidance (published in 2016 and updated in 2019) confirms the requirements for inclusion.

As the proposed development is being changed to residential, the lifespan of the development and requirements for climate change should allow up to the 2115 scenario.

Table 3. Climate change rainfall allowances

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Sustainable Drainage System (SuDS)

It is recommended that attenuation of run-off is undertaken on-Site to compensate for proposed increases in runoff over the lifespan of the development. Attenuation may comprise the provision of storage within a Sustainable Drainage System (SuDS). SuDS can deliver benefits from improving the management of water quantity, water quality, biodiversity and amenity. Potential SuDS options are presented in the table below, subject to further investigation:

Table 4. SuDS features which may be feasible for the Site

Option	Description
Rainwater harvesting	Rainwater harvesting can collect run-off from the roofs for use in non-potable situations, using water butts for example.
Green roof	Having part/all of the roof as a green roof covered in vegetation can intercept and store a proportion of the rainfall to result in an overall reduction in the amount of surface water run-off generated from a building structure. They comprise a substrate (growth medium) layer which can be seeded with specially selected plants suitable for the local climatic conditions. Beneath the growth medium is a geotextile filter layer which filters out the substrate from entering the aggregate/geo-composite drainage layer below. At the very bottom of the green roofing, a waterproof membrane protects the roof structure below.
Lined Permeable paving	Permeable pavements can be used for driveways, footpaths and parking areas to increase the amount of permeable land cover. Suitable aggregate materials (angular gravels with suitable grading as per CIRIA, 2007) will improve water quality due to their filtration capacity. Plastic geocellular systems beneath these surfaces can increase the void space and therefore storage but do not allow filtration unless they are combined with aggregate material and/or permeable geotextiles.

Due to the Moderate groundwater flood risk on-Site and spatial constraints, attenuation SuDS are recommended in preference to infiltration SuDS, this is reflected in the potential options suggested above.

It is assumed that any changes to the existing drainage system will be undertaken in accordance with best practice and that care will be taken to ensure the new development does not overload/block any existing drainage or flow pathways to/from the Site.

Based on the topography and Low surface water flood risk in the vicinity interference with overland flow paths is considered unlikely.

6. Suitability of the proposed development



The information below outlines the suitability of proposed development in relation to national and local planning policy.

National policy and guidance

The aims of the national planning policies are achieved through application of the Sequential Test and in some cases the Exception Test.

	Guidance
	Sequential test: The aim of this test is to steer new development towards areas with the lowest risk of flooding (NPPF, 2019). Reasonably available sites located in Flood Zone 1 should be considered before those in Flood Zone 2 and only when there are no reasonably available sites in Flood Zones 1 and 2 should development in Flood Zone 3 be considered. Exception test: In some cases, this may need to be applied once the Sequential Test has been considered. For the exception test to be passed it must be demonstrated that the development would provide wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Suitability of the proposed development, and whether the Sequential and Exception Tests are required, is based on the Flood Zone the Site is located within and the flood risk vulnerability classification of the existing and proposed development. Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

This report has been produced to assess all development types, prior to any development. The vulnerability classification and Flood Zones are compared within Table 5 overleaf (Table 3 of the NPPG (2014)).

As the Site is located within Flood Zone 3a and the proposed development is defined as More Vulnerable; the proposals would be acceptable subject to the Sequential and Exception Tests; but this should be confirmed with the Local Planning Authority (LPA).

Where the Sequential Test is required it must be demonstrated that there are no alternative reasonably available Sites at lower risk of flooding within an area agreed with Arun District Council. In order for a site to be considered to be reasonably available it must be 'deliverable' and 'developable' as defined by the NPPF (2019).

Table 5. Flood risk vulnerability and flood zone 'compatibility' (taken from NPPG, 2014)

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone	Zone 1 – low probability	✓	✓	✓	✓	✓
	Zone 2 – medium probability	✓	✓	Exception test required	✓	✓
	Zone 3a – high probability	Exception test required	✓	X	Exception test required	✓
	Zone 3b – functional flood plain	Exception test required	✓	X	X	X

EA Flood Risk Standing Advice for vulnerable developments located in Flood Zones 2 or 3

For all relevant vulnerable developments (i.e. more vulnerable, less vulnerable and water compatible), advice on the points should be followed:

- Surface water management;
- Access and evacuation; and
- Floor levels.

Surface water management

Plans for the management of surface water need to meet the requirements set out in either the local authority's:

- Surface water management plan where available; OR
- Strategic flood risk assessment.

They also need to meet the requirements of the approved building regulations Part H: drainage and water disposal. Read section H3 rainwater drainage.

Planning permission is required to use a material that can't absorb water (e.g. impermeable concrete) in a front garden larger than 5m².

Access and evacuation

Details of emergency escape plans should be provided for any parts of a building that are below the estimated flood level:

Plans should show:

- Single storey buildings or ground floors that don't have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;
- Basement rooms have clear internal access to an upper level, e.g. a staircase;
- Occupants can leave the building if there's a flood and there's enough time for them to leave after flood warnings.

Floor levels

The following should be provided:

- Average ground level of the building; and
- Finished floor level of the lowest habitable room in the building.

Ground floor levels should be a minimum of whichever is higher of:

- 0.3 m above the general ground level of the Site; OR
- At least 0.6 m above the estimated river or sea flood level⁵.

If you cannot raise floor levels above the estimated flood level, you need to consider extra flood resistance and resilience measures.

Extra flood resistance and resilience measures

Follow the extra flood resistance and resilience requirements for developments in flood risk areas where ground floor levels are lower than the estimated flood level for the Site.

Water depth up to 0.3 m

The design of the building or development should keep water out as much as possible. You should use materials that have low permeability (materials that water cannot pass through, for example, impermeable concrete).

⁵ This is 0.6 m above the 1 in 100 year fluvial or 1 in 200 year coastal flood events. The 0.6 m is split into a 0.3 m freeboard allowance for climate change and 0.3 m allowance for the inaccuracies in the EA's flood modelling. Where the climate change flood level is known, a 0.3 m allowance should be added to the climate change flood level to allow for the inaccuracies in the EA's flood modelling.

Water depth from 0.3 m to 0.6 m

The design of the building or development should keep water out (unless there are structural concerns) by:

- using materials with low permeability to at least 0.3 m
- using flood resilient materials (for example lime plaster) and design (for example raised electrical sockets)
- making sure there's access to all spaces to enable drying and cleaning

Water depth above 0.6 m

The design of the building or development should allow water to pass through the property to avoid structural damage by:

- using materials with low permeability to at least 0.3 m
- making it easy for water to drain away after flooding
- making sure there's access to all spaces to enable drying and cleaning

Local policy and guidance

For this report, several documents have been consulted for local policy and guidance and relevant information is outlined below:

Arun District Council Level 1 Strategic Flood Risk Assessment (JBA Consulting, 2016):

"5.3 Fluvial flood risk

The primary fluvial flood risk to Arun District is associated with the River Arun, Aldingbourne Rife and Ferring Rife. The Main Rivers watercourses in the Arun District, recorded within the Environment Agency's Statutory (Sealed) Main River dataset are detailed in Table 5-1 and a figure of their locations is provided in Appendix A. Numerous other watercourses are present within the district, some of which are listed in section 5.2.3.

The catchment of the River Arun is predominately rural, with the exception of two main urban areas of Arundel and Littlehampton. There is a long history of fluvial flooding from the River Arun. Arundel has the highest number of properties at risk from fluvial flooding along the River Arun, followed by Littlehampton. Two significant events of fluvial flooding have occurred in 1974/1974 and 2000³⁰. In the 1975 flood event more than 10 properties in Arundel were flooded. Water levels in the downstream reaches of the River Arun channel are heavily influenced by tide levels."

" 6.3 Fluvial defences in Arun District

6.3.1 Raised defences

River Arun

Water levels in the River Arun from Arundel to Littlehampton through the Arun District are influenced by tides and river flows and the risk of flooding is determined by the height and condition of the

raised flood defences adjacent to the channel banks. The location of these, and the authority which maintains them, is shown in Figure 6-1. As the river flows closer to the coast, it is normally expected that fluvial flows may have less influence on flood risk as tidal mechanisms begin to predominate.

In Arundel and on the western side of the channel at Littlehampton, the defences along the River Arun are primarily raised walls, whose maintenance is the responsibility of the private land owner. The east bank defences in Littlehampton were constructed by the Environment Agency, and post-construction these are privately maintained. Although the Environment Agency and Arun District Council have permissive powers to maintain defences, they do not hold responsibility to carry out maintenance or improvement works. Downstream of Arundel, the River Arun is defended by embankments that run along the stretch of the channel to Littlehampton. The maintenance of these embankments are the responsibility of the Environment Agency.

The defences which line the River Arun primarily have the standard of protection of 0.33% annual probability (1 in 300 chance in each and every year of experiencing an event of this magnitude) or lower (Figure 6-3) downstream of Arundel until Littlehampton.

A Flood Management Scheme for defences along the eastern bank of the River Arun adjacent to Littlehampton has recently been completed. The new defences, which extend from the coastal frontage of Littlehampton to approximately 500m beyond the A259, are reported by the Environment Agency to have been constructed to a 1 in 300 annual exceedance probability standard of protection. The new defences are under the responsibility of the private owners to maintain⁵⁵.

It is understood that there is an approximately **17m gap in the new defences close to 'Riverside Autos' in Littlehampton (NGR: 502397,102097) which is currently not to the 1 in 300-year standard of protection** (represented by the yellow star in Figure 6-1). Arun District Council understand that the **Environment Agency have arrangements in place to deploy temporary barriers at this gap** in the defence should it be necessary, until the defence line has been completed. If influential for development, the current status of this defence should be determined.

The condition grade for the embankment defences along the River Arun is generally 'Very Good', 'Good' or 'Fair' (Figure 6-2). However, a section of wall (circa 115m length) on the north bank south of River Road at Arundel has a condition grade of 'Poor', a condition grade also assigned to circa 350m of the River Arun west bank at the southern extent of Rope Walk."

"7.4.3 Raised floor levels

The raising of floor levels within a development avoids damage occurring to the interior, furnishings and electrics in times of flood. If it has been agreed with the Environment Agency that, in a particular instance, the raising of floor levels is acceptable, the developer should be **raised to a minimum of 600mm above the maximum water level caused by a 1 in 100-year fluvial flood event including an appropriate allowance for climate change or 1 in 200-year tidal/coastal flood event plus an appropriate allowance for climate change**. However, if raised floor levels are proposed these should be agreed with Arun District Council. The minimum Finished Floor Level (FFL) may change depended on the vulnerability and flood risk of the development. Reference to the latest climate change guidance will be made when considering the FFL.

Many areas currently situated within Flood Zone 2 may become part of Flood Zone 3a in the future due to the effects of climate change, therefore it is essential that the potential risk of flooding in the future is considered when planning development.

Allocating the ground floor of a building for less vulnerable, non-residential, use is an effective way of raising living space above flood levels.

Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route. However, access and egress would still be an issue, particularly when flood duration covers many days. **All sleeping accommodation in Flood Zone 2 and 3a should be located above the recommended flood level.** No sleeping accommodation should be located in Flood Zone 3b.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone will be required to pass the Exception Test."

"7.4.5 Modification of ground levels

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken at locations where raising ground levels could adversely affect existing communities and property.

In most areas of fluvial flood risk, raising land above the floodplain would reduce conveyance or flood storage in flood the floodplain and could adversely impact flood risk downstream or on neighbouring land.

Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated).

Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

Raising levels can also create areas where surface water might pond during significant rainfall events.

Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land. Any proposal for modification of ground levels will need to be assessed as part of a detailed flood risk assessment."

Beachy Head to Selsey Bill Shoreline Management Plan (South Downs Coastal Group, 2006):

"The coast between Brighton and Littlehampton is low lying, with limited sediment input and linkage along the frontage, and is susceptible to significant flood risk. The main defence along this section is the shingle beach which if not maintained will be susceptible to breaches, increasing in frequency, particularly in the longer term. This will lead to loss of properties and important historical assets, and flood damage to many more. **Thus, there is justification, economically, to maintain defences**

and hold the line. However, to maintain this Hold the Line policy in the longer term, linear hard defences would need to be maintained along the frontage with significant lengths of new defences constructed where at present only a beach offers protection from flood damage and erosion losses. Given the nature of sea level rise, these defences will become significantly large structures associated with narrower beaches, which would have an impact on the tourist and coastal industries in this area."

Adoption Arun Local Plan 2011-2031 (Arun District Council, 2018):

"18.1 Water

... **18.1.2** Climate change is also likely to increase the risk of flooding in the District from rivers and the sea. Development must adapt to this by being suitably located away from areas at risk from flooding and by incorporating measures to mitigate against the impact of flooding such as sustainable drainage systems which reduce the volume of surface water rapidly entering groundwater flows which can result in surface water flooding and water pollution."

"18.3 Flooding

18.3.1 All of Arun District is at some level of risk from flooding, with large areas within Zones 2 or 3 of the Environment Agency's Flood Map. Much of the coastline, including the towns of Bognor Regis and Littlehampton, is currently low lying and protected against erosion and tidal inundation by coastal defences. Parts of the coastal plain are at risk of flooding from watercourses or groundwater due to a high water table .

"Policy WDM2

Flood risk

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

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

Guidance

Strategic Flood Risk Assessments are carried out by local authorities, in consultation with the Environment Agency, to assess the flood risk to the area from all sources both now and in the future due to climate change. They are used to inform planning decisions to ensure inappropriate development is avoided (NPPF, 2019).

7. Resilience and mitigation



Based on the flood risk identified at the Site, the national and local policies and guidance and proposed development, the mitigation measures outlined within this section of the report are likely to help protect the development from flooding.

Rivers (fluvial) & Sea (coastal/tidal) flood mitigation measures

The Site is located within an area which is affected by flooding from the sea, the following table confirms the flood depths associated with the area proposed for development.

Table 6. Flood levels compared to ground levels in the area proposed for development

Ground levels at the Site (mAOD)	Modelled Flood Levels (mAOD)				
	2012 0.5 % AEP	2115 0.5 % AEP	2121 0.5 % AEP		0.1 % AEP
			Higher central	Upper end	
Lower Ground Floor					
3.29 and 4.07	N/A	4.55	4.64	4.67	4.03
Flood depths	No flooding anticipated	Up to 1.26 m	Up to 1.35 m	Up to 1.38 m	Up to 0.74 m
Ground Floor FFL					
5.27	N/A	4.55	4.64	4.67	4.03
Flood depths	No flooding anticipated	No flooding anticipated	No flooding anticipated	No flooding anticipated	No flooding anticipated

Raising minimum floor levels

The vulnerability classification of the Site and the Flood Zone means proposals for the Site fall under the EA's Flood Risk Standing Advice (FRSA) for More Vulnerable developments. In this instance, in line with the EA's FRSA the recommended minimum Finished Floor Level (FFL) of the ground floor should be set at least 0.6 m above the 1 in 200 year 2121 scenario flood level of 4.67 mAOD.

Table 7. Recommended Minimum Finished Floor Level Required

Ground Level (mAOD)	Flood Level (mAOD)	Freeboard above Flood Level (m)	Recommended FFL (mAOD)
3.29 and 4.07	4.67	0.6 m	5.27

Raising of finished floor levels to 5.27 mAOD is in line with the SFRA requirements (2016) and this would reduce the flood risk to the development from Medium to Low.

Additional Mitigation

As the defence policy to hold the line runs to 2105, it is recommended that the following flood resilience measures are also considered, as well as providing additional mitigation for the 1000 year event.

- Flood resilient materials and designs:
 - Use of low permeability building materials up to 0.3 m such as engineering bricks (Classes A and B) or facing bricks;
 - Hard flooring and flood resilient metal staircases;
 - The use of internal lime plaster/render or where plasterboards are used these should be fitted horizontally instead of vertically and/or using moisture resistant plasterboard at lower levels;
 - Water, electricity and gas meters and electrical sockets should be located above the predicted flood level;
 - Communications wiring: wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage.

As flood depths are expected to exceed 0.6 m in the parking and bin storage areas of the Site, a water entry strategy should be adopted for the lower ground floor to preserve building integrity and to promote flood resilience rather than resistance (which is more difficult to achieve for significant flood depths). A structural engineer should be consulted to confirm this would be a suitable strategy for the proposed development, to ensure flood flows would not impact the structural integrity of the building. Potential strategies include:

- Lower ground floor designed to permit water passage at high flood depths;
- Hard flooring and flood resilient metal staircases;
- Heating systems, electrical sockets and utility meters should be raised above the predicted flood level where possible; and
- Sump and pump.

Where mitigation measures are implemented this would reduce the flood risk to the development from Medium to Low over the lifetime of the development.

A Flood Warning and Evacuation Plan (FWEP) is recommended to ensure persons using the Site can evacuate safely on receipt of a Flood Warning. Occupants of the Site should be signed up to receive EA Flood Alerts and Flood Warnings.

Surface water (pluvial) flood mitigation measures

As the Site is not identified as being at risk of pluvial flooding, mitigation measures are not required.

A Sustainable Drainage Strategy (SuDS) should be developed for the Site, for effective management of surface water runoff over the lifetime of the proposed development.

Groundwater flood mitigation measures

It is likely the flood mitigation measures recommended for fluvial; and coastal risk will be sufficient to reduce the groundwater flood risk at the development. However specific groundwater measures that may also be considered for the Negligible to Moderate risks identified include:

- Waterproofing of the lower ground floor;
- Interceptor drains;
- Automatic sump and pump to extract flood water; and
- Non-return flap valves on the proposed foul and surface water sewer lines.

Reservoir flood mitigation measures

The Site is not a risk of flooding from reservoirs; therefore, mitigation measures are not required.

Other flood risk mitigation measures

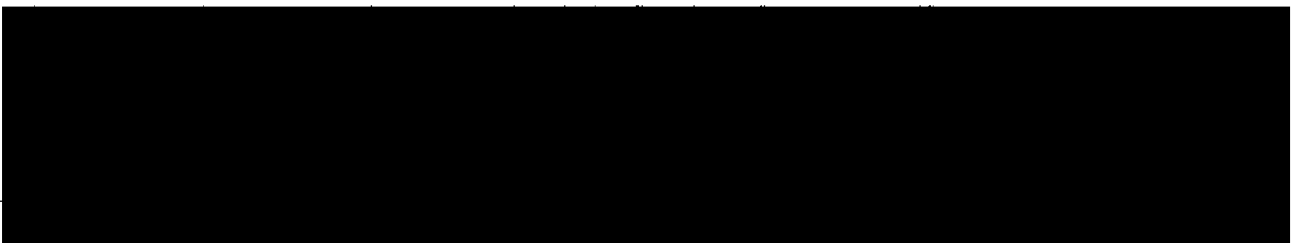
A risk has been identified from sewers, although the level of risk could not be determined.

Residual flood risk mitigation measures

The risk to the Site has been assessed from all sources of flooding and appropriate mitigation and management measures proposed to keep the users of the development safe over its lifetime. There is however a residual risk of flooding associated with the potential for failure of mitigation measures if regular maintenance and upkeep isn't undertaken. If mitigation measures are not implemented or maintained, the risk to the development will remain as the baseline risk.

Further flood mitigation information

More information on flood resistance, resilience and water entry can be found here:



Emergency evacuation - safe access / egress and safe refuge

Emergency evacuation to land outside of the floodplain should be provided if feasible. Where this is not possible, 'More Vulnerable' developments and, where possible, development in general should have internal stair access to an area of safe refuge within the building to a level higher than the maximum likely water level. An area of safe refuge should be sufficient in size for all potential users and be reasonably accessible to the emergency services.

Emergency evacuation from the development and the Site should only be undertaken in strict accordance with any evacuation plans produced for the Site, with an understanding of the flood risks at the Site including available mitigation, the vulnerability of occupants and preferred evacuation routes.

Flood warnings

The EA operates a flood warning service in all areas at risk of flooding; this is available on their website: [REDACTED] The Site is located within an EA Flood Alerts/Warning coverage area (ref: 065FWC2602) so is able to receive alerts and warnings (Figure 11). All warnings are also available through the EA's 24 hour Floodline Service 0345 988 1188.

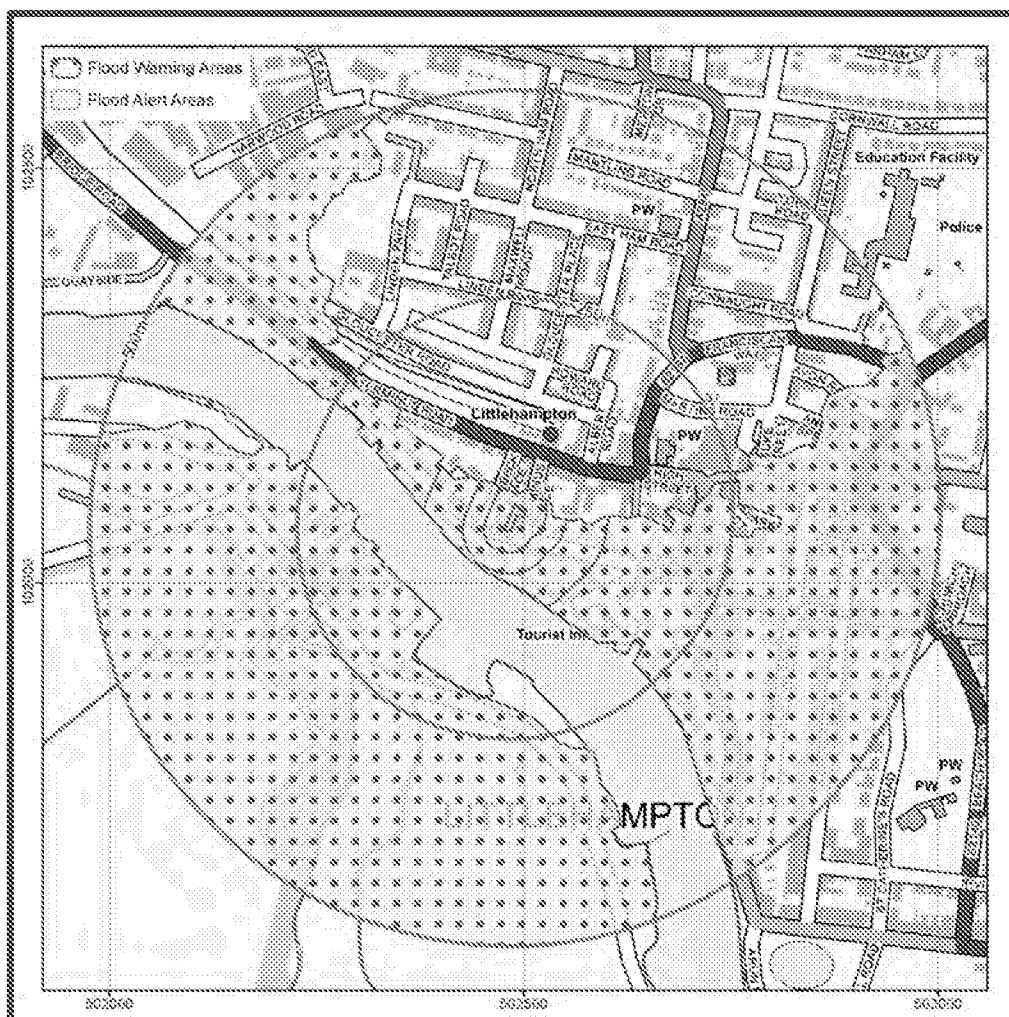
The EA aims to issue Flood Warnings 2 hours in advance of a flood event. Flood Warnings can provide adequate time to enable protection of property and evacuation from a Site, reducing risk to life and property.

Emergency evacuation

Where possible, a safe access and egress route with a 'very low' hazard rating from areas within the floodplain to an area wholly outside the 1 in 100 year flood event including an allowance for climate change should be demonstrated.

Based on the EA's Flood Zone Map the closest dry evacuation area within Flood Zone 1 is adjacent to the north along Terminus Road. It is advised that evacuation from the premises would be the preferred option in a flood event if safe to do so. It is recommended that residents prepare to evacuate as soon as an EA Flood Warning is issued in order to completely avoid flood waters.

Figure 11. EA Flood Warning Coverage for the local area (EA, 2021).



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On-Site refuge (Invacuation)

Evacuation should be the primary action in preference, however safe refuge (Invacuation) could be sought at first floor level in a worst-case scenario as the residential areas of the development are situated on the ground and first floor.

Other relevant information

A Flood Warning and Evacuation Plan (FWEP) is recommended, and occupants should be signed up to receive EAs Flood Alerts and Warnings.

Registration to the Environment Agency's flood warning scheme can be done by following this link [\[REDACTED\]](#)

It is recommended that main communication lines required for contacting the emergency services, electricity sockets/meters, water supply and first aid stations and supplies are not compromised by flood waters. Where possible these should all be raised above the extreme flood level.

8. Conclusions and recommendations



Table 8. Risk ratings following implementation and subsequent maintenance of mitigation measures

Table 9. Source of Flood Risk	Baseline	After Mitigation
Sea (coastal/tidal) and River (fluvial) flooding	Medium	Low
Surface water (pluvial) flooding	Very Low	N/A
Groundwater flooding	Moderate	Negligible to Low
Other flood risk factors present	Yes ¹	Yes
Is any other further work recommended?	Yes	No

N/A = mitigation not required

¹A risk has been identified from sewers, although the level of risk could not be determined.

The table below provides a summary of where the responses to key questions are discussed in this report. Providing the recommended mitigation measures are put in place it is likely that flood risk to this Site will be reduced to an acceptable level.

Table 10. Summary of responses to key questions in the report

Key sources of flood risks identified	Yes, costal & fluvial, groundwater (see Section 4).
Are standard mitigation measures likely to provide protection from flooding to/from the Site?	Yes (see Section 7).
As there is a risk of flooding from both fluvial and coastal sources, Finished Floor Levels (FFL) of the proposed ground floor of the development will be set to 5.27 mAOD ⁶ . Standard flood resilient design measures will also be incorporated above this level to	

⁶ 600mm above the design flood level of 4.67 mAOD, in line with the SFRA requirements.

provide further protection in the event that the flood defences are not maintained in line with current policy or the 1 in 1000 year event occurred.

Is any further work recommended?

Yes

- As there is a risk of flooding from groundwater sources, surrounding ground levels and ground levels should slope away from buildings. Risk to buried infrastructure should be considered along with standard flood resilient design and non-return valves on the sewer outlet.
- A Flood Warning and Evacuation Plan (FWEP) is recommended to ensure persons using the Site can evacuate safely on receipt of a Flood Warning.
- Occupants of the Site should be signed up to receive EA Flood Alerts and Flood Warnings.
- A Sustainable Drainage Strategy (SuDS) should be developed for the Site, for effective management of surface water runoff over the lifetime of the proposed development.

GeoSmart recommend the mitigation measures discussed within this report are considered as part of the proposed development where possible and evidence of this is provided to the Local Planning Authority as part of the planning application.

9. Further information



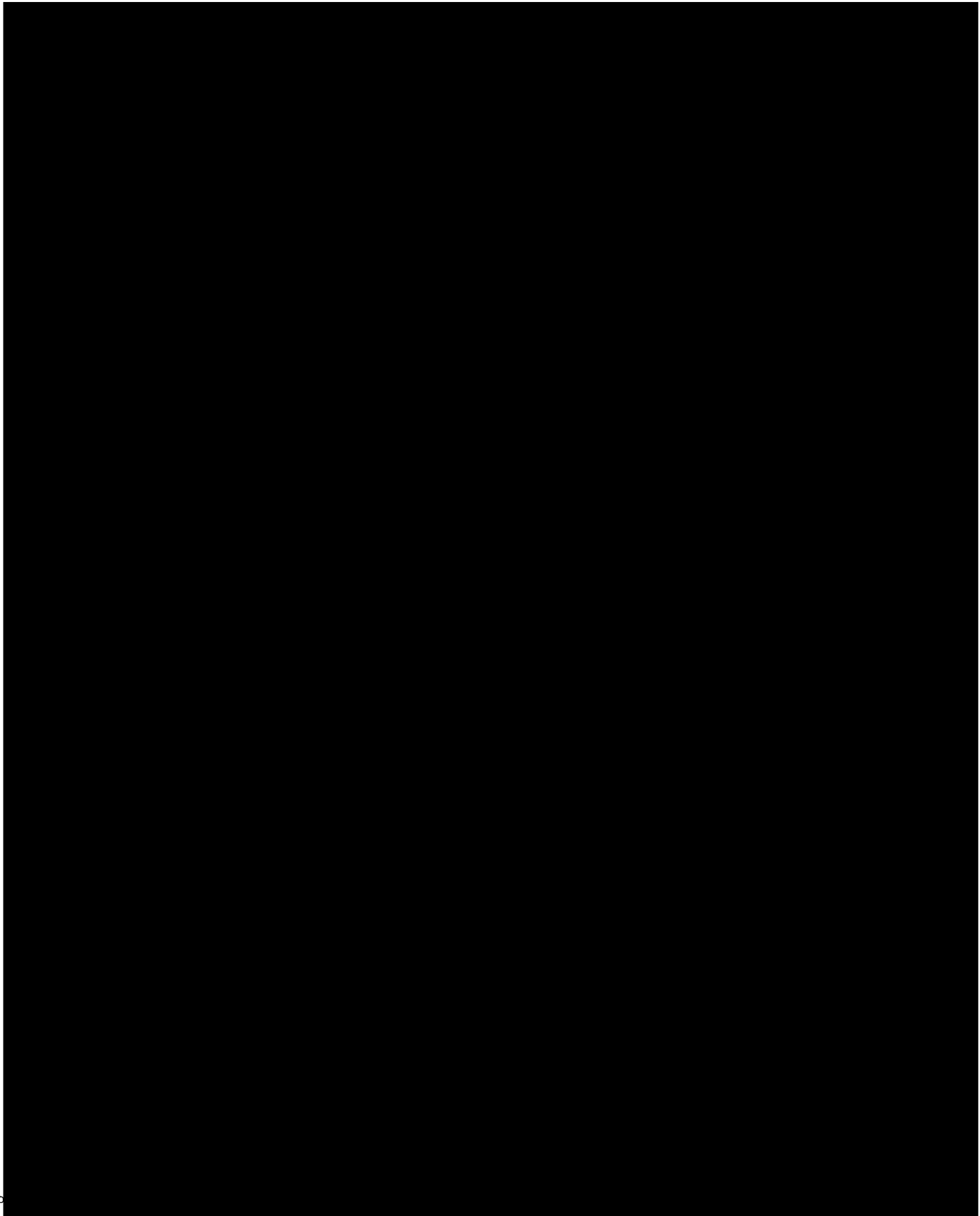
The following table includes a list of additional products by GeoSmart:

Additional GeoSmart Products			
✓	Additional assessment: SuDSmart Report		The SuDSmart Report range assesses which drainage options are available for a Site. They build on technical detail starting from simple infiltration screening and work up to more complex SuDS Assessments detailing alternative options and designs. Please contact info@geosmartinfo.co.uk for further information.
✓	Additional assessment: EnviroSmart Report		Provides a robust desk-based assessment of potential contaminated land issues, taking into account the regulatory perspective. Our EnviroSmart reports are designed to be the most cost effective solution for planning conditions. Each report is individually prepared by a highly experienced consultant conversant with Local Authority requirements. Ideal for pre-planning or for addressing planning conditions for small developments. Can also be used for land transactions. Please contact info@geosmartinfo.co.uk for further information.

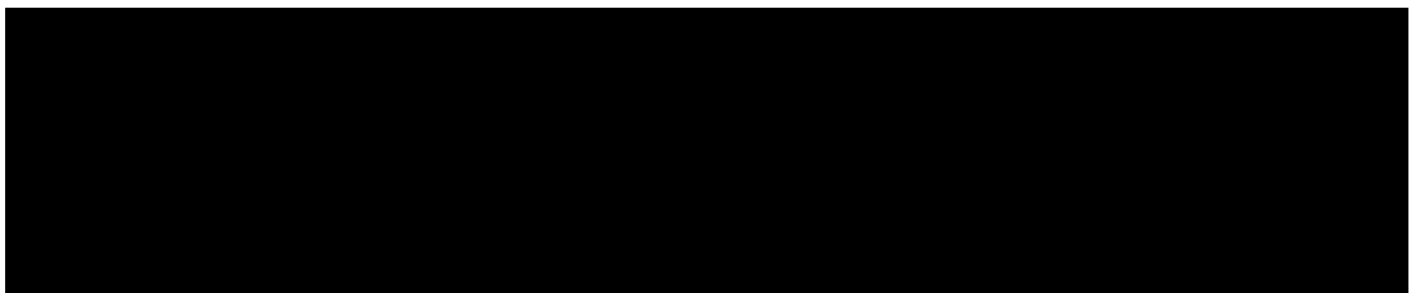
10. References and glossary



References



Arun District Council (2018) Adoption Arun Local Plan 2011-2031. Accessed from:
<https://www.arun.gov.uk/download.cfm?doc=docm93jjm4n12844.pdf&ver=12984> on
19/04/21.



Glossary

General terms

BGS	British Geological Survey
EA	Environment Agency
GeoSmart groundwater flood risk model	GeoSmart's national groundwater flood risk model takes advantage of all the available data and provides a preliminary indication of groundwater flood risk on a 50m grid covering England and Wales. The model indicates the risk of the water table coming within 1 m of the ground surface for an indicative 1 in 100 year return period scenario.
Dry-Island	An area considered at low risk of flooding (e.g. In a Flood Zone 1) that is entirely surrounded by areas at higher risk of flooding (e.g. Flood Zone 2 and 3)
Flood resilience	Flood resilience or wet-proofing accepts that water will enter the building, but through careful design will minimise damage and allow the re-occupancy of the building quickly. Mitigation measures that reduce the damage to a property caused by flooding can include water entry strategies, raising electrical sockets off the floor, hard flooring.
Flood resistance	Flood resistance, or dry-proofing, stops water entering a building. Mitigation measures that prevent or reduce the likelihood of water entering a property can include raising flood levels or installation of sandbags.
Flood Zone 1	This zone has less than a 0.1% annual probability of river flooding
Flood Zone 2	This zone has between 0.1 and 1% annual probability of river flooding and between 0.1% and 0.5 % annual probability sea flooding
Flood Zone 3	This zone has more than a 1% annual probability of river flooding and 0.5% annual probability of sea flooding
Functional Flood Plain	An area of land where water has to flow or be stored in times of flood.
Hydrologic model	A computer model that simulates surface run-off or fluvial flow. The typical accuracy of hydrologic models such as this is $\pm 0.25\text{m}$ for estimating flood levels at particular locations.
OS	Ordnance Survey
Residual Flood Risk	The flood risk remaining after taking mitigating actions.
SFRA	Strategic Flood Risk Assessment. This is a brief flood risk assessment provided by the local council

SuDS

A Sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SuDS also significantly improve the quality of water leaving the Site and can also improve the amenity and biodiversity that a Site has to offer. There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. Sites over 1 Ha will usually require a sustainable drainage assessment if planning permission is required. The current proposal is that from April 2014 for more than a single dwelling the drainage system will require approval from the SuDS Approval Board (SABs).

Aquifer Types

Principal aquifer

These are layers of rock or drift deposits that have 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.

Secondary A aquifer

Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

Secondary B aquifer

Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Secondary undifferentiated

Has been assigned in cases where it has not been possible to attribute either category A or B to a rock type due to the variable characteristics of the rock type.

Unproductive Strata

These are rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

NPPF (2019) terms

Exception test

Applied once the sequential test has been passed. For the exception test to be passed it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Sequential test

Aims to steer new development to areas with the lowest probability of flooding.

Essential infrastructure

Essential infrastructure includes essential transport infrastructure, essential utility infrastructure and wind turbines.

Water compatible	Water compatible land uses include flood control infrastructure, water-based recreation and lifeguard/coastal stations.
Less vulnerable	Less vulnerable land uses include police/ambulance/fire stations which are not required to be operational during flooding and buildings used for shops/financial/professional/other services.
More vulnerable	More vulnerable land uses include hospitals, residential institutions, buildings used for dwelling houses/student halls/drinking establishments/hotels and sites used for holiday or short-let caravans and camping.
Highly vulnerable	Highly vulnerable land uses include police/ambulance/fire stations which are required to be operational during flooding, basement dwellings and caravans/mobile homes/park homes intended for permanent residential use.

Data Sources

Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2021 BlueSky copyright and database rights 2021
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2021 Ordnance Survey data © Crown copyright and database right 2021
Flood Risk (Flood Zone/RoFRS/Historic Flooding/Pluvial/Surface Water Features/Reservoir/ Flood Alert & Warning)	Environment Agency copyright and database rights 2021 Ordnance Survey data © Crown copyright and database right 2021
Flood Risk (Groundwater)	GeoSmart, BGS & OS GW5 (v2.4) Map (GeoSmart, 2021) Contains British Geological Survey materials © NERC 2021 Ordnance Survey data © Crown copyright and database right 2021
Location Plan	Contains Ordnance Survey data © Crown copyright and database right 2021
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2021 Environment Agency copyright and database rights 2021

11. Appendices



Appendix A



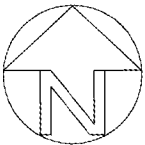
Site plans



Proposed Block Plan Scale 1:500 @A3



Existing Site Location Plan
Scale 1:1250 @A3



Draft planning

rev.	date

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client **Hall Homes**

project **25 River Road
Littlehampton**

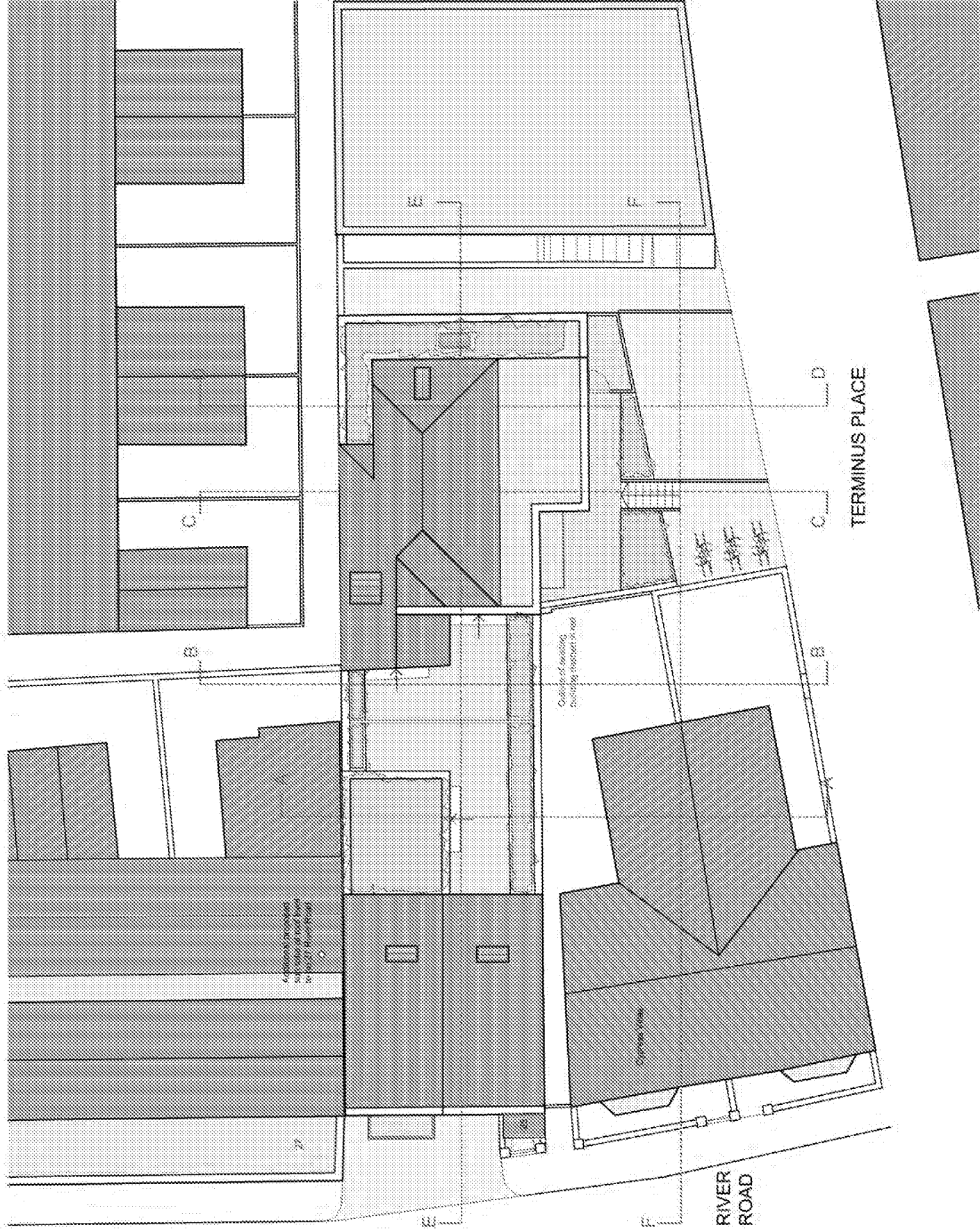
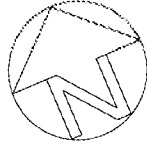
drawing **Block & Site Location Plans**

scale **Shown@A3** date **March 2020**
drawn **MOONCIE**

19a Wilbury Avenue
Hove, East Sussex
BN3 6HS
tel: 01273 203230
fax: 01273 321687
email: info@turnerassociates.co.uk



TA 1235 /01 rev.



Draft planning

ref	1000
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Sheet Hall Homes

project 25 River Road
Littlehampton

drawing Proposed Site Plan

scale Shown@A3 date March 2020
drawn MCOONCE

15a Wilbury Avenue
Hove, East Sussex
BN3 6HS

ref: 01273 203239
fax: 01273 521687
email: info@turnerassociates.co.uk

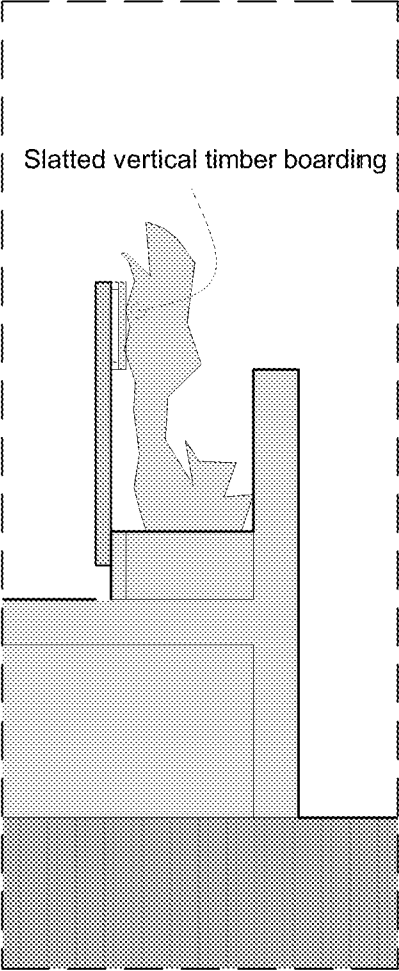


Turner Associates
architects and planning consultants

TA 1235 / 10

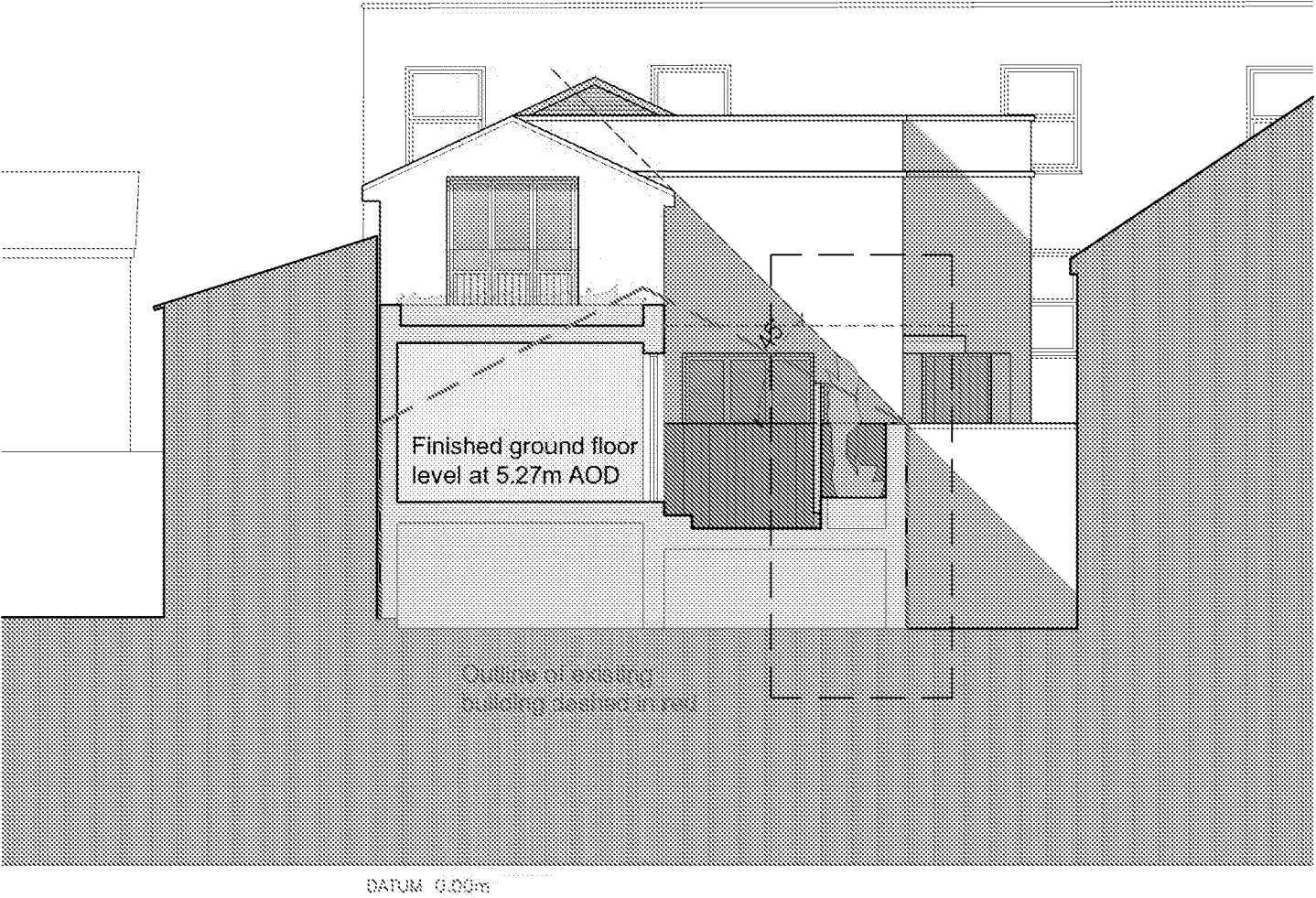
Proposed Site Plan Scale 1:200 @A3



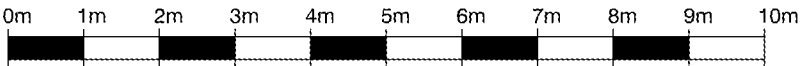
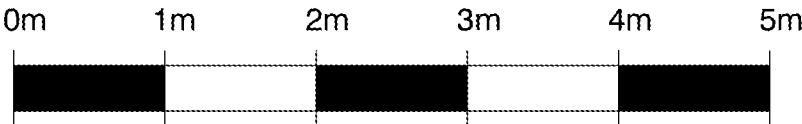


Slatted vertical timber boarding

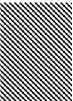
Proposed section AA detail
Scale 1:50 @A3



Proposed section AA Scale 1:100 @A3
See drawings 10, 11, 12, 13 for section references
See enlarged detail of dashed area adjacent



Planning issue

rev.	date
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client	Hall Homes
project	25 River Road Littlehampton
drawing	Proposed Section AA
scale	Shown@A3
date	March 2020
drawn	MOONCIE
19a Wilbury Avenue Hove, East Sussex BN3 6HS	
tel: 01273 293230 fax: 01273 321687 email: info@taarchitects.co.uk	
 Turner Associates Architects and Planning Consultants	
TA 1235 / 18	
rev.	

Appendix B



Environment Agency data

Becky Davies
GeoSmart

Our ref: SSD211547
Date: 31/03/2021

Dear Becky Davies,

Enquiry Regarding Product 4 for a Flood Risk Assessment for 25 River Road, Littlehampton, BN17 5BZ.

Thank you for your enquiry which was received on 9th March 2021.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

The information on Flood Zones in the area relating to this address is as follows:

The site is in an area located within Flood Zone 1, 2 & 3 as shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself as it is influenced by factors such as the height of door steps, air bricks or the height of surrounding walls. We do not have access to this information and is not currently used in our flood modelling.

Flood Zone definitions can be found at www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

Flood Defences

There are flood defences in the form of a flood wall, the Asset ID is 154862.

Model Information

The model used was the Arun to Adur Coastal Modelling which was completed by JBA Consulting in 2012, with updated defended modelling (2017).

Flood History

We hold no record of previous flooding events affecting this site.

Please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flood Authority, **West Sussex County Council** or the Local Authority, **Arun District Council** for a more comprehensive flood history check.

FRA advisory text

Name	Product 4
Description	Detailed Flood Risk Assessment Map for 25 River Road, Littlehampton, BN17 5BZ.
Licence	<u>Open Government Licence</u>
Information Warnings	The flood risk data provided is based on existing EA hydraulic models for existing 0.5% annual probability events with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 17 December 2019. You should refer to ' <u>Flood risk assessments: climate change allowances</u> ' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
Information Warning - OS background mapping	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2021 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

- Flood Map For Planning (Flood Zone 2, Flood Zone 3, Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)
- Risk of Flooding from Rivers and Sea
- Historic Flood Map
- Current Flood Warnings

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

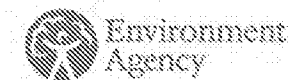
Yours sincerely,

Tom Lamboo

FCRM Officer, Partnership & Strategic Overview West Sussex, Solent and South Downs

Environment Agency, Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD

Flood Map for Planning (Rivers and Sea). Centred BN17 5BZ. Created 31/03/2021.



1: 10,000

0 Metres 250



Flood Map for Planning (Rivers & Sea)

- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

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

Use of Environment Agency Information for Flood Risk Assessments

Important

The Environment Agency are keen to work with partners to enable development which is resilient to flooding for its lifetime and provides wider benefits to communities. If you have requested this information to help inform a development proposal, then we recommend engaging with us as early as possible by using the pre-application form available from our website:

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

We recognise the value of early engagement in development planning decisions. This allows complex issues to be discussed, innovative solutions to be developed that both enables new development and protects existing communities. Such engagement can often avoid delays in the planning process following planning application submission, by reaching agreements up-front. We offer a charged pre-application advice service for applicants who wish to discuss a development proposal.

We can also provide a preliminary opinion for free which will identify environmental constraints related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In preparing your planning application submission, you should refer to the Environment Agency's Flood Risk Standing Advice and the Planning Practice Guidance for information about what flood risk assessment is needed for new development in the different Flood Zones. This information can be accessed via:

<https://www.gov.uk/flood-risk-assessment-standing-advice>
<http://planningguidance.planningportal.gov.uk/>

You should also consult the Strategic Flood Risk Assessment or other relevant materials produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or surface water runoff. Information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires an FRA and this is not submitted or is deficient, the Environment Agency may raise an objection.



Environment
Agency



Legend

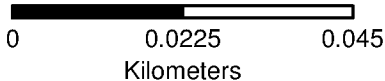


Site_Nodes



Site_Boundary

Scale: 1:1,000



Product 4 Flood Risk Data Requested by: GeoSmart
Site: 25 River Road, Littlehampton, BN17 5BZ

Table 1: Water Levels: Tidal Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			0.5%	0.5% (2065)	0.5% (2115)	0.1%
1	502483	102068	3.77	4.30	4.88	4.03
2	502494	102087	-	4.30	4.88	4.03

Table 2: Water Levels: Tidal Defended

Node Ref	NGR		Modelled Flood Levels in Metres AOD			
	Eastings	Northings	Defended Annual Exceedance Probability			
			0.5%	0.5% (2065)	0.5% (2115)	0.1%
1	502483	102068	-	-	4.36	-
2	502494	102087	-	-	4.55	-

Table 3: Water Depths: Tidal Undefended

Node Ref	NGR		Modelled Flood Depths in Metres			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			0.5%	0.5% (2065)	0.5% (2115)	0.1%
1	502483	102068	0.46	0.99	1.57	0.71
2	502494	102087	-	0.31	0.89	0.05

Table 4: Water Depths: Tidal Defended

Node Ref	NGR		Modelled Flood Depths in Metres			
	Eastings	Northings	Defended Annual Exceedance Probability			
			0.5%	0.5% (2065)	0.5% (2115)	0.1%
1	502483	102068	-	-	1.10	-
2	502494	102087	-	-	0.64	-

All levels taken from: Arun to Adur Coastal Modelling (2012) with updated defended modelling (2017)

Produced on: 13/01/2020

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.



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Agency



N

Legend

-  Site_Boundary
-  0.5% AEP Defended Tidal
-  0.5% AEP (2065) Defended Tidal
-  0.5% AEP (2115) Defended Tidal
-  0.1% AEP Defended Tidal

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



00.2250.45

Kilometers







Environment
Agency

N
▲

Legend

Site_Boundary

0.5% AEP (2012) (Un defended)

0.5% AEP (2070) (Un defended)

0.5% AEP (2115) (Un defended)

0.1% AEP (2012) (Un defended)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000

00.2250.45

Kilometers

Legend

Please see page 2 for asset
symbology



1: 10,000

0 250

Metres



Structures

-  Control Gate
-  Draw Off Tower
-  Fish Pass
-  Hydrobrake
-  In Channel Stoplogs
-  Inspection Chamber
-  Jetty
-  Outfall
-  Screen
-  Spillway
-  Stilling Basin
-  Weir

Beach Structures

-  Breakwater
-  Ramp
-  Slipway
-  Steps
-  Groyne

Instruments

-  Active Monitoring
-  Passive Monitoring

Channel Crossings

-  Bridge
-  Utility Services

Aids to Navigation

-  Beacon
-  Buoy
-  Dolphin
-  Signage
-  Signal

Building Assets

-  Pump House

Major Civils

-  Abutment
-  Central Pier

Defences

-  Embankment
-  Wall
-  Flood Gate
-  Demountable defence
-  Bridge abutment
-  High Ground
-  Beach
-  Barrier Beach
-  Promenade
-  Quay
-  Cliff
-  Dunes

Channels

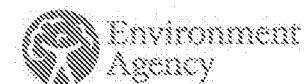
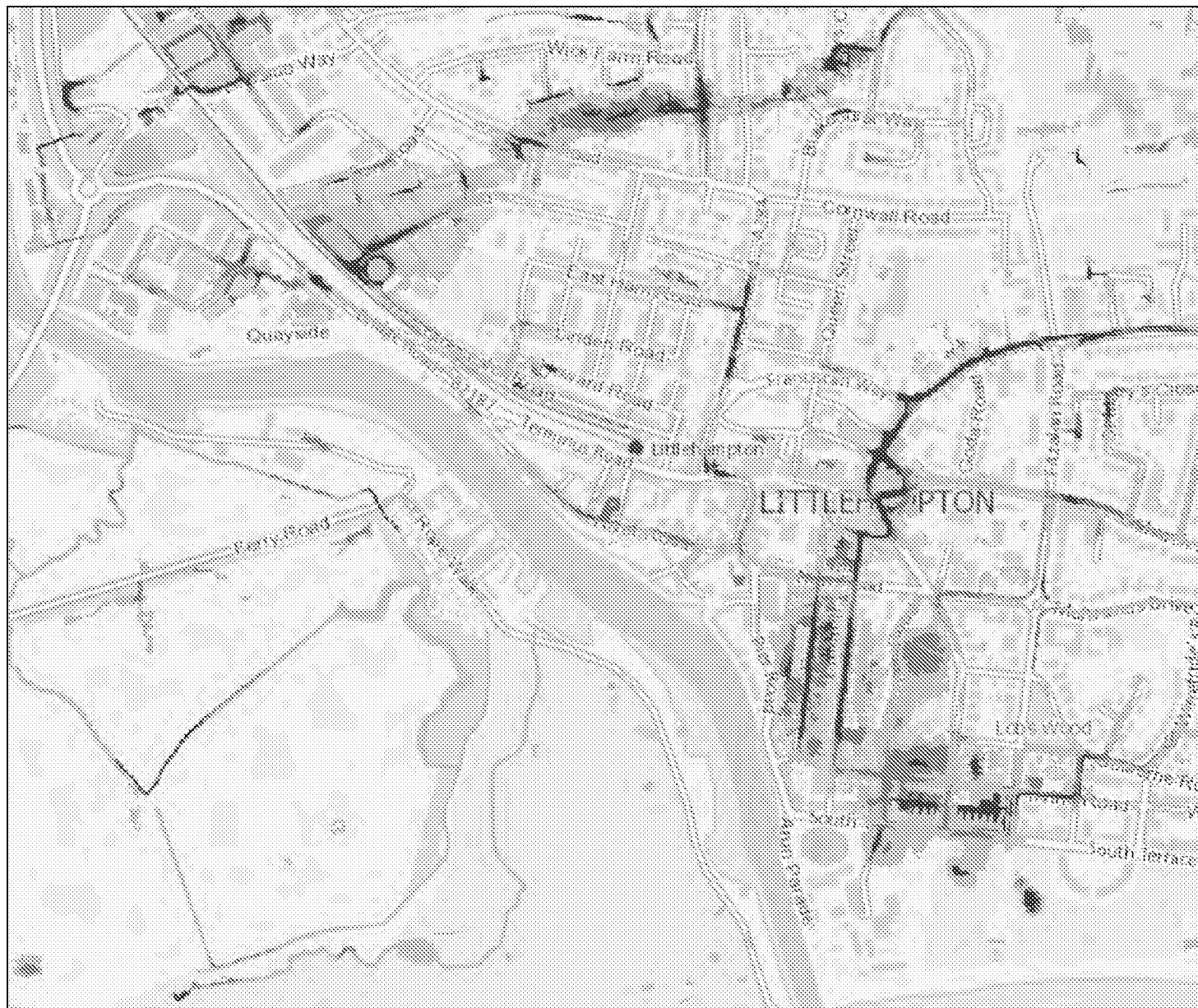
-  Open channel
-  Simple culvert
-  Complex culvert

Land

-  Mudflats
-  Saltmarsh
-  Washland

Sites

-  Amenity
-  Control Structure
-  Erosion Protection
-  General
-  Harbour
-  Monitoring
-  Navigation Lock
-  Pumping Station
-  Reservoir
-  Tidal Barrier



1: 10,000

0 Metres 250



Likelihood of flooding from Surface Water

- High ($\geq 3.3\%$)
- Medium (3.3% - 1%)
- Low (1% - 0.1%)
- Very Low
- Flood Extent 1 in 30
- Flood Extent 1 in 100
- Flood Extent 1 in 1000

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 GOV.UK.



Solent & South Downs Area

Pre-application Advice Note

September 2019

This document sets out the environmental issues we will consider when providing our planning application consultation advice to Local Councils. It can be used by applicants, developers and consultants at the pre-planning stage.

Fluvial Flood Risk

Development must be safe and should not increase the risk of flooding.

You can view a site's flood zone on the Flood Map for Planning on our website: <https://flood-map-for-planning.service.gov.uk>

If your proposed development is located within flood zone 2 or 3 you should consult the Flood Risk and Coastal Change pages of the National Planning Policy Guidance (NPPG)

<http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/>

Here you can determine whether the flood risk vulnerability of your proposed development and the flood zone are compatible. You can also establish if there are flood risk sequential test and exception test requirements for your proposed development. In the first instance we recommend the developer/applicant liaises with the Local Planning Authority (LPA) to undertake the Sequential Test in accordance with the National Planning Policy Framework (NPPF).

If your proposed development is located within flood zone 2 or 3 and its vulnerability and flood zone are considered acceptable under the NPPG then a site specific Flood Risk Assessment (FRA) is required to support any subsequent planning application. This is required by paragraph 163 of the NPPF: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

Guidance on the content of a site specific FRA can be found in the NPPG and online: <https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications>

More detailed flood risk modelling data is available to help you produce a FRA please contact our Customers and Engagement team at SSDenquiries@environment-agency.gov.uk.

Climate Change Allowances

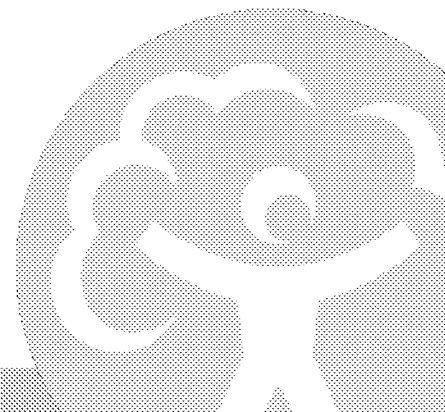
On 19 February 2016, we published new guidance for planners and developers on how to use climate change allowances in a site-specific FRA: <https://www.gov.uk/guidance/flood-risk-assessments-climatechange-allowances>

Groundwater Quality

Development must not cause pollution to the water environment.

Source Protection Zones

We have defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used across the country for public drinking water supply. These zones are more sensitive to contamination from activities that might cause pollution in the area. The closer the activity, the greater the risk.



SPZ1s are the areas designated as most at risk from contamination and development activities and in these areas we may consider it inappropriate for development to discharge foul or surface water into the ground.

To see if your proposed development is located within a Source Protection Zone, please use our online map: <https://magic.defra.gov.uk/>

Contaminated Land

The NPPF takes a precautionary approach to land contamination. Before the principle of development can be determined, land contamination should be investigated to see whether it could preclude certain development due to environmental risk or cost of remediation. Where contamination is known or suspected, a desk study, site investigation, remediation and other works may be required to enable safe development.

Pollution

If the proposed development use has the potential to pollute ground or surface water receptors then an assessment to establish whether the risk of pollution is acceptable or can be mitigated will be required within any planning application.

Foul Drainage

When drawing up wastewater treatment proposals for any development, the first presumption is to provide a system of foul drainage discharging into a public sewer to be treated at a public sewage treatment works (those provided and operated by the water and sewerage companies). This should be done in consultation with the sewerage company of the area prior to the submission of a formal planning application.

If connection to a public sewage treatment plant is not feasible, a package sewage treatment plant may be considered. If you would like further advice please call 03708 506 506.

Cemeteries

The development of new cemeteries in areas where groundwater vulnerability is high should be avoided, except where the thickness and nature of the unsaturated zone, or the impermeable formations beneath the site, protect groundwater; or where the long-term risk is mitigated by appropriate engineering methods.

Main Rivers

Ecology

In accordance with the National Planning Policy Framework (NPPF), any development proposal should avoid significant harm to biodiversity and seek to protect and enhance it. Opportunities to incorporate biodiversity in and around the development will be encouraged.

Your scheme should be designed with a naturalised buffer zone of at least 8 metres from the main river to protect and enhance the conservation value of the watercourse and ensure access for flood defence maintenance.

This buffer zone should be managed for the benefit of biodiversity for example by the planting of locally appropriate, UK native species. The buffer zone should be undisturbed by development with no fencing, footpaths or other structures. This buffer zone will help provide more space for flood waters, provide improved habitat for local biodiversity and allows access for any maintenance requirements.

To identify any Main Rivers in proximity to your proposed development please see our Main Rivers Consultation Map: <http://apps.environment-agency.gov.uk/wiyby/151293.aspx>

customer service line
03708 506 506

incident hotline
0800 80 70 60

floodline
0345 988 1188

www.gov.uk/environment-agency

Culverting

The Environment Agency is likely to oppose culverting as it is damaging to the ecological integrity of the river channel and its corridor and acts as a barrier to the movement of wildlife, including fish and may also increase flood risk. If the proposal will impact an existing culvert the Environment Agency may oppose planning consent for development either over, or within 8 metres of an existing culvert. Wherever possible, existing culverts should be removed and the river channel and bankside habitat reinstated to restore the ecological continuity of the river channel and its corridor.

Water Framework Directive (WFD)

Any marine works below MHWS require an assessment of possible impacts on Water Framework Directive (WFD) . The assessment should include all elements of the works that fall within, or have the potential to affect, a WFD water body and any of the protected areas therein (including Bathing Waters and Shellfish Waters).

The WFD assessment should follow the 'Clearing the Waters for All' guidance available at <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>

Where appropriate, a WFD Assessment should assess any potential impacts and demonstrate that the required enhancements will be delivered. In some cases the requirements of a WFD assessment can be incorporated into an Environmental Impact Assessment (EIA). Any development that has the potential to cause deterioration in classification under WFD or that precludes the recommended actions from being delivered in the future is likely to be considered unacceptable to us.

Permits & Consents

Environmental Permitting Regulations

To see if your proposed development requires an Environmental Permit under the Environment Permitting Regulations please refer to our website: <https://www.gov.uk/guidance/check-if-you-need-an-environmental-permit>

From 6 April 2016 an Environmental Permit is required for any proposed works or structures, in, under, over or within 8 metres of the top of the bank of designated Main River, and within 16 metres of a tidal defence.

Ordinary Watercourse Consent

The prior written consent of the relevant Lead Local Flood Authority is required for the erection of any flow control structures, culverting or diversion of ordinary watercourses, including streams, land drains and ditches.

Marine Licence

A marine licence may be required for any activities at the mean high water spring tide up to the territorial limit. This also includes the waters of every estuary, river or channel where the tide flows at mean high water spring tide.

Any development must demonstrate how adverse impacts on migratory fish, bathing waters, shellfish waters, designated sites, protected and priority species and habitats will be avoided, minimised, mitigated and if necessary compensated for. Works within or affecting a Water Framework Directive (WFD) waterbody will need to demonstrate that compliance with WFD objectives will be achieved. 'Clearing the Waters for All' provides guidance on how the impacts on WFD should be addressed, and should be used when preparing an assessment, including the screening and scoping of activities. <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>

Further pre-application options

The information provided above details generic information which may or may not be applicable to your development. We are able to provide more detailed and bespoke advice and answer technical questions for a charged fee of £100 per person per hour +VAT.

If you are interested in finding out more about this service, please email:

planningssd@environment-agency.gov.uk

We can explain this service and provide you with a bespoke quote for further pre-application advice that you may require please see .gov - <https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Please note

Please note that the view expressed in this letter by the Environment Agency is in response to the enquiry only and does not represent our final view in relation to any future planning application made in relation to this site.

We reserve the right to change our position in relation to any such application.

As part of this preliminary response we have not technically reviewed any documents. This opinion is based on the information submitted and current planning policy and guidance.

If you have any questions please contact the Solent & South Downs Sustainable Places team:

planningssd@environment-agency.gov.uk

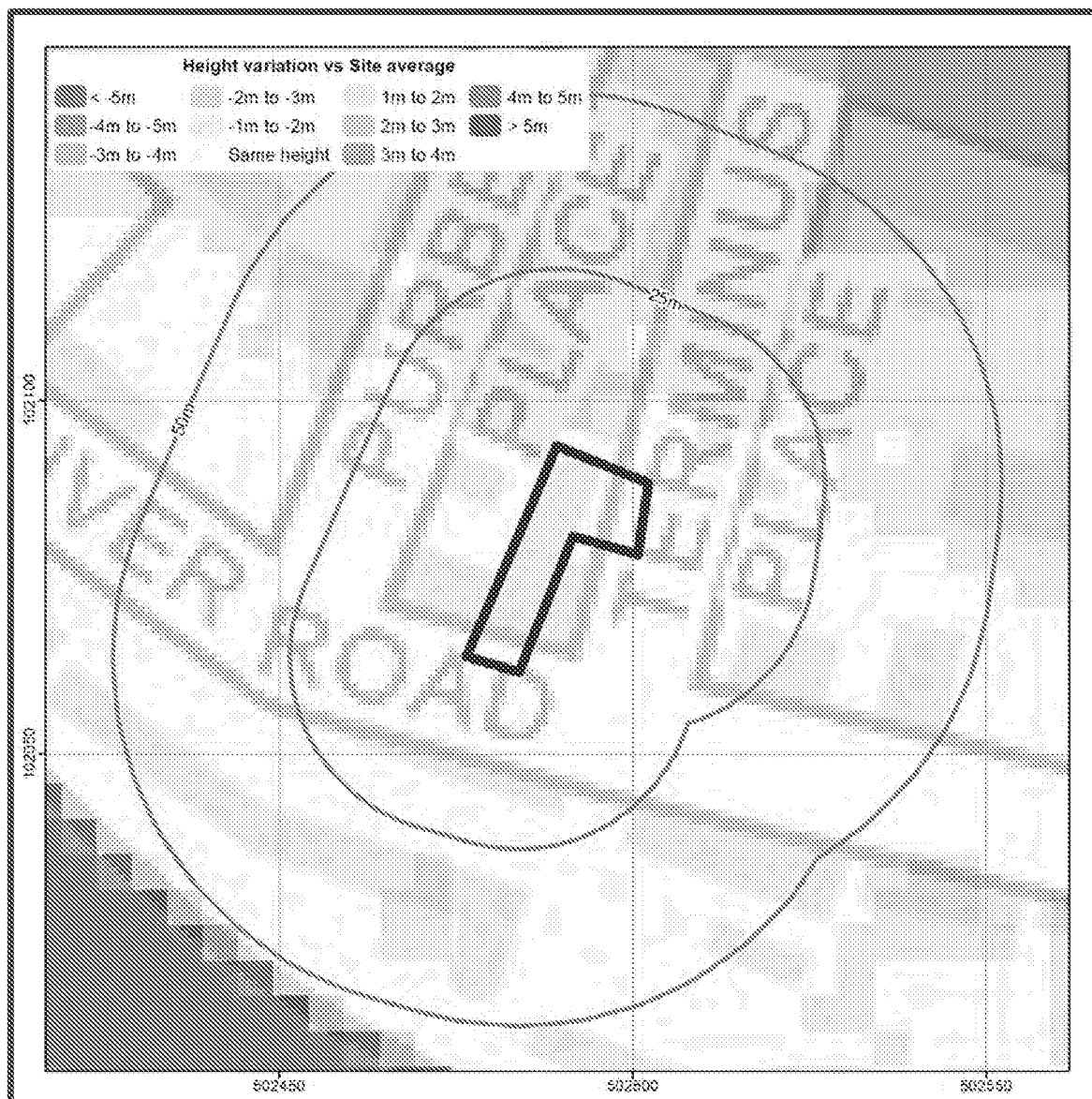
To make a request for data

Please submit your request for data to ssdenquiries@environment-agency.gov.uk. You should get the information within 20 working days. We will tell you when to expect the information if we need more time.

There are many datasets available online at www.data.gov.uk including flood maps, historic landfill, waste exemptions, consented discharges to controlled waters, and much more.



Environment Agency LiDAR ground elevation data

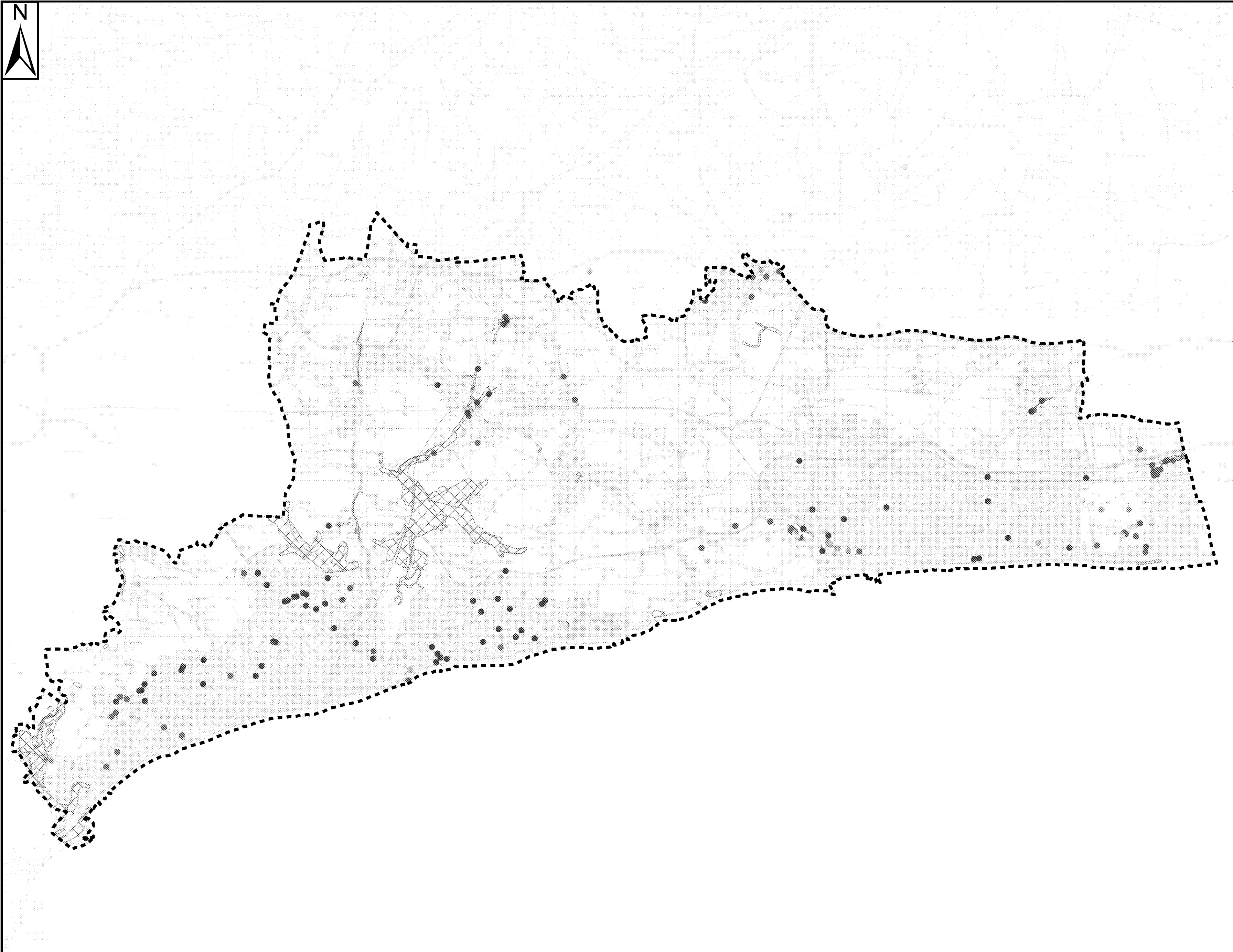


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Appendix D



Local Council mapping



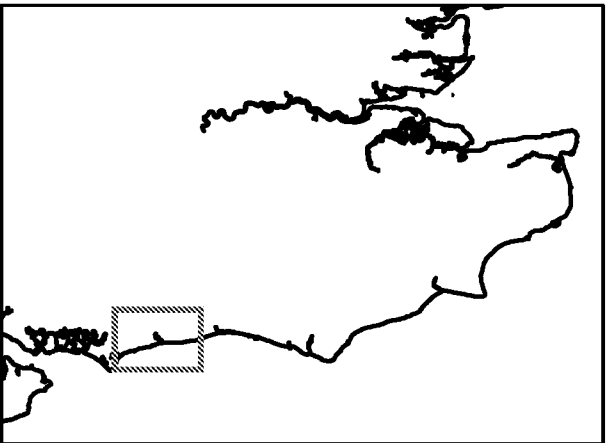
Notes

The Historic Flooding Map shows the recorded incidents and flood outlines provided by Arun District Council, West Sussex County Council, Southern Water and Environment Agency. Historical flood extent was obtained from the Environment Agency.

Flooding incidents provided have been categorised based upon the details provided in the records. Unknown flood points could not be determined from the information provided, and therefore could be from a number of sources.

Please note that not all historical records may be shown on this map, and that it is therefore advised you contact Arun District Council for updated information post 2015.

Key Plan



Legend

- Arun District SFRA boundary
- Historic flood outline

Source of flooding

- Fluvial
- Coastal
- Tidal
- Surface Water
- Failure
- Unknown

REF	Date	Comments
A	June 2016	-

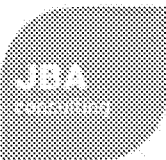


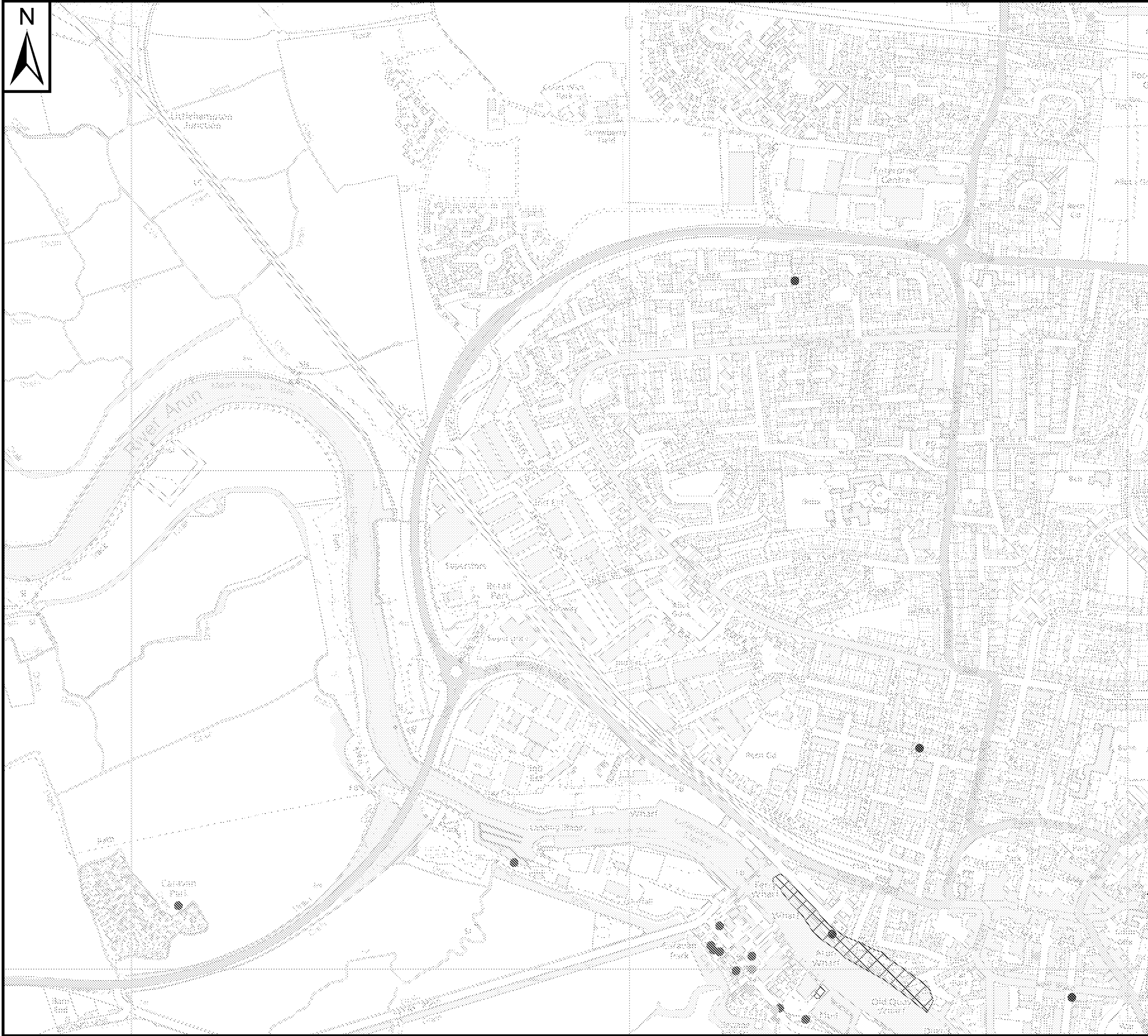
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ARUN DISTRICT COUNCIL

SFRA: APPENDIX H
HISTORIC FLOOD RECORDS

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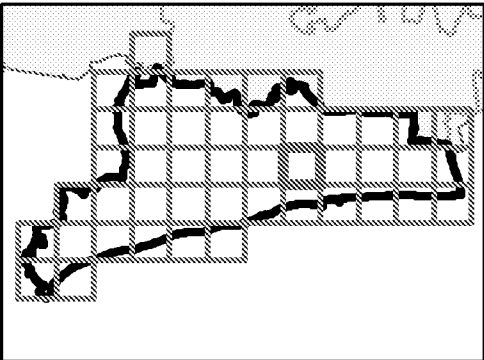
Notes

The Historic Flooding Map shows the recorded incidents and flood outlines provided by Arun District Council, West Sussex County Council, Southern Water and Environment Agency. Historical flood extent was obtained from the Environment Agency

Flooding incidents provided have been categorised based upon the details provided in the records. Unknown flood points could not be determined from the information provided, and therefore could be from a number of sources.

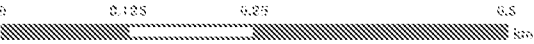
Please note that not all historical records may be shown on this map, and that it is therefore advised you contact Arun District Council for updated information post 2016.

Key Plan



Legend

- Arun District SFRA boundary
- Historic flood outline
- Source of flooding**
- Fluvial
- Coastal
- Tidal
- Surface Water
- Failure
- Unknown



REF	Date	Comments
A	June 2019	-
B		
C		

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ARUN DISTRICT COUNCIL
LEVEL 1 SFRA: APPENDIX H
HISTORIC FLOODING RECORDS

Sheet No: 25 of 48 Index Number: AGC_25

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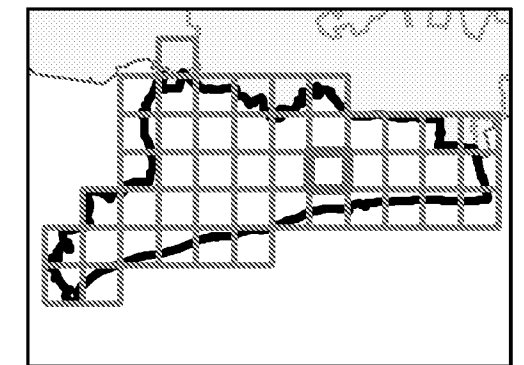
Notes

Hydraulic modelling has been undertaken as part of this SFRA to provide updated climate change flood mapping in the Arun District for Flood Zone 3a. This modelling followed the latest guidance for climate change in FRAs/SFRAs released by the Environment Agency in February 2016 (and updated in April 2016). Climate change for fluvial events has been based on the Higher Central estimates for the years 2031, 2061 and 2111. Present day flood risk information is available for comparison. Arun District is within the South East River Basin District and therefore allowance are:

- 2031 = +15% flows
- 2061 = +30% flows
- 2111 = +45% flows

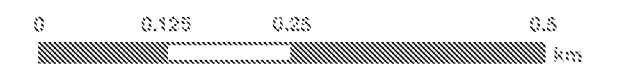
For tidal/coastal models, undefended case still water level and defended case still water level with wave overtopping simulations have been completed to inform future flood risk within the Arun District. Again, climate change allowance predictions are for the years 2031, 2061 and 2111, with present day outputs for comparison.

Key Plan



Legend

- Arun District SFRA boundary
- Present Flood Zone 3a
- Future Flood Zone 3a (2031)
- Future Flood Zone 3a (2061)
- Future Flood Zone 3a (2111)



REF	Date	Comments
A	August 2016	
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX D CLIMATE CHANGE MAPPING

Sheet No: 25 of 46

Index Number: ADC_25

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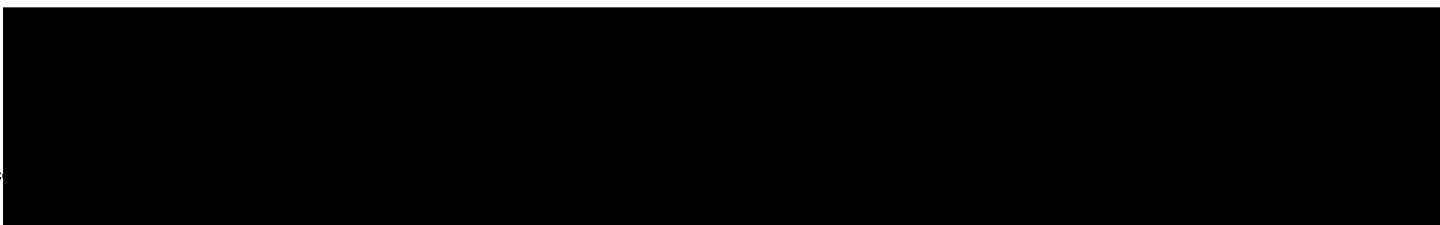
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- sets out minimum standards which firms compiling and selling search reports have to meet.
- promotes the best practice and quality standards within the industry for the benefit of consumers and property professionals.
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.
- By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

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- act with integrity and carry out work with due skill, care and diligence.
- at all times maintain adequate and appropriate insurance to protect consumers.
- conduct business in an honest, fair and professional manner.
- handle complaints speedily and fairly.
- ensure that products and services comply with industry registration rules and standards and relevant laws.
- monitor their compliance with the Code.



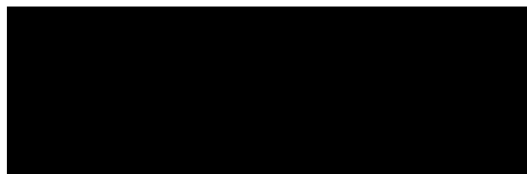
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Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs contact details:

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP



You can get more information about the PCCB from www.propertycodes.org.uk.

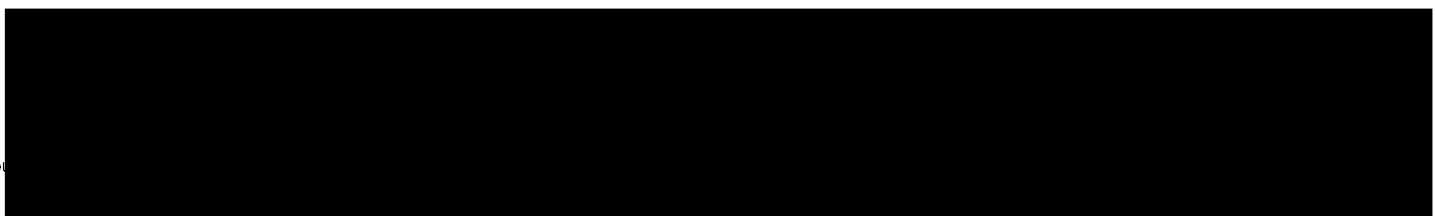
Please ask your search provider if you would like a copy of the search code

Complaints procedure

GeoSmart Information Limited is registered with the Property Codes Compliance Board as a subscriber to the Search Code. A key commitment under the Code is that firms will handle any complaints both speedily and fairly. If you want to make a complaint, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 





We will co-operate fully with the Ombudsman during an investigation and comply with his final decision. Complaints should be sent to:

Alan White

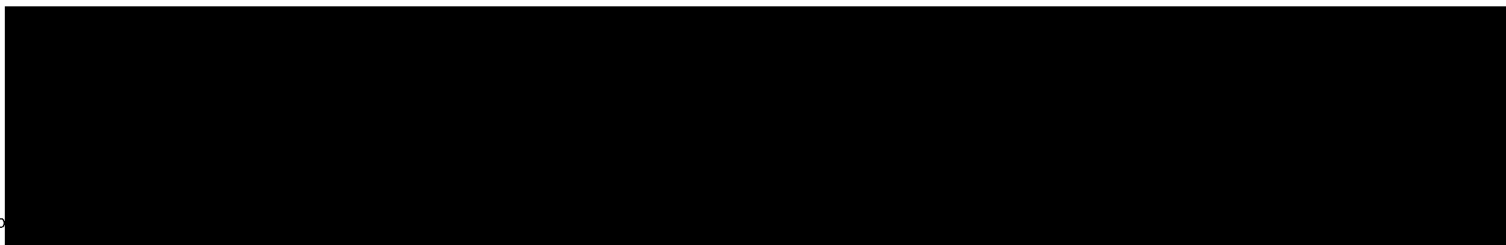
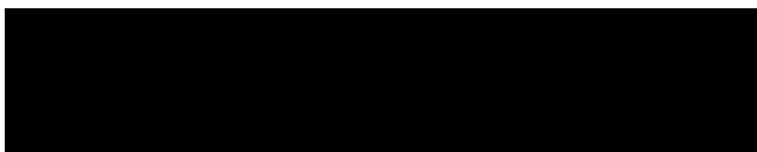
Operations Manager

GeoSmart Information Limited

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12. Terms and conditions, CDM regulations and data limitations

