Flood Risk Assessment

94 Marine Crescent, Worthing, West Sussex

Date	Prepared For	Reference
September 2025	Fiona Sayers	73436

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Contract

GeoSon Limited were instructed by Paula Phillip of Paula Philp Architecture, on behalf of Fiona Sayers, by an email dated the 24th July 2025 to undertake a Site Specific Flood Risk Assessment to support a proposed planning application for development at the 94 Marine Crescent, Worthing.

Project	Flood Risk Assessment for Planning
Prepared For	Fiona Sayers
Location	94 Marine Crescent, Worthing, West Sussex BN12 4JH
Application	Construction of a single dwelling in the rear garden of number 94
Our Reference	73436
Version	1.0
Issue Date	12/09/2025
Issued To	Fiona Sayers and Paula Phillip (Paula Philp Architecture)
Prepared By	Thomas Smith BSc (Hons) PIEMA MCIWEM C.WEM

Purpose

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Introduction

Context

GeoSon Limited have been instructed by Fiona Sayers to undertake a Site Specific Flood Risk Assessment (FRA) to support a proposed planning application for development at 94 Marine Crescent, Worthing, West Sussex BN12 4JH.

This FRA has been undertaken in accordance with the revised National Planning Policy Framework (NPPF) December 2024 and the associated Planning Practice Guidance (PPG).

The level of flood risk to and from the site has been determined using third party information including Environment Agency flood data, national government mapping, LiDAR topography data and Local Authority documentation.

National FRA Requirements

In accordance with the National Planning Policy Framework (NPPF), a Flood Risk Assessment is required to accompany a planning application when a development site is:

- located within flood zones 2 or 3 (including minor development and change of use)
- more than 1 hectare (ha) in size
- less than 1 ha in flood zone 1 however includes a change of use in development type to a more vulnerable class (for example from commercial to residential) which could be affected by sources of flooding other than rivers and the sea
- located within an area which has been identified to have critical drainage problems by the Environment Agency

The site is located within Flood Zone 2 and 3 on the Environment Agency's Flood Map for Planning. As such, in accordance with NPPF guidance the applicant is required to submit a Flood Risk Assessment with any planning application at the site.

The Flood Risk Assessment is required to consider the proposed use of the site and assess the potential flood risk posed to the intended development from multiple sources of flooding including rivers, sea, surface water, groundwater, reservoir failure, sewer surcharge and any other artificial sources.

The Flood Risk Assessment will assess the risk posed from all potential sources of flooding so that site users and third party land will be safe now and for the expected lifetime of the development, taking climate change into account.

Objectives

The objectives of this document are to determine:

- Whether the site is at significant risk of flooding from any source currently or in the future, taking climate change into account
- Whether the development will increase flood risk elsewhere

If the site is identified to be at risk of flooding from any source this FRA will:

- Outline appropriate mitigation measures, compliant with NPPF and PPG, which would be suitable to incorporate within the proposed development to alleviate flood risk on and off site
- Determine whether safe ingress and egress can be achieved and maintained for the lifetime of the development

Site Details

Site Description

The proposed application site is located at 94 Marine Crescent, Worthing, West Sussex BN12 4JH.

The site measures approximately 850m^2 in size and is occupied by a detached residential dwelling with a driveway in the south. The remaining area, including land in the north of the site (proposed to be developed), is underlain by soft landscaping.

The site is accessed via Marine Crescent which forms the southern boundary of the application area.

Review of aerial imagery shows that the surrounding area is characterised by residential dwellings, similar to that of the site. The English Channel is located some 180m south of the application boundary.

Site Address	94 Marine Crescent, Worthing, West Sussex BN12 4JH
Current Use	Residential Use
Proposed Use	Residential Use
OS NGR	TQ 11644 02050
County	West Sussex
Local Planning Authority	Worthing Borough Council
Lead Local Flood Authority	West Sussex County Council

Table 1: Site Details

Figure 1: View of the Development Area from St John's Avenue (Source: Google)

Figure 2: Site Location

Topography

Topographic LiDAR data has been obtained from the Environment Agency to assess the ground elevation profile across the site and within the wider area.

Light Detection and Ranging (LiDAR) is an airborne remote sensing technique, which accurately measures the height of the terrain and surface objects on the ground through the use of a laser, scanner and GPS receiver. The mapping technique measures the distance between the aircraft and the ground to generate precise, three-dimensional information of the terrain and surface objects. Hundreds of thousands of measurements per second are made of the ground, allowing highly detailed surface and terrain models to be generated at different spatial resolutions ranging between 25cm and 2.0 metres.

The LiDAR dataset can be supplied in two forms by the EA:

1. As a Digital Surface Model (DSM), which includes surface objects, such as vehicles, buildings and vegetation, as well as the terrain surface. Or;
2. As a Digital Terrain Model (DTM) produced by removing surface objects such as buildings from the Digital Surface Model through application of bespoke algorithms and manual filtering techniques.

For the purposes of this study the 1.0m resolution Digital Terrain Model has been used.

Environment Agency 1.0m LiDAR data indicates that the ground topography within the red outline application boundary has a 0.60m elevation range from approximately 3.70mAOD, associated with land in the south, to 4.30mAOD, relating to land in the rear garden.

Based on plans provided by the applicant, the proposed dwelling will be constructed upon land with an approximate elevation of 4.20mAOD.

Figure 3 shows the elevation profile of the site and surrounding area.

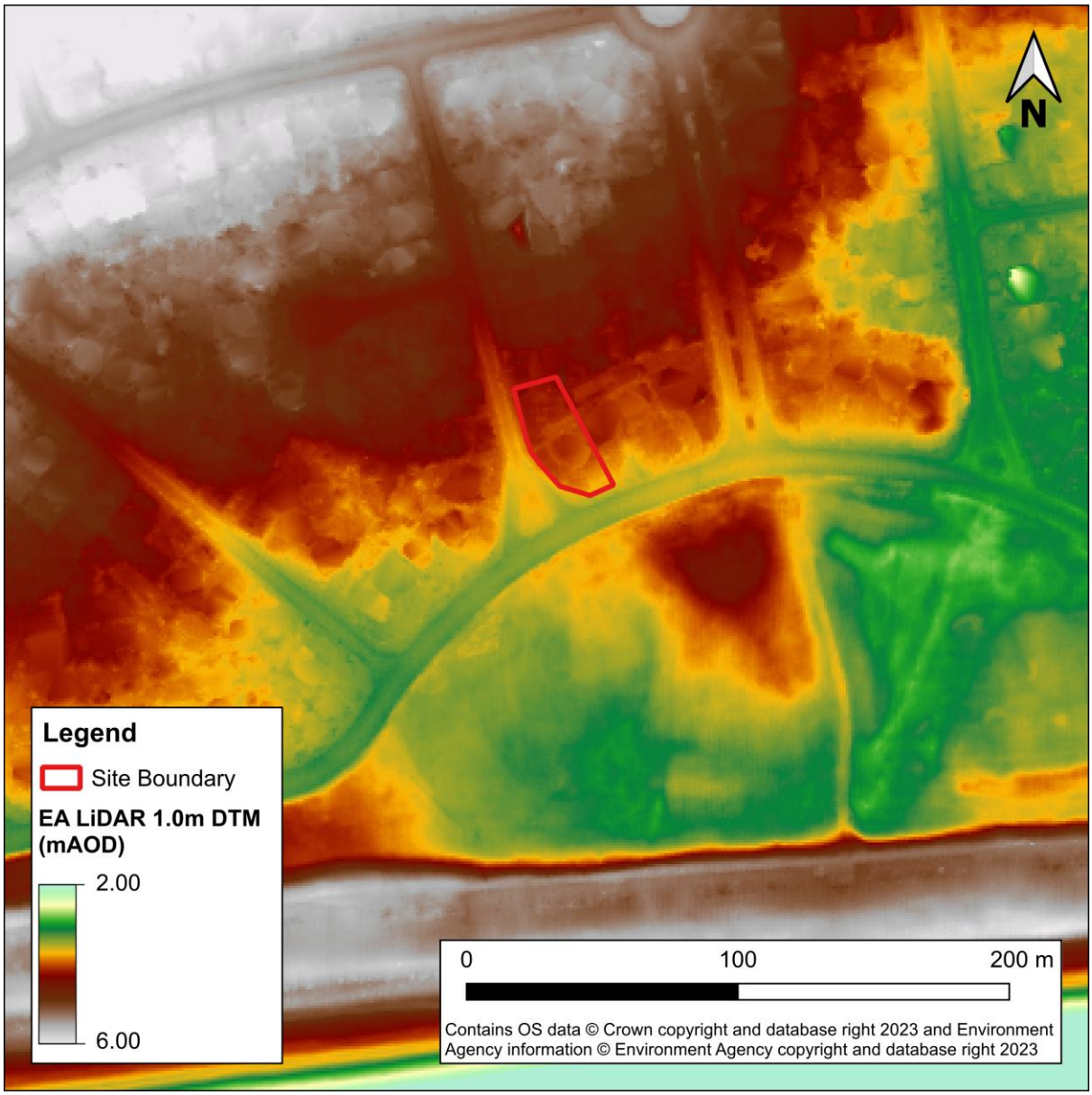


Figure 3: Topography of the Surrounding Area

Geology and Hydrogeology

Review of online British Geological Survey (BGS) records indicate that the site is located upon New Pit Chalk Formation bedrock. This geological strata was formed during the Turonian Age some 89.4 to 93.9 million years ago.

Records state that New Pit Chalk Formation is typically characterised by *Principally blocky, white firm to moderately hard chalk with numerous marls or paired marl seams. Flint occurs sporadically in the upper part in the deeper basin areas of the Southern Province. In some localities flint, in seams, occurs towards the base of the formation most notable over structural highs, towards the margins of the outcrop and within the "Transitional" Province.*

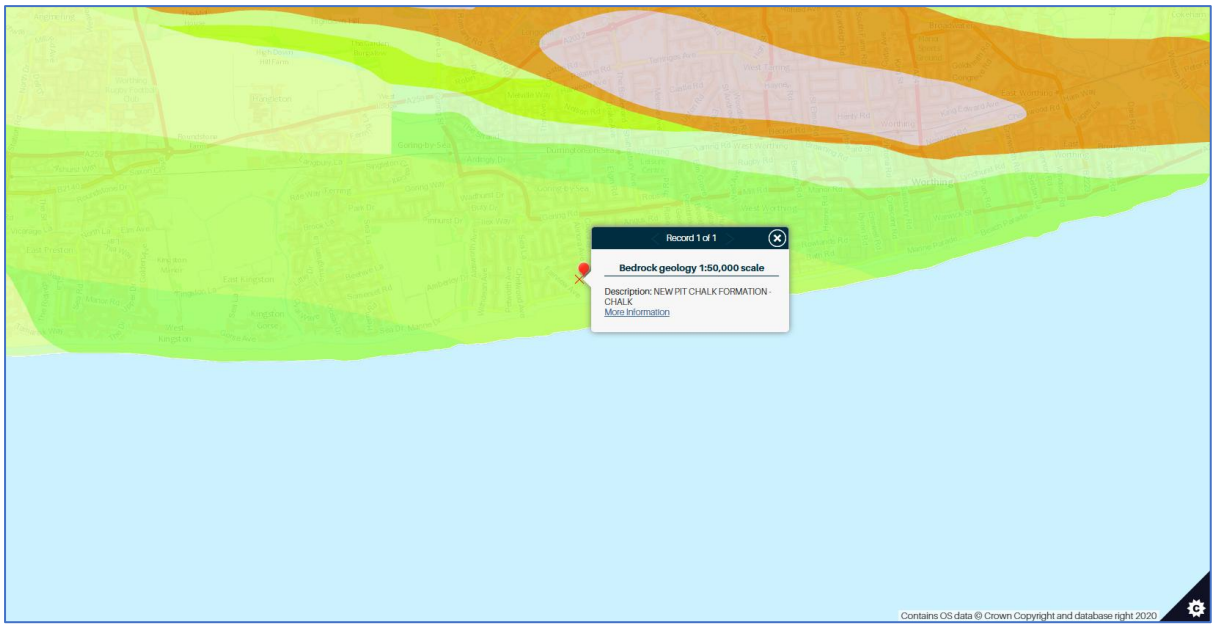


Figure 4: Bedrock Geology Map (Source: British Geological Survey)

According to BGS data the site is also underlain superficial deposits comprising River Terrace Deposits (Sand, Silt and Clay).

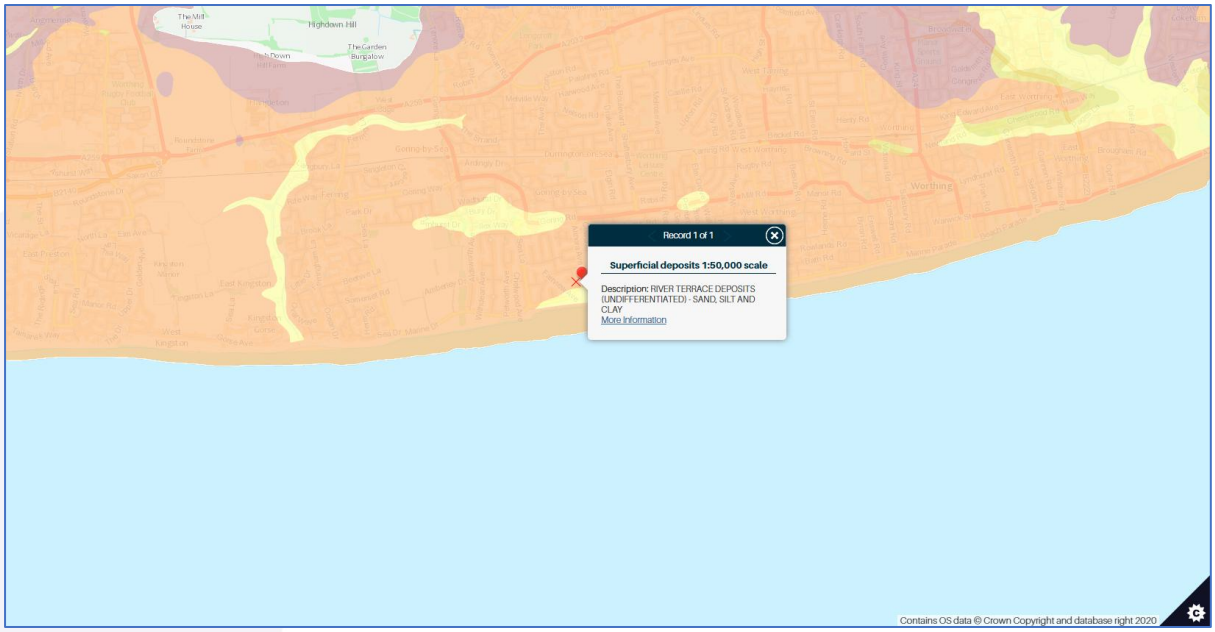


Figure 5: Superficial Deposit Geology Map (Source: British Geological Survey)

Review of Landis Soilscapes online viewer suggests that the site is located within an area where the soils are classified as 'Freely draining slightly acid loamy soils'.

DEFRA 'Magic Maps' indicate that there are no groundwater Source Protection Zones beneath the site. According to DEFRA 'Magic Maps' the closest Source Protection Zone to the development is located approximately 3.20km north of the application area and is classified as a Zone 2 – Outer Protection Zone.

Nearby Watercourses

Review of aerial imagery indicates that there are no open watercourses at, or along the boundaries of, the site. However, several water features have been identified within a 1.0km radius of 94 Marine Crescent, including:

- The English Channel located some 180m south of the application boundary, and
- An ornamental pond in the grounds of Courtlands approximately 315m north east.

The watercourses within a 1.0km of the site are shown in Figure 6 (below).

Figure 6: Watercourses Near the Site

Proposed Development

Development Proposals

The proposed planning application comprises construction of a two bedroom, chalet style dwelling in the rear garden of number 94 Marine Crescent which will face onto St John's Avenue.

Plans provided by the applicant show that the ground floor will consist of a snug, shower room and an open plan kitchen/dining/living room which will open out onto a private rear garden. Two double bedrooms along with a family bathroom will be situated at first floor level.

In addition to this, two parking spaces will be provided and a new access point will be created off St John's Avenue.

The proposed layout plan is shown in Figure 7 and Appendix A.

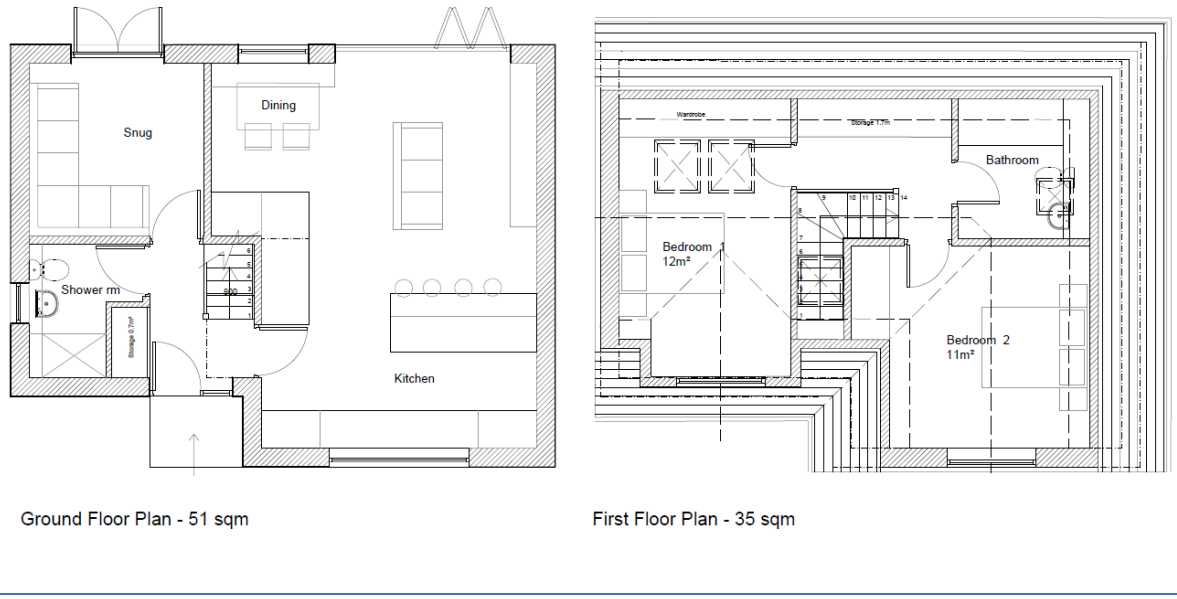


Figure 7: Proposed Ground Floor Layout Plan (Source: Paula Philp Architecture)

Development Vulnerability Classification

The National Planning Policy Framework classifies land use type in terms of vulnerability to flooding. Annex 3 of the NPPF details the flood risk vulnerability classification for each land use type (refer below).

Essential infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood.
- Wind turbines.
- Solar farms.

Highly vulnerable

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'.)

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- **Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.**
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).

• Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place. • Car parks.
Water-compatible development
• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 2: Flood Risk Vulnerability Classification (Source: NPPF)

The site is currently occupied by a single residential dwelling. Therefore, in terms of flood risk vulnerability it is considered "More Vulnerable".

The proposals comprise construction of a residential dwelling upon vacant land in the rear garden of number 94. As such, according to NPPF guidance the proposed works are classified as "More Vulnerable" development.

In light of this, it is considered that the vulnerability of the site as a whole will not increase as a result of the proposals.

Sequential and Exception Test Guidance

In accordance with the National Planning Policy Framework, and associated Planning Practice Guidance, the Sequential and Exception Tests should be undertaken to determine the most appropriate location for a development and used to inform the proposed design layout.

The Sequential Test is designed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account.

The Exception Test is undertaken when development in a flood risk area cannot be avoided. The Exception Test comprises of two elements which need to be satisfied before a development can be permitted. It needs to be demonstrated that:

1. A development will provide wider sustainability benefits to the community that outweigh flood risk; and
2. A 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.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	X	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	X	X	X	✓

Table 3: Flood risk vulnerability and flood zone 'incompatibility' (Source: PPG)

Given the nature of the proposals the development is considered 'More Vulnerable'.

According to Table 3 (above) 'More Vulnerable' development is considered suitable within Flood Zone 1, 2 and 3a (subject to the Exception Test).

However, it should be noted that the Sequential and Exception Tests do not apply to Change of Use and Minor Extension applications.

Climate Change Allowance Guidance

Peak River Flow Uplifts

In July 2021 the Environment Agency issued revised peak river flow allowances for management catchments in England. As part of the update the EA published the Peak River Flow Map which shows anticipated changes to peak river flows over time based on management catchment. Management catchments are sub-catchments of river basin districts.

According to the EA's Peak River Flow Map the site is located within the Arun and Western Streams Management Catchment. Updated peak river flow allowances for this catchment are as follows:

Epoch	Central	Higher	Upper
2020s	11%	16%	27%
2050s	13%	19%	36%
2080s	**25%**	36%	64%

Table 4: Arun and Western Streams Management Catchment Peak River Flow Allowances

The specific Climate Change allowance required to the be assessed within the Flood Risk Assessment, to account for future change in peak river flows, is dependent on the development's design lifetime and vulnerability classification.

In accordance with the development lifetime guidance, residential developments should be considered to have a minimum lifetime of 100 years.

Additionally, residential developments are considered 'More Vulnerable'. In line with government guidance More Vulnerable developments located in flood zones 2 and 3a should use the Central Allowance to account for future climate change.

Sea Level Uplifts

In December 2019 the Environment Agency published an updated range of epoch allowances for sea level rise based on river basin district. According to the EA's River Basin District Map the site and the surrounding area are located within the South East River Basin District. Updated sea level allowances for each epoch for the South East region are as follows:

South East Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (m)
Higher Central	5.7 (200)	8.7 (261)	11.6 (348)	13.1 (393)	1.20
Upper End	6.9 (242)	11.3 (339)	15.8 (474)	18.2 (546)	1.60

Table 5: Sea Level Allowances for Each Epoch in mm per year with Cumulative Sea Level Rise for Each Epoch in Brackets (Based on a 1981 to 2000 Baseline)

The Higher Central and Upper End climate change allowances should be assessed by applying the relevant cumulative mm allowance for each epoch to the current day 1 in 200 year tidal projection.

Assessment of Flood Risk

Flood risk is a combination of:

- the probability (likelihood or chance) of a flood event happening; and
- the potential consequences (impact) if an event were to occur.

In accordance with guidance set out in the Flood Risk and Coastal Change section of the PPG, areas at risk of flooding should be considered as those at risk of flooding from any source, now or in the future.

This study uses publicly available data (including EA flood maps and Local Authority documentation) to assess the potential flood risk posed to the intended development from multiple sources of flooding and the risk of flooding elsewhere, as a result of the proposals.

Where flood risks are identified this study outlines appropriate mitigation measures, compliant with NPPF and PPG, which would be suitable to incorporate within the proposed development to manage said flood risk(s).

Historical Flooding

Historical flood incident information within the area has been assessed based on a review of Worthing Borough Council's and West Sussex County Council's flood risk documentation (including Section 19 Flood Investigation Reports) along with the Environment Agency's Historic Flood Map and an internet search.

Worthing Borough Council Level 1 Strategic Flood Risk Assessment (2024) states that the catchment has a long history of recorded flood events caused by multiple sources of flooding.

The SFRA includes a list of key historical flood incidents along with a map which shows the known locations of flood events. Data presented within the SFRA was collated from records held by the Environment Agency, West Sussex County Council and Southern Water's SIRF datasets.

According to the SFRA, the most notable flooding incidents in Worthing occurred in October 1980, October 2000, June 2007, June 2012 and the winter of 2013/14. Review of the Local Authority information indicates that the aforementioned events were predominantly caused by surface water accumulation and local drainage systems being overwhelmed by intense rainfall.

The SFRA historic flood map shows that West Sussex County Council hold records of several flood incidents along Marine Crescent. However, further review indicates that all reported events were associated with properties on the eastern side of Marine Crescent, situated approximately 150m away from the site. A copy of the SFRA map is shown in Appendix B.

In addition to the events detailed within the Local Authority documentation, review of the Environment Agency's Recorded Flood Outline and Historic Flood Map datasets show that no historical tidal/fluvial events have been recorded within a 1.0km radius of the site.

To summarise, whilst several flood events have been reported along Marine Crescent no information has been provided to suggest that the site itself has ever been impacted by historical flooding.

Fluvial (River) / Tidal (The Sea)

Environment Agency Flood Zones

The Environment Agency has created a set of Flood Zones which show the risk of flooding from rivers and sea in England, for several return period events, ignoring the presence of defences. The Flood Zones are shown on the EA's Flood Map for Planning which forms the basis for assessing flood risk and development suitability under the National Planning Policy Framework.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than a 1 in 1000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1000 annual probability of tidal flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of tidal flooding. (Land shown in dark blue on the Flood Map)
Zone 3b Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. The functional floodplain will normally comprise: • land having a 1 in 30 or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 1 in 1000 annual probability of flooding). Areas of functional floodplain should be identified by local planning authorities within Strategic Flood Risk Assessments, in agreement with the Environment Agency. (Note, Zone 3b is not separately distinguished from Zone 3a on the Flood Map).

Table 6: Flood Zone Definitions (Source: Planning Practice Guidance)

The Flood Map for Planning was updated on the 25th March 2025.

The updated Flood Map for Planning continues to show Flood Zones 1, 2 and 3 for the present day (ignoring the benefits of defences).

However, the Environment Agency's mapping tool now also displays the following information:

- Rivers and sea with defences for the present day and climate change scenarios
- Rivers and sea without defences for the present day and climate change scenarios
- Surface water flood extents for the present day

According to the Environment Agency's Flood Map for Planning (refer to Figure 8) whilst part of the site is located within Flood Zone 3, the area proposed to be developed is situated entirely within Flood Zone 2.

Flood Zone 2 and 3 are defined as follows:

- Flood Zone 2 - land which has 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 tidal flooding
- Flood Zone 3 - land which has greater than a 1 in 100 annual probability of fluvial flooding or greater than a 1 in 200 annual probability of tidal flooding.

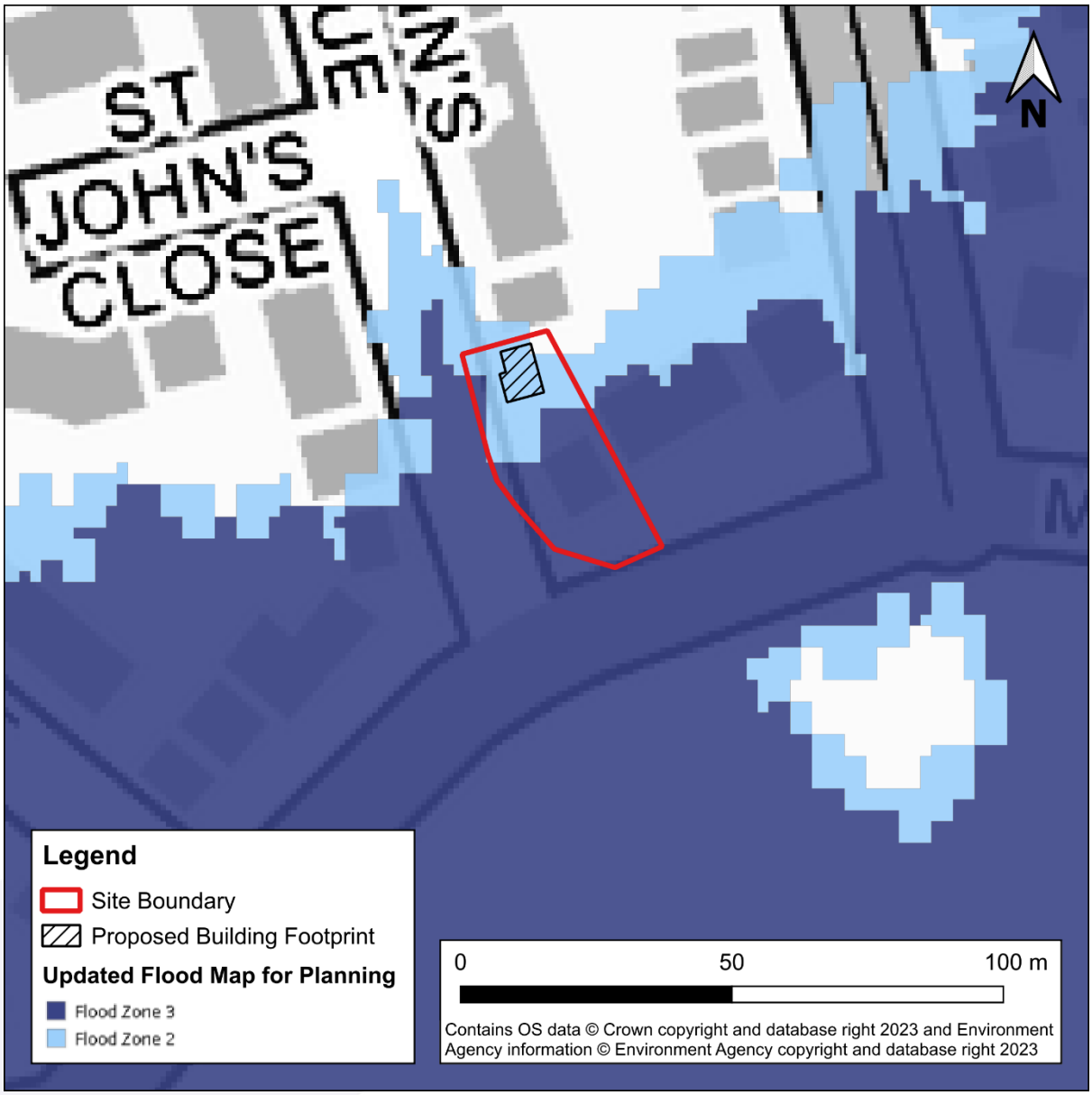


Figure 8: Environment Agency Flood Map for Planning (Source: EA)

Environment Agency Product 4 Response

Considering that the application area has been modelled within Flood Zone 2 and 3 on the EA's Flood Map for Planning, a Product 4 enquiry has been raised with the Environment Agency to obtain detailed flood model information in the relation to the site.

A Product 4 response (EA reference: EIR2025/10383) was received from the Environment Agency, refer to Appendix C. Within which the EA provided details of the maximum 2D modelled tidal flood levels and depths for the defended (actual situation) and undefended (natural floodplain) scenarios at the site, extracted from the 2012 Arun Coastal Model.

Defended and undefended 2D floodplain levels have been provided at 5 node points across the site for several return period events including the 0.5% AEP (1 in 200yr) and 0.1% AEP (1 in 1000yr) scenarios.

Table 7 (below) shows the highest 2D floodplain level at the site for each return period event. The full list of node points and their corresponding data can be seen in Appendix C.

Return Period Event	Modelled Tidal Flood Level at the Site (mAOD)	
	Defended Scenario	Undefended Scenario
0.5% AEP	3.60	4.07
0.5% AEP +CC (2070)	3.72	4.56
0.5% AEP +CC (2115)	3.68	5.19
0.1% AEP	3.65	4.26

Table 7: Modelled Defended and Undefended Flood Levels at the Site (Source: EA)

Comparison of the modelled tidal levels provided within the Product 4 response with ground levels at the site (3.70mAOD to 4.30mAOD, taken from EA LiDAR data) shows that the application area is generally elevated above all modelled defended return period events.

However, at least part of the site could be at risk of tidal flooding during all four modelled undefended scenarios.

Extreme Tide Level (Still Water)

In accordance with Environment Agency advice, developments located within areas at risk of tidal flooding should also provide an assessment of the Still Water Tide Level data from the Coastal Flood Boundary Study (2018).

The following flood levels have been taken from the Coastal Flood Boundary Study and relate to chainage point 4562 located off the coast of Worthing, some 2.25km south of the site.

Chainage point	Easting	Northing
4562	511301	99775

Return Period Event	Tide Level (mAOD)
1:1 AEP	3.49
1:2 AEP	3.56
1:5 AEP	3.66
1:10 AEP	3.74
1:20 AEP	3.81
1:25 AEP	3.84
1:50 AEP	3.92
1:75 AEP	3.97
1:100 AEP	4.00
1:150 AEP	4.05
1:200 AEP	4.09
1:250 AEP	4.12
1:300 AEP	4.14
1:500 AEP	4.20
1:1000 AEP	4.29
1:10000 AEP	4.61

Table 8: Modelled Tidal Levels for Chainage Point 4562 (Source: EA)

Comparison of the modelled tidal levels for chainage point 4562 with ground levels associated with the area proposed to be developed (4.20mAOD) indicates that the proposed dwelling will be constructed upon land elevated entirely above the modelled 1 in 200 year flood level for the present day.

However, the developable area is shown to lie below the modelled 1 in 1000 year flood level for the present day.

Sea Level Allowance Uplifts

Following Environment Agency guidance, in instances where the predicted Still Water Tide Levels are higher than the locally modelled water levels (as in this case) the highest water levels should be taken forward to base the Flood Risk Assessment on.

As such climate change allowance uplifts, to account for future sea level rise, have been applied to the 1:200 AEP Still Water Tide Level to determine the design flood level for the development.

Since the Coastal Flood Boundary Study was produced in 2018, the Environment Agency have issued revised climate change allowances for the study area.

In December 2019 the Environment Agency published an updated range of epoch allowances for sea level rise based on river basin district. According to the EA's River Basin District Map the site and surrounding area are located within the South East River Basin District.

Updated sea level allowances for each epoch for the South East region are as follows:

South East Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (m)
Higher Central	5.7 (200)	8.7 (261)	11.6 (348)	13.1 (393)	1.20
Upper End	6.9 (242)	11.3 (339)	15.8 (474)	18.2 (546)	1.60

Table 9: Sea Level Allowances for Each Epoch in mm per year with Cumulative Sea Level Rise for Each Epoch in Brackets (Based on a 1981 to 2000 Baseline)

In accordance with the development lifetime guidance, given the future site use, the development should be considered to have a minimum lifetime of 100 years. As such, the 2125 climate change tidal flood level is required to be assessed within this study.

Based on the revised guidance, the Higher Central and Upper End climate change allowances have been calculated for the site utilising the modelled 1 in 200 year flood level for chainage point 4562 (4.09mAOD) and applying the South East sea level allowances for each epoch (workings below).

Allowance	2018 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2018 to 2125 (m)
Higher Central	102.6	261	348	393	1.10
Upper End	124.2	339	474	546	1.48

Table 10: Calculated Cumulative Sea Level Allowances for Each Epoch at the Site

Applying the cumulative rises detailed in the last column of Table 10 to the modelled 1 in 200 year flood level, provides the following Higher Central and Upper End climate change flood levels for the site:

Allowance	2018 1 in 200 year flood level (mAOD)	Cumulative rise 2018 to 2125 (m)	2125 1 in 200 year plus climate change flood level (mAOD)
Higher Central	4.09	1.10	5.19
Upper End	4.09	1.48	5.57

Table 11: 1 in 200 year Flood Level with Higher Central and Upper End Climate Change Uplifts

Comparison of the 2125 1 in 200 year plus climate change Upper End flood level (5.57mAOD) with EA LiDAR data associated with the area of land proposed to be developed (4.20mAOD) indicates that the dwelling footprint may experience depths of up to 1.37m during the 2125 1 in 200 year Upper End climate change scenario.

However, it is important to note that the flood level outlined above does not take into account the presence of flood defences located within wider area which afford the site protection.

This is demonstrated by the outputs from the 2012 Arun Coastal Model which shows the development area to be elevated entirely above the modelled defended 2070 and 2115 0.5% AEP scenarios.

Defences

Adur and Worthing are included within the Beachy Head to Selsey Shoreline Management Plan (SMP) which details the flooding and erosion management policy for said section of coastline until 2105.

According to the Shoreline Management Plan the site is located behind the Worthing to Goring-by-Sea Unit, reference 4D16.

Using the Environment Agency's Shoreline Management Plan Explorer web-based platform the management approach for this section of coastline is to 'Hold the Line' up until at least 2105.

The Hold the Line approach entails sustaining the current defensive position through to the longer term, maintaining and improving structures as required, to ensure the local community are protected from flooding and erosion into the future.

The Environment Agency confirm that actions for Unit 4D16 include replacing the groynes at the end of their residual life and undertaking beach nourishment (subject to funding and approval).

Pluvial (Surface Water)

Pluvial flooding occurs as a result of excess overland flow and stormwater ponding. Surface water flooding can happen when water does not have time to soak into the underlying ground or cannot infiltrate at all, for instance because the ground is already fully saturated.

This mechanism of flooding can also arise when the volume of precipitation exceeds the capacity of the drainage system meaning that water is unable to drain away through the sewer network and instead flows overland.

Overland flow will follow the local topography and can therefore pose a risk to both the development and surrounding third party land.

The risk posed to the site from surface water flooding has been assessed using the new National Flood Risk Assessment (NaFRA) 'Risk of Flooding from Surface Water' dataset. The updated Risk of Flooding from Surface Water maps were published on the 28th January 2025 by the Environment Agency and were subsequently integrated into the Flood Map for Planning on 25th March 2025.

The revised mapping is considered to represent a significant improvement on previous iterations of the surface water flood maps, both in terms of method and representation of the risk of flooding.

The NaFRA dataset was created by combining the best available flood models (including locally produced detailed model information and national flood modelling) to generate the probability of flood risk for each 2m grid square of land, with the aim of using the best available flood risk information in any one location.

Considerable improvements have been made when compared to the previous iterations of the RoFSW dataset including a more accurate representation of buildings within the model terrain to better capture the influence of built footprints on flow routes, the correction of misinterpretations in earlier surface water maps that wrongly suggested some buildings would remain dry, and a focus toward assessing flood risk to land rather than individual properties.

The new RoFSW dataset includes details of the annual chance of flooding to a specific depth. The dataset presents the likelihood (categorised as High, Medium or Low) of flooding to reach the following depth increments at a set location in any given year:

- 0.2m
- 0.3m
- 0.6m
- 0.9m
- 1.2m

Risk is displayed as one of the following likelihood categories:

High	An area which has more than 3.3% chance of flooding each year
Medium	An area which has between 1% and 3.3% chance of flooding each year
Low	An area which has between 0.1% and 1% chance of flooding each year
Very Low	An area which has less than a 0.1% chance of flooding each year

The 2025 RoFSW dataset includes modelled outputs for both the present day and climate change scenarios. The newly introduced climate change map shows the predicted impacts of climate change on future flood risk for the 2050's epoch (2040 – 2060) where the central allowances have been used to support short and medium-term decisions informed by the highest flood likelihood projections.

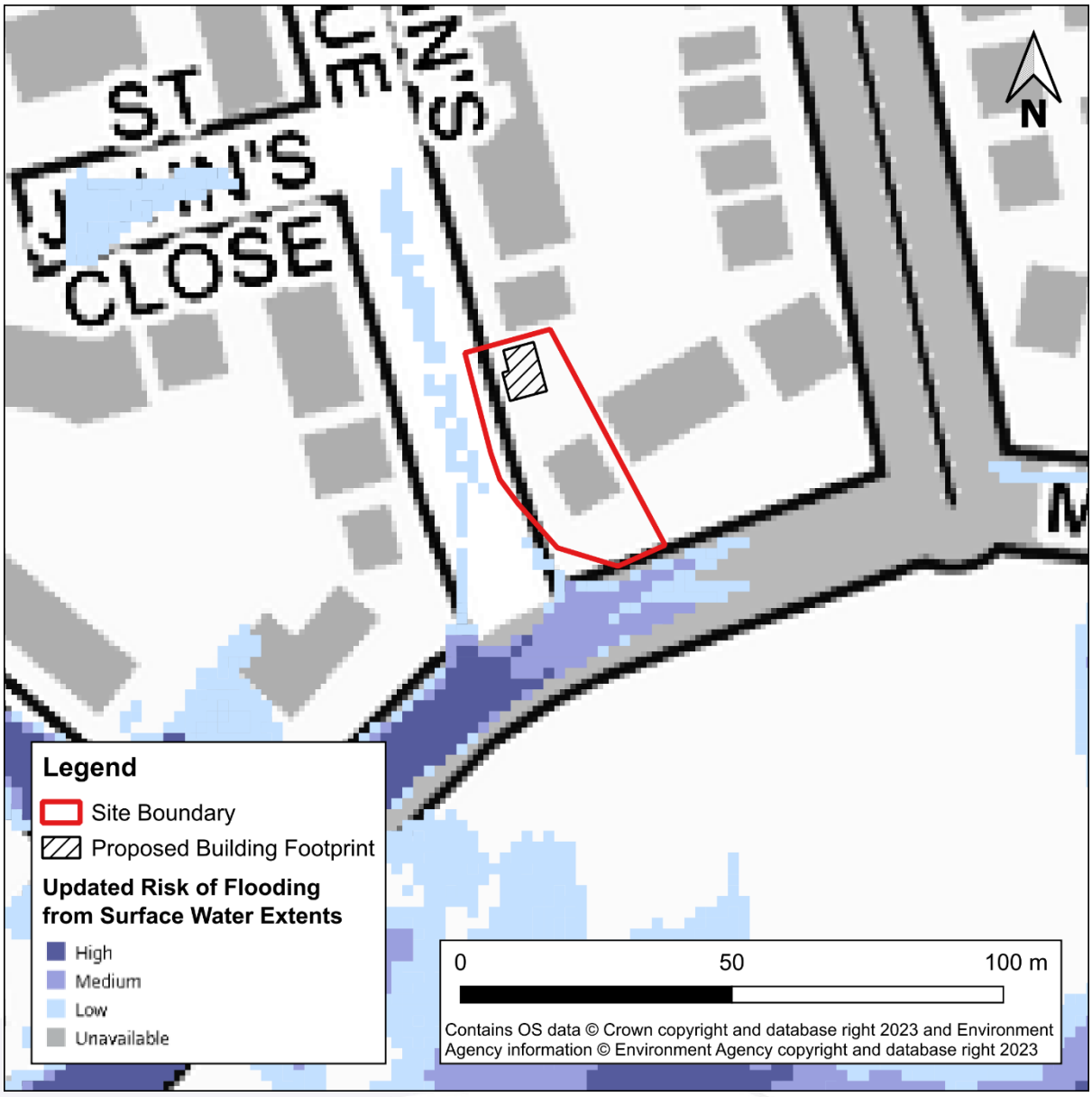


Figure 9: Risk of Flooding from Surface Water Extents (Source: EA)

The EA's Risk of Flooding from Surface Water data (Figure 9) shows that the entire site is located within an area modelled to be at 'Very Low' risk of flooding from surface water.

The section of St John's Avenue, adjacent west of the application boundary, is partially modelled to be at 'Low' risk of surface water flooding with land along Marine Crescent shown to be at 'Low' to 'High' risk.

Despite this, no information has been provided to suggest that the site has ever been impacted by surface water accumulation.

Groundwater

Groundwater flooding occurs when the water table rises up from the underlying rocks and emerges at the ground surface or within subsurface infrastructure (such as basements). Low lying areas that are underlain by permeable bedrock, superficial geology and aquifers are particularly susceptible to this form of flooding, especially during the winter months and after periods of heavy, sustained precipitation.

Unlike other mechanisms of flooding, groundwater flooding takes longer to dissipate as the water table needs to lower before any emerged flood water can soak back into the ground. As a result of this, whilst groundwater flooding does not pose a significant risk to life, flood waters can last for many months and can cause considerable damage to property.

Worthing Borough Council Level 1 Strategic Flood Risk Assessment (2024) uses the national scale 5m resolution JBA Groundwater map to assess groundwater flood risk across the catchment. The modelling involves simulating groundwater levels for a range of return periods including the 75, 100 and 200-year events. Groundwater levels are then compared to ground surface levels to determine the head difference in metres.

According to the map the site is located in an area where the groundwater levels are between 0.5m and 5m below the ground surface.

In addition to the JBA Groundwater map, Worthing Borough Council's 2024 SFRA includes a technical assessment of the future impact of groundwater flood risk within Adur and Worthing.

As part of the SFRA commission, Tidal Drainage Risk Zones and Groundwater Risk Zones were derived to understand how increases in tidal levels associated with climate change may impact groundwater and surface water flood risk within the Local Plan areas.

The assessment identified the site to be located within a Groundwater Zone 2, defined as follows:

Groundwater level more than 0.5m below the surface and region is below the present day tidal level

OR

Groundwater level between 0.025m and 0.5m below the surface and region is above the current tidal level but below the future tidal level

Despite the above, a dwelling is already present at the site and there have been no reports of groundwater ingress.

No further information has been provided to suggest that the site itself has historically been subject to groundwater flooding.

Sewer Surcharge

Sewer flooding occurs when the volume of water entering a drainage system is greater than the capacity of the sewer network. It is often experienced during periods of heavy rainfall, when a large amount of precipitation falls within a short period of time, and overloads the sewer system capacity causing a surcharge and localised short-term flooding.

Sewer flooding can also occur when the sewerage system is unable to discharge as intended. This is frequently caused by problems such as high water levels within the receiving watercourse, blockages, siltation and structural defects.

Worthing Borough Council Level 1 SFRA (2024) includes details of historical sewer flood incidents which have been recorded by Southern Water in the catchment area. Southern Water have provided records of incidents of flooding relating to public foul, combined and surface water sewers. For confidentiality reasons, the data has been supplied on a postcode basis from the Sewer Incident Report Form (SIRF) hydraulic overload database. Data covers all reported incidents within the borough between January 2013 and May 2023.

The SIRF database shows that the most frequently flooded postcode is BN13 2 in Worthing Borough (45 incidents) and BN42 4 in Adur District (45 incidents).

According to information within the SFRA, 13 sewer flood incidents were reported between January 2013 and May 2023 within the postcode area where the development is located (BN12 4).

Despite this, no information has been provided to suggest that the site itself is susceptible to sewer surcharge flooding.

Reservoir

Reservoirs are artificially created lakes, typically formed by building a dam across an existing watercourse to hold water back. Whilst unlikely, flooding from reservoirs can occur as a result of water exceeding the reservoir capacity or structural failure of the dam or bank.

All large reservoirs are regulated under the Reservoirs Act 1975 and undergo regular maintenance to minimise the possibility of reservoir failure. This legislation is enforced by the Environment Agency and requires reservoirs to be routinely inspected and maintained to an appropriate standard. As an enforcement authority the Environment Agency is responsible for some 2,000 reservoirs in England and Wales.

The Environment Agency have produced a flood map which shows where water may go in the unlikely event of a dam or reservoir failure. Two flooding scenarios are shown on the reservoir flood maps:

- A 'dry-day' scenario which shows the predicted flood extents if a dam or reservoir failed when rivers are at normal levels
- A 'wet-day' scenario which shows how much greater the flood extent might be if a downstream river is already experiencing an extreme flood event

Review of the Environment Agency's Risk of Flooding from Reservoirs map indicates that the site is not located within the 'maximum extent of flooding from reservoirs'. As such, the application area is not considered to be susceptible to reservoir failure.

Other Sources

No canals or other artificial infrastructure have been identified within the surrounding area which could pose a risk of flooding to the development.

Flood Risk Management

Site-specific modelled 2D floodplain levels and extents have been provided by the Environment Agency as part of a Product 4 enquiry response, taken from the Arun Coastal Model, which was produced in 2012.

Modelled outputs include 2D floodplain levels and depths at five points across the site for several return period events including the 0.5% AEP (1 in 200 year) and 0.1% AEP (1 in 1000 year) scenarios.

However, the data provided does not take into consideration the latest climate change uplifts, which were updated in 2019.

In accordance with the latest guidance, the Higher Central and Upper End climate change allowances have been calculated for the development utilising the modelled 0.5% AEP Still Water Tide Level at chainage point 4562 (taken from the 2018 Coastal Flood Boundary Study) and applying the South East sea level allowances for each epoch.

Adding the appropriate Upper End Climate Change allowance to account for future uplift between 2018 and 2125 gives an updated 0.5% AEP Upper End Climate Change flood level at the site of 5.57mAOD.

Comparison of the 2125 0.5% AEP Upper End climate change flood level (5.57mAOD) with reported topographic levels at the development area (4.20mAOD, taken from EA LiDAR data) indicates that the land proposed to be constructed upon may experience flood depths of up to 1.37m during the 2125 0.5% AEP Upper End climate change scenario.

Finished Floor Levels

The NPPF requires new residential Finished Floor Levels (FFL) to be set at least 300mm above the modelled 1 in 200 year plus allowance for climate change flood level. In instances where bedroom accommodation is proposed on the ground floor, such as in bungalows and self-contained flats, Finished Floor Levels should be set at least 600mm above the modelled 1 in 200 year plus allowance for climate change flood level.

Considering this, the Finished Floor Level of the dwelling should be set at a minimum elevation of 5.87mAOD, raised at least 300mm above the updated 2125 1 in 200 year Upper End climate change flood level (5.57mAOD).

However, setting the FFL at 5.87mAOD would require the dwelling to be raised some 1.67m above the surrounding ground levels.

Given the position of the site along an existing residential street the applicant is restricted to how high the Finished Floor Level (FFL) of the new dwelling can be raised without compromising other planning constraints such as ridge height restrictions.

Therefore, whilst it is not feasible to set the proposed Finished Floor Level above the 2125 0.5% AEP Upper End climate change flood level it is recommended that (if possible) the applicant sets the Finished Floor Level of the property at 4.80mAOD, raised 600mm above the surrounding ground levels.

As shown on the proposed plans, both bedrooms within the dwelling will be located at first floor level. As such, assuming that that FFL is set at 4.80mAOD and a standard floor to ceiling height, the finished first floor level will be elevated at least 7.20mAOD; raised approximately 1.63m above the updated 2125 0.5% AEP Upper End climate change flood level.

Provision of a first floor level set at 7.20mAOD or above would offer an area of safe refuge within the dwelling should a flood event occur.

Mitigation Measures

It is recommended that the Finished Floor Level of the dwelling is set at approximately 4.80mAOD, raised 600mm above the surrounding ground levels.

Comparison of the FFL with the 2125 0.5% AEP Upper End climate change flood level (5.57mAOD) indicates that the ground floor of the dwelling may experience internal flood depths of up to 0.77m during the design storm event.

In accordance with guidance published by the Environment Agency and the Department for Communities and Local Government (DCLG) flood resistance measures should be designed to keep water out of a property (by sealing off points of entry) to a maximum height of 600mm above the FFL. Holding back greater flood depths than 600mm may impact the structural integrity of a building. Therefore, in situations where flood depths are greater than 600mm it is advised that flood resilience measures are considered.

In order to offer protection for the ground floor of the building during an extreme flood event it is recommended that the following mitigation measures are considered in consultation with the Local Authority:

- Non-return valves fitted on drains and pipes
- Any chambers fitted with a double seal screw down cover and frame
- Seals/bungs on hand to install in toilets and on pipes, should a flood event occur
- All electrics and sockets are raised at least 1.07m above the estimated Finished Floor Level thus are installed at least 300mm above the 2125 0.5% AEP Upper End CC flood level from 5.87mAOD or above
- The electrical main ring run for the upper floor is installed on a separate switch circuit to the ground floor
- Any new boilers, gas meters and electrical incomer/meters are installed at least 300mm above the 2125 0.5% AEP Upper End CC flood level, set at 5.87mAOD or above
- Waterproof screed used on ground floor with waterproof ground floor internal render
- External walls rendered resistant to flooding to first floor level
- Water resistant materials such as stainless steel, plastic or solid wood used for the fitout
- Any cracks and holes in the external walls, including service and drainage entry points are sealed with mortar/sealant and made watertight
- Covers are provided for airbricks, pet flaps and appliance vents
- Where possible, the use of MDF carpentry is avoided within the fitout
- Ensure there is access to all spaces to enable drying and cleaning, should a flood event occur

The applicant should also consider installation of demountable flood defence barriers to further protect ground floor entry thresholds against flood water ingress up to a maximum depth of 0.6m.

Additionally, important items and documents (including insurance policies and photographs) should be stored above the design flood level.

Surface Water Flood Risk Mitigation

The entire site is shown to be located outside of the Environment Agency's modelled 1 in 30 year, 1 in 100 year and 1 in 1000 year surface water flood extents.

Despite this, based on the risk of tidal flooding, it is recommended that the Finished Floor Level of the dwelling is set at least 600mm above the surrounding external ground levels.

It is also recommended that linear drains are installed in front of all building entry points and any external landscaping is designed to slope away from the built footprint.

These measures will help mitigate the risk of stormwater ponding at threshold entry points and stormwater ingress.

Groundwater Flood Risk Mitigation

The applicant has confirmed that no basement levels will be created as part of the proposals.

Whilst there is no information to suggest that the site has ever experienced groundwater flooding, it is recommended that the floor of the new dwelling is made of either solid construction materials or the ground beneath the suspended floor is sealed.

This mitigation measure will protect against the unlikely occurrence of groundwater ingress should water table levels fluctuate in the future.

Flood Warnings and Alerts

The site is located within an EA Flood Warning and Alert area.

Therefore it is recommended that the site owner(s) and future residents sign up to the Environment Agency's free Targeted Flood Alert Service at https://www.gov.uk/sign-up-for-flood-warnings.

Warning	Meaning / Response Actions
 **Flood Alert**	**What it means:** Flooding is possible – be prepared. **When it is used:** The Environment Agency will issue a Flood Alert status when flooding is possible. It is usually issued between 2 hours and 12 hours in advance of flooding, dependant on the form and characteristics of the flood risk. **Triggers:** Forecasts that indicate that flooding from rivers and/or high tides, surges or strong winds at sea. **How is it issued:** This will be issued through the Environment Agency website and via the Flood Warnings Direct service, based upon weather, river and sea conditions. **Actions:** When a Flood Alert is issued, individuals should: • Be prepared to act on Flood Warning and Evacuation Plans. • Prepare to relocate or move to an area outside of the modelled Flood Zone extent. • Prepare a flood kit of essentials and have it ready if needed. • Monitor local water levels and forecasts on the Environment Agency website and on the Local TV/radio stations.
 **Flood Warning**	**What it means:** Flooding expected – immediate action is required. **When it is issued:** Flood Warnings will be issued when water levels are rising, heavy rain is anticipated to cause rivers to flash flood or there are high tides / surges coupled with strong winds at sea. It is usually issued between 30 minutes to 2 hours in advance of flooding. **Triggers:** Heavy rainfall forecast to cause flash flooding of rivers, and forecast flooding from rivers or the sea. **How it is issued:** This will be issued through the Environment Agency website and via the Flood Warnings Direct service, based upon weather and river/sea conditions. **Actions:** When a Flood Warning is issued, individuals should: • If necessary, move possessions, valuables and pets higher or to a safe place. • Locate keys to lock windows and tools to switch off gas and electricity supplies in the event evacuation is required. • If flood protection measures are available (e.g. flood gates and airbrick covers) put them in place. • Consider moving any vehicles to a higher level or to an area outside of the Flood Zone. • Contact the Local Authority to find out whether evacuation is considered necessary, and if so, where they are providing rest centres for evacuees. • If evacuation is required, switch off the gas and electricity supply before leaving the property (if safe to do so).

 **Severe Flood Warning**	**What it means:** Severe flooding. Danger to life. **When it is used:** When flooding poses a significant threat to life. **Triggers:** Actual flooding where the conditions pose a significant risk to life and/or widespread disruption to communities, onsite observations from flooded locations or a breach in defences or failure of a barrier that is likely to cause significant risk to life. **How it is issued:** This will be issued through the EA website and via the Flood Warnings Direct service based upon weather and river conditions. In this location a Severe Flood Warning may also be received via the Local Authority. **Actions:** When a Severe Flood Warning is issued, individuals should: • Stay in a safe place with a means of escape. • Be ready should you need to evacuate the property. • Cooperate with the emergency services. • Call 999 if you are in immediate danger.
Warning No Longer in Force	**What it means:** No further flooding is currently expected in your area. **When it is used:** When a Severe Flood Warning, Flood Warning or Flood Alert is no longer in force. **Triggers:** The risk of flooding has passed, water levels have dropped below the warning level and no further flooding is affected. **How it is issued:** This will be issued through the EA website, local TV/radio stations and news bulletins. **Actions:** When a 'Warnings No Longer in Force' status is issued, site owners should: • If evacuation has occurred, check with the Local Authority that it is safe to return to the property/building. • Be careful as flood water may still be around for a few days and could be contaminated. • If there has been flooding to the property contact your landlord/management company for advice (if applicable), take photographs of any damage and contact your insurance company. If you need to make an insurance claim do not throw anything away until the insurance company says so.

Table 12: EA Flood Warnings and Flood Alerts

Future owners/occupants should also be advised to monitor weather forecasts by signing up to the Met Office weather warnings.

Considering the nature of flood risk at the site, it is recommended that the applicant develops a Flood Warning and Evacuation Plan in accordance with the Environment Agency's Flood Plan template (refer to Appendix D) and West Sussex County Council's emergency planning guidance.

The Flood Warning and Evacuation Plan will outline the site-specific actions which will be followed in the event of a flood warning being issued.

Emergency Flood Kit

It is recommended that the future owners put together a flood kit. Provision of an emergency kit will help residents and site users to prepare and react quickly in the event of flooding.

It is important to remember that in a flood event people may not have time to find essential items. Therefore, it is vital to prepare a small easy-to-carry bag with essentials in advance.

The Environment Agency recommend that you create a grab bag of essential items including:

- Important documents in a waterproof bag such as insurance certificates, passports, driving licences and other hard to replace documents
- A copy of the emergency action plan
- Emergency contact numbers: Insurance helpline, local council and emergency services
- Contact details for your water, electricity and gas suppliers
- Spare keys for the building and any cars
- Torch and batteries (in case it floods at night and you lose power)
- Portable radio (wind-up preferable) for local station updates
- Fully charged mobile phone and charging lead
- Small power bank or portable charger
- Additional batteries for torches and radios
- Camera (if phone doesn't have one) to record damage for insurance purposes
- First aid kit and essential prescription medication (including respiratory aids)
- Anti-bacterial hand wipes/gel
- Hearing aids
- Spare glasses and/or contact lenses
- Whistle
- Bottled water (check use-by date)
- Non-perishable food items (including tinned goods and energy or cereal bars)
- Blankets and sleeping bags
- Warm clothes, waterproof clothes, wellington boots, rubber gloves
- Wash kit and essential toiletries (including toilet paper and wet wipes)
- Children's / baby essentials (including baby food / nappies etc.)
- Bank cards and emergency cash
- Notebook and pen

It is recommended that the information in this document is used to help the developer complete a flood plan (refer to the template in the report appendix).

The details within this Flood Risk Assessment should assist with deciding what practical actions to take before and during a flood event, with the aim of reducing the damage flooding could cause to the site.

Safe Access and Egress

The NPPF requires all new residential developments in areas at risk of flooding to demonstrate a route of safe escape for residents and site users which can be maintained for the lifetime of the development.

The proposals relate to construction of a two storey dwelling.

Assuming the FFL recommendations in this report can be met and a standard floor to ceiling height, the finished first floor level of the house will be elevated at least 7.20mAOD. Therefore, it is considered that safe refuge above the modelled 2125 1 in 200 year Upper End climate change flood level (5.57mAOD) can be provided on the upper floor of the residential unit itself.

It is recommended that the route to the stairs is kept free of obstacles to ensure swift refuge can be achieved to the upper floor, if required.

In the event of a severe flood warning, an evacuation route can be provided via St John's Avenue, adjacent west. If safe to do so, it is recommended that residents travel north along St John's Avenue before heading west along Alinora Crescent.

This route will lead site users towards higher ground that is located entirely outside of Flood Zone 2, Flood Zone 3 and the 2125 Upper End 0.5% AEP tidal extent from 140m north west of the development onwards.

The route shown in Figure 10 provides the shortest route to an area entirely outside of all flood zone extents. It also leads to a position which is not located on a 'dry island' enabling access to the wider area.

If flooding occurs and water exceeds 25cm anywhere along the evacuation route (including on site) residents should seek refuge on the upper floor of the building and await further instruction from the emergency services.

It is recommended that future residents are made aware of the evacuation route.

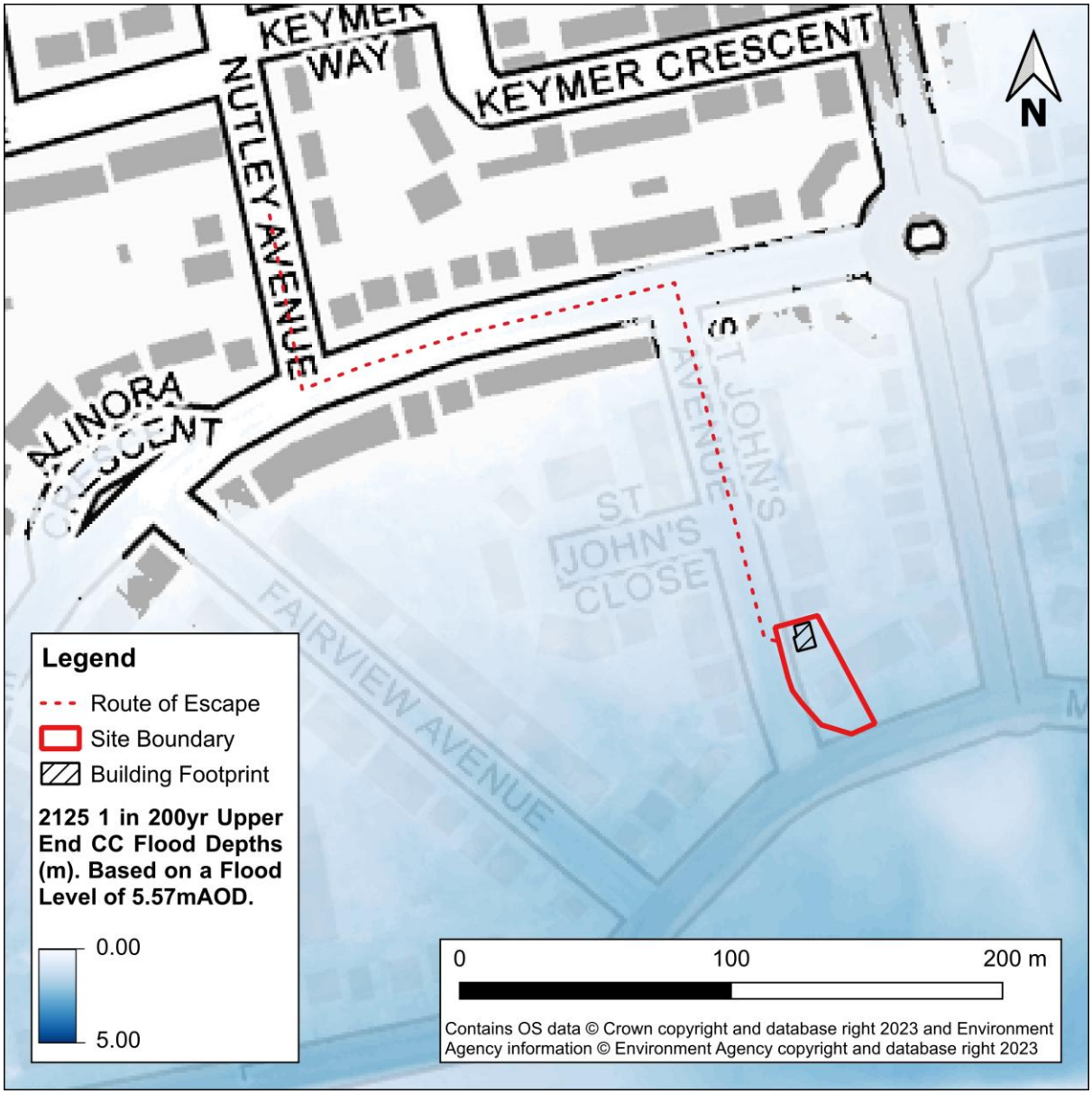


Figure 10: Evacuation Route

Given that flood risk at the site is tidally influenced, it is considered that flood waters would start to recede as the tide lowers.

On average the duration between low and high tide is 6 hours and 12.5 minutes. Therefore, it is likely that flood waters would begin to recede allowing emergency services to gain access to the property within approximately 6 hours (dependent on the low tide level and any topography/fluvial influences).

Offsite Impacts

Increases in Surface Water Runoff

The development proposals will increase the impermeable coverage within the application boundary and potentially increase surface water runoff rates and volumes when compared with the existing site. As a result, post development surface water runoff will need to managed accordingly.

It is recommended that the applicant incorporates Sustainable Drainage System (SuDS) techniques into the scheme such as rainwater butts, rain gardens and permeable paving to mitigate against increased flood risk to third party land and deterioration of the receiving water environment.

Surface water drainage techniques should be explored in accordance with the drainage hierarchy whereby discharge options are considered in the following order of preference:

1. Store rainwater for later use
2. Infiltration to ground
3. Discharge to a watercourse
4. Discharge to a surface water sewer/drain
5. Discharge to a combined sewer

At this stage, the client has confirmed that channel drains will be installed where appropriate to ensure that no surface water runoff from the site will discharge into the highway.

Floodplain Displacement

Whilst the site is located within the 2125 0.5% AEP Upper End climate change flood extent, flood risk at the development is tidally sourced.

As such, it is considered that there will be no significant loss in floodplain storage as a result of the proposals and compensatory storage is not required.

Conclusions and Recommendations

Conclusions

GeoSon Limited have been instructed by Fiona Sayers to undertake a Site Specific Flood Risk Assessment (FRA) to support a proposed planning application for development at 94 Marine Crescent, Worthing, West Sussex BN12 4JH.

This FRA has been undertaken in accordance with the revised National Planning Policy Framework (NPPF) December 2024 and the associated Planning Practice Guidance (PPG).

The proposed application site is located at 94 Marine Crescent, Worthing, West Sussex BN12 4JH. The site measures approximately 850m^2 in size and is occupied by a detached residential dwelling with a driveway in the south. The remaining area, including land in the north of the site (proposed to be developed), is underlain by soft landscaping.

The proposed planning application comprises construction of a two bedroom, chalet style dwelling in the rear garden of number 94 Marine Crescent which will face onto St John's Avenue.

The site is currently occupied by a single residential dwelling. Therefore, in terms of flood risk vulnerability it is considered "More Vulnerable". The proposals comprise construction of a residential dwelling upon vacant land in the rear garden of number 94. As such, according to NPPF guidance the vulnerability of the site as a whole will not increase as a result of the proposals.

According to the Environment Agency's Flood Map for Planning whilst part of the site is located within Flood Zone 3, the area proposed to be developed is situated entirely within Flood Zone 2.

Considering that the application area has been modelled within Flood Zone 2 and 3 on the EA's Flood Map for Planning, a Product 4 enquiry has been raised with the Environment Agency to obtain detailed flood model information in the relation to the site.

Maximum 2D modelled tidal flood levels and depths have been provided by the EA for defended (actual situation) and undefended (natural floodplain) scenarios at the site, extracted from the 2012 Arun Coastal Model.

Additionally, given that the site is located within an area at risk of tidal flooding, an assessment of the Still Water Tide Level data from the Coastal Flood Boundary Study (2018) has also been undertaken.

Following Environment Agency guidance, in instances where the predicted Still Water Tide Levels are greater than the locally modelled water levels the highest water levels should be taken forward to base the Flood Risk Assessment on.

The Still Water Tide Levels for chainage point 4562 are shown to be greater than the 2012 Arun Coastal Model outputs. Therefore, climate change allowance uplifts, to account for future sea level rise, have been applied to the 1:200 AEP Still Water Tide Level to determine the design flood level for the development.

Based on the revised guidance, the Higher Central and Upper End climate change allowances have been calculated for the site utilising the modelled 0.5% AEP flood level for chainage point 4562 and applying the South East sea level allowances for each epoch.

The 2125 1 in 200 year Higher Central and Upper End climate change flood levels in relation to the site are 5.19mAOD and 5.57mAOD, respectively.

Comparison of the 2125 1 in 200 year plus climate change Upper End flood level (5.57mAOD) with EA LiDAR data associated with the area of land proposed to be developed (4.20mAOD) indicates that the dwelling footprint may experience depths of up to 1.37m during the 2125 1 in 200 year Upper End climate change scenario.

However, it is important to note that the flood level outlined above does not take into account the presence of flood defences located within wider area which afford the site protection.

This is demonstrated by the outputs from the 2012 Arun Coastal Model which shows the development area to be elevated entirely above the modelled defended 2070 and 2115 0.5% AEP scenarios.

The EA's Risk of Flooding from Surface Water data shows that the site is located within an area modelled to be at 'Very Low' risk of flooding from surface water.

Worthing Borough Council Level 1 Strategic Flood Risk Assessment (2024) uses the national scale 5m resolution JBA Groundwater map to assess groundwater flood risk across the catchment. According to the map the site is located in an area where the groundwater levels are between 0.5m and 5m below the ground surface.

Despite this, a building is already present at the site and there have been no reports of groundwater ingress.

Review of the Environment Agency's Risk of Flooding from Reservoirs map indicates that the site is not located within the 'maximum extent of flooding from reservoirs'. As such, the application area is not considered to be susceptible to reservoir failure.

No information has been provided to suggest that the site has historically been subject to sewer surcharge flooding. In addition, no other artificial infrastructure have been identified within the surrounding area which could pose a risk of flooding to the development.

Summary and Recommendations

- The proposed planning application relates to construction of a two bedroom, chalet style dwelling in the rear garden of number 94 Marine Crescent.
- The updated 2125 1 in 200 year Upper End climate change flood level at the site is 5.57mAOD.
- Given the position of the site along an existing residential street the applicant is restricted to how high the Finished Floor Level (FFL) of the new dwelling can be raised without compromising other planning constraints such as ridge height restrictions.
- Therefore, whilst it is not feasible to set the proposed Finished Floor Level above the 2125 0.5% AEP Upper End climate change flood level it is recommended that (if possible) the applicant sets the Finished Floor Level of the property at 4.80mAOD, raised 600mm above the surrounding ground levels.
- Both bedrooms within the dwelling will be located at first floor level. As such, assuming that that FFL can be set at 4.80mAOD and a standard floor to ceiling height, the finished first floor level will be elevated at least 7.20mAOD; raised approximately 1.63m above the updated 2125 0.5% AEP Upper End climate change flood level.
- Comparison of the suggested FFL with the 2125 0.5% AEP Upper End climate change flood level (5.57mAOD) indicates that the ground floor of the dwelling may experience internal flood depths of up to 0.77m during the design storm event.
- In order to offer protection to the dwelling during an extreme flood event mitigation measures have been recommended on Page 31.
- Any external landscaping should be designed to slope away from the property.

- Linear drains should be installed in front of all building entry points.
- Any cracks and holes in the external walls, including service and drainage entry points are sealed with mortar/sealant and made watertight.
- Demountable flood defence barriers should be installed to protect ground floor entry thresholds against flood water ingress up to a maximum depth of 0.6m.
- The site is located within an EA Flood Warning and Alert area. Therefore it is recommended that site owner(s) and future residents sign up to the Environment Agency's free Targeted Flood Alert Service at https://www.gov.uk/sign-up-for-flood-warnings.
- Future owners/occupiers should also be advised to monitor weather forecasts by signing up to the Met Office weather warnings.
- Considering the nature of flood risk at the site, it is recommended that the applicant develops a Flood Warning and Evacuation Plan in accordance with the Environment Agency's Flood Plan template (refer to Appendix D) and West Sussex County Council's emergency planning guidance.
- Assuming the FFL recommendations in this report can be met and that the dwelling is constructed with a standard floor to ceiling height, the finished first floor level of the house will be elevated at least 7.20mAOD. Therefore, it is considered that safe refuge above the modelled 2125 1 in 200 year Upper End climate change flood level (5.57mAOD) can be provided on the upper floor of the residential unit itself.
- In the event of a severe flood warning, an evacuation route can be provided via St John's Avenue, adjacent west. If safe to do so, it is recommended that residents travel north along St John's Avenue before heading west along Alinora Crescent. This route will lead site users towards higher ground that is located entirely outside of Flood Zone 2, Flood Zone 3 and the 2125 Upper End 0.5% AEP tidal extent from 140m north west of the development onwards.
- The development proposals will increase the impermeable coverage within the application boundary. As a result, post development surface water runoff will need to managed accordingly. At this stage, the applicant has confirmed that channel drains will be installed where appropriate to ensure that no surface water runoff from the site will discharge into the highway.
- There will be no loss in floodplain storage as a result of the proposals.

Appendix

A. Existing and Proposed Plans

B. Worthing Borough Council SFRA Historical Flood Map

C. Environment Agency Product 4 Response

D. Environment Agency Flood Evacuation Plan Template

Appendix A

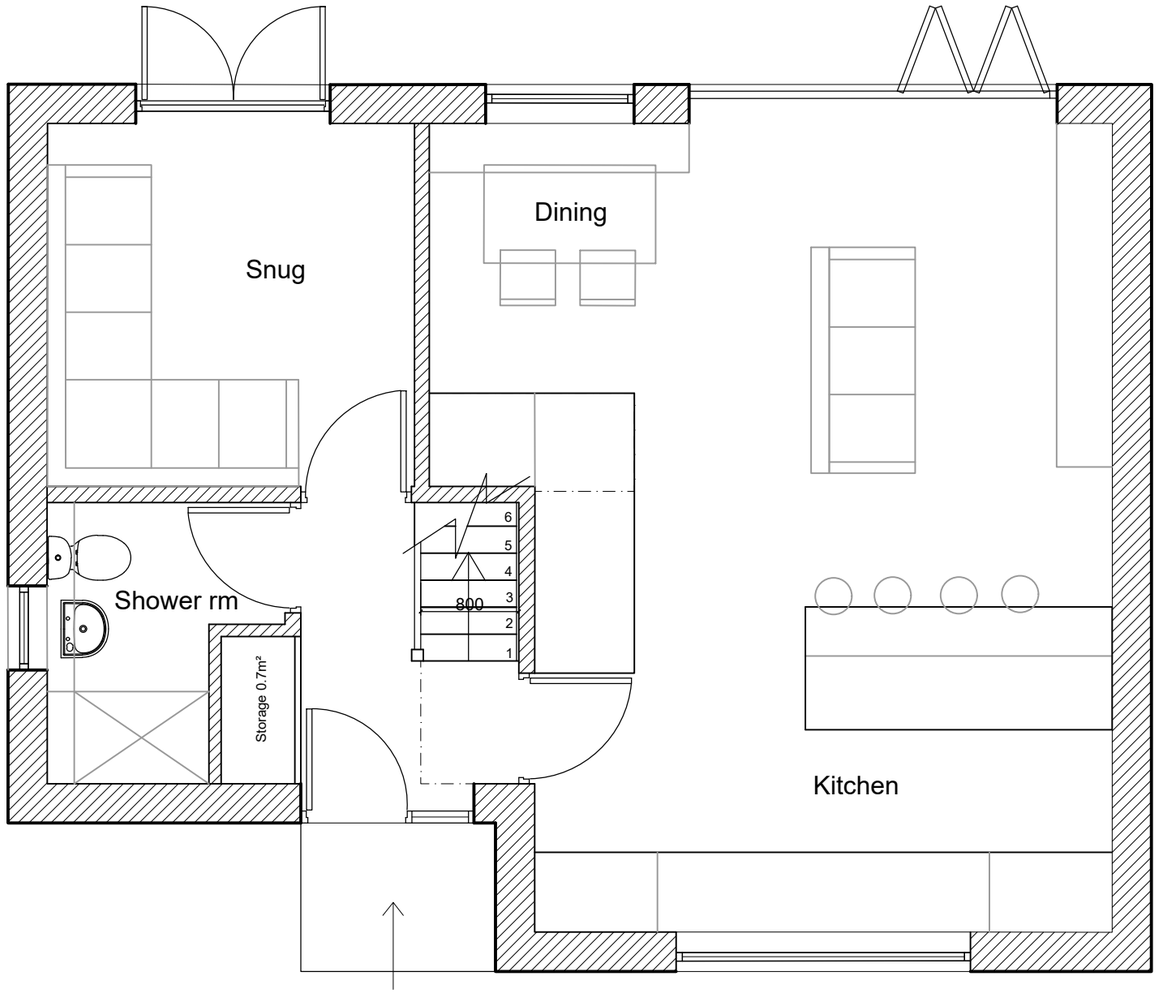
Revisions

PROJECT TITLE: **94 Marine Crescent, Goring-by-sea**

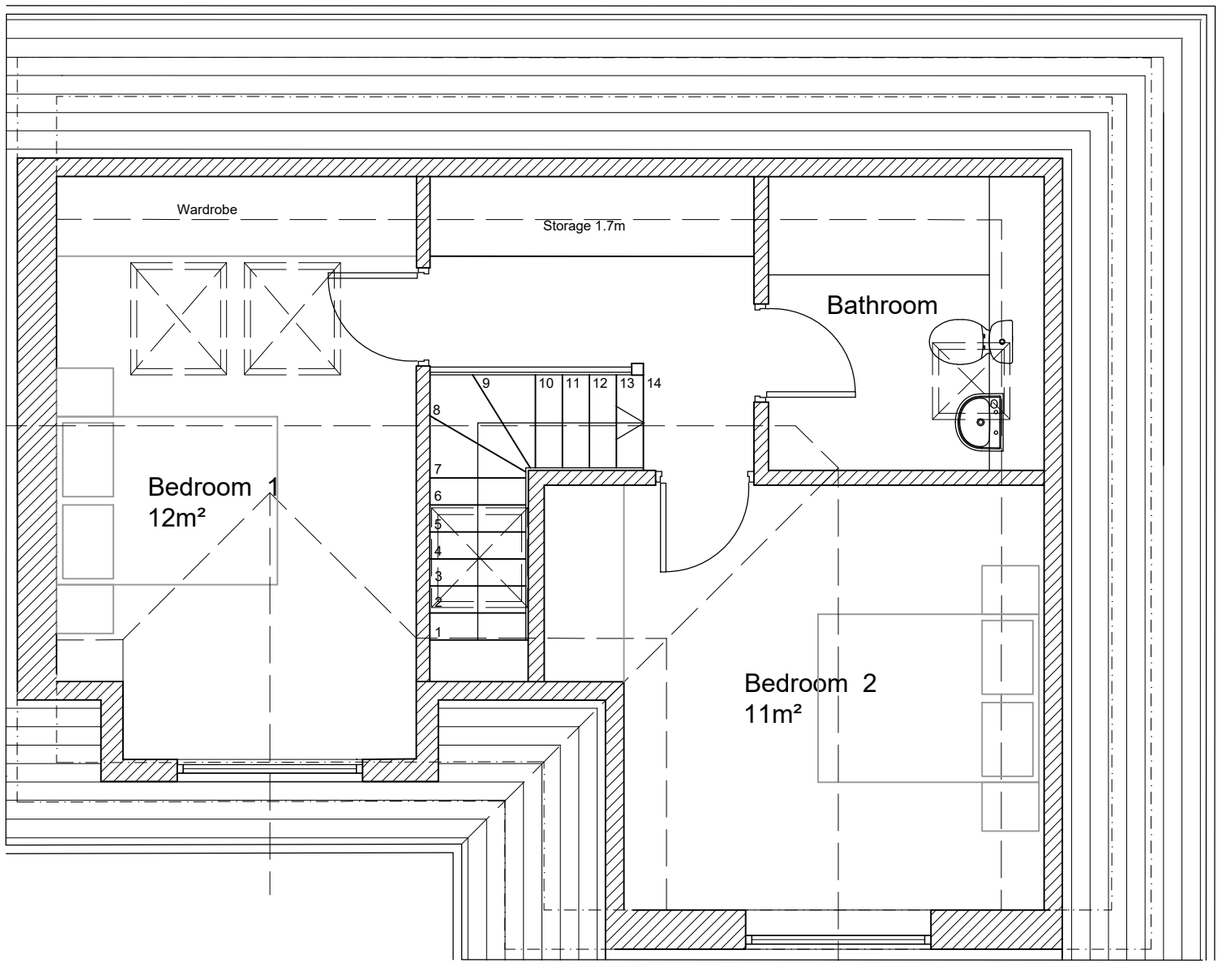
DRWG TITLE: **Site plan**
DRWG No: **1106_102**
REV: **-**

SCALE: **1:500@A3** DATE: **02.04.25**

DRWG STATUS : **For Information**



Ground Floor Plan - 51 sqm



First Floor Plan - 35 sqm

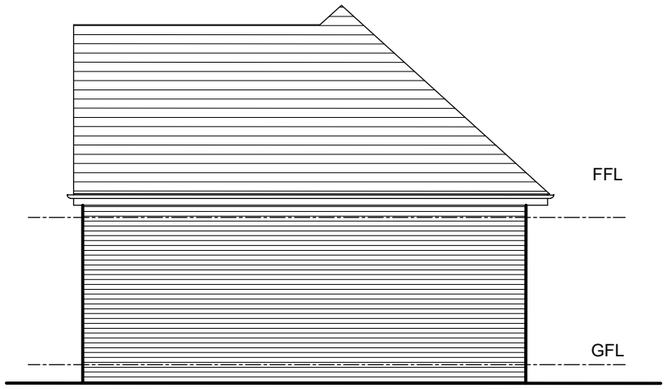
Revisions

PROJECT TITLE: **94 Marine Crescent, Goring-by-sea**

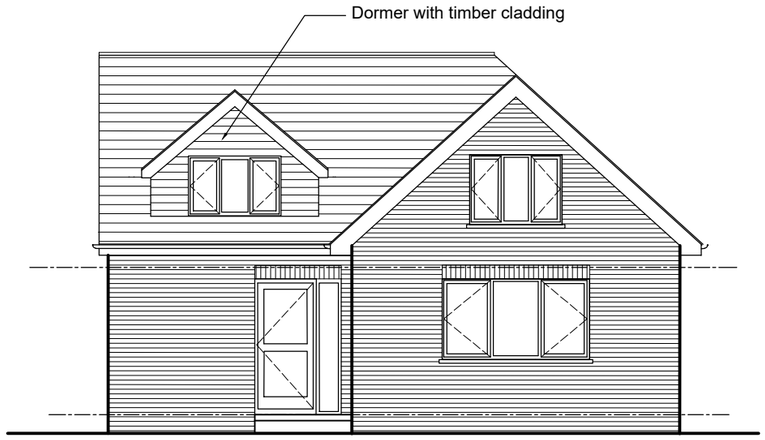
DRWG TITLE: **Proposed plans**
DRWG No: **1106_201**
REV: **-**

SCALE: **1:50@A3** DATE: **23.04.25**

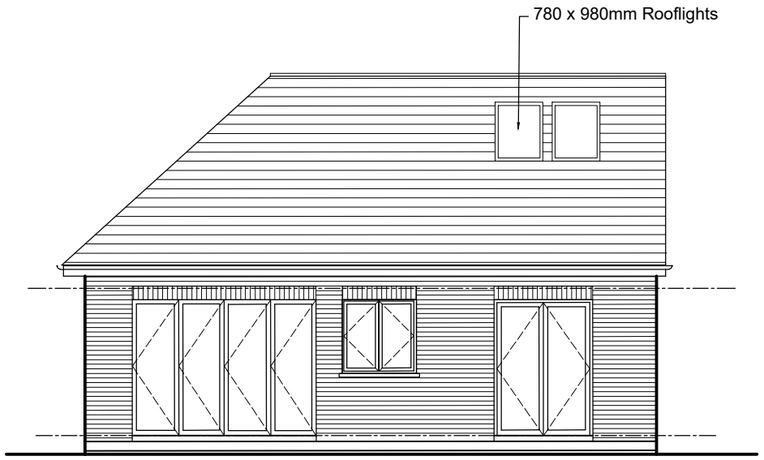
DRWG STATUS : **For Planning**



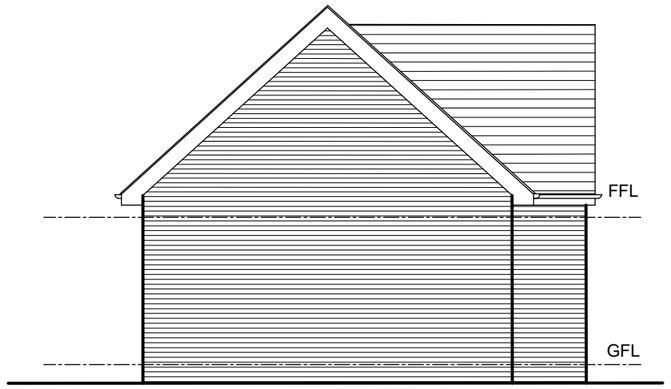
South Elevation



West Elevation



East Elevation



North Elevation

PROJECT TITLE: **94 Marine Crescent, Goring-by-sea**

DRWG TITLE: **Proposed Elevations**
DRWG No: **1106_301**
REV: **-**

SCALE: **1:100@A3** DATE: **28.04.25**

DRWG STATUS : **For planning**

Revisions

Existing Street Elevation

Proposed Street Elevation

0 1 2 3 4 5 6 7 8 9 10 15 20 25 30

Revisions

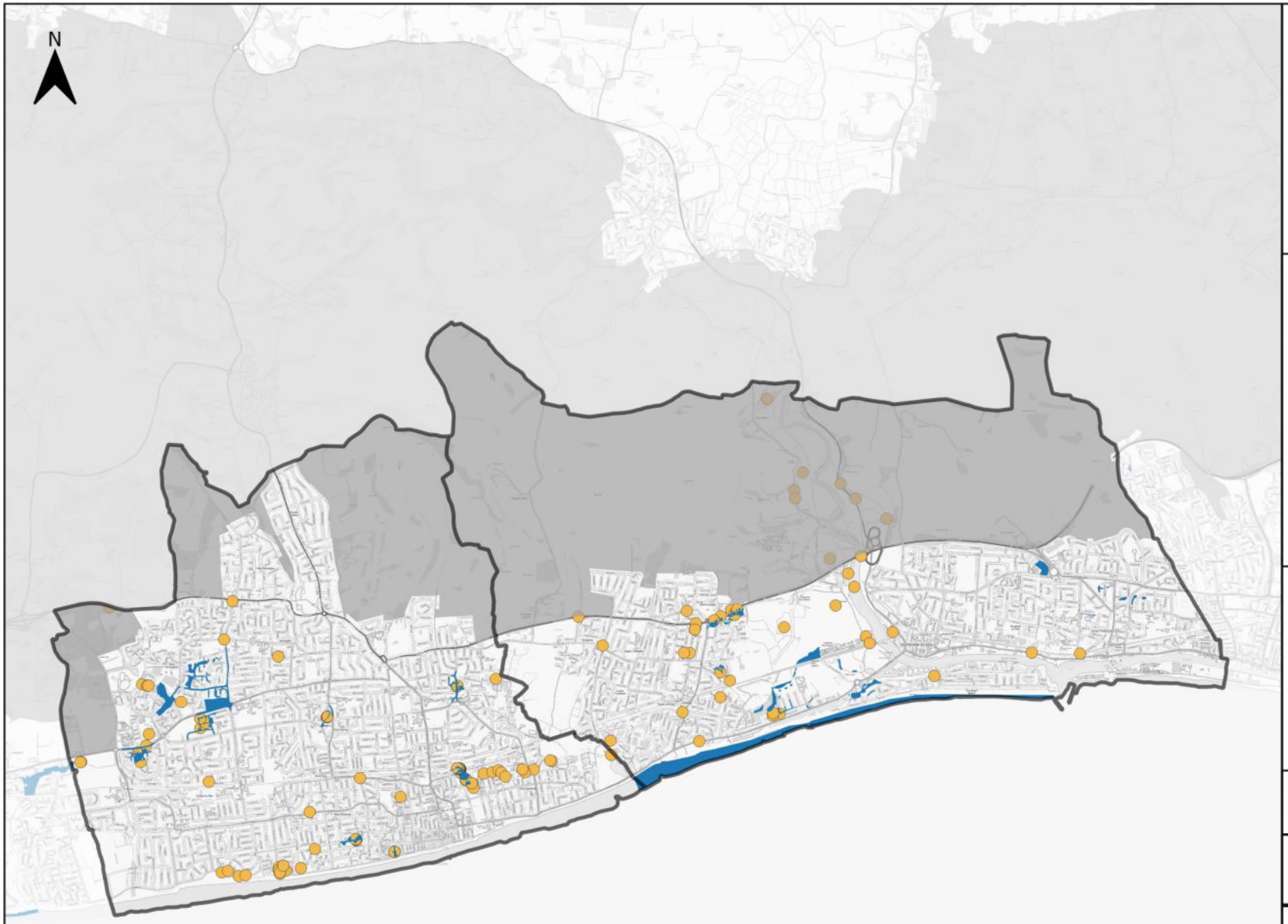
PROJECT TITLE: **94 Marine Crescent, Goring-by-sea**

DRWG TITLE: **Street Elevations**
DRWG No: **1106_300**
REV: **-**

SCALE: **1:200@A3** DATE: **11.05.25**

DRWG STATUS : **For planning**

Appendix B



Legend

Adur District and Worthing Borough

Historic Flooding

Recorded Flood Outlines

WSCC Recorded Incidents

0 1 2 3 4 km

Adur and Worthing Councils SFRA: Historic Flooding

ADUR & WORTHING COUNCILS

Appendix C

Flood risk assessment data

Location of site: 94 Marine Crescent, Goring-by-Sea, Worthing, BN12 4JH
Document created on: 13 June 2025
This information was previously known as a product 4.
Customer reference number: EIR2025/10383

Map showing the location that flood risk assessment data has been requested for.

How to use this information

You can use this information as part of a flood risk assessment for a planning application. To do this, you should include it in the appendix of your flood risk assessment.

We recommend that you work with a flood risk consultant to get your flood risk assessment.

Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- information on the models used
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- modelled data
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

Information that's unavailable

This document **does not** contain:

- past floods
- flood defences and attributes

We do not have past flooding data for this location.

Please note that:

- flooding may have occurred that we do not have records for
- flooding can come from a range of different sources
- we can only supply flood risk data relating to floodng from rivers or the sea

You can contact your Lead Local Flood Authority or Internal Drainage Board to see if they have other relevant local flood information. Please note that some areas do not have an Internal Drainage Board.

We aren't able to display flood defence locations and attributes as there are no formal flood defences in the area of interest.

Surface water and other sources of flooding

When using the surface water map on the check your long term flood risk service the following considerations apply:

- surface water extents are suitable for use in planning
- surface water climate change scenarios may help to inform risk assessments, but the available data fall short of what is required to assess planned development
- surface water depth information should not be used for planning purposes

To find out about other factors that might affect the flood risk of this location, you should also check:

- reservoir flood risk
- groundwater flood risk - you could use the British Geological Survey groundwater flooding data, groundwater: current status and flood risk and the guide on mining and groundwater constraints for development - further information may be available from the lead local flood authority (LLFA)
- your local planning authority's SFRA, which includes future flood risk

Your Lead Local Flood Authority is West Sussex County.

For information about sewer flooding, contact the relevant water company for the area.

About the models used

Model name: Arun Coastal Model, 2012
Scenario(s): Defended tidal, Undefended tidal
Date: 20 August 2012

These models contain the most relevant data for your area of interest.

Terminology used

Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1% chance of occuring in any one year, is described as 1% AEP.

Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.

Flood map for planning (rivers and the sea)

Your selected location is in flood zone 3.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

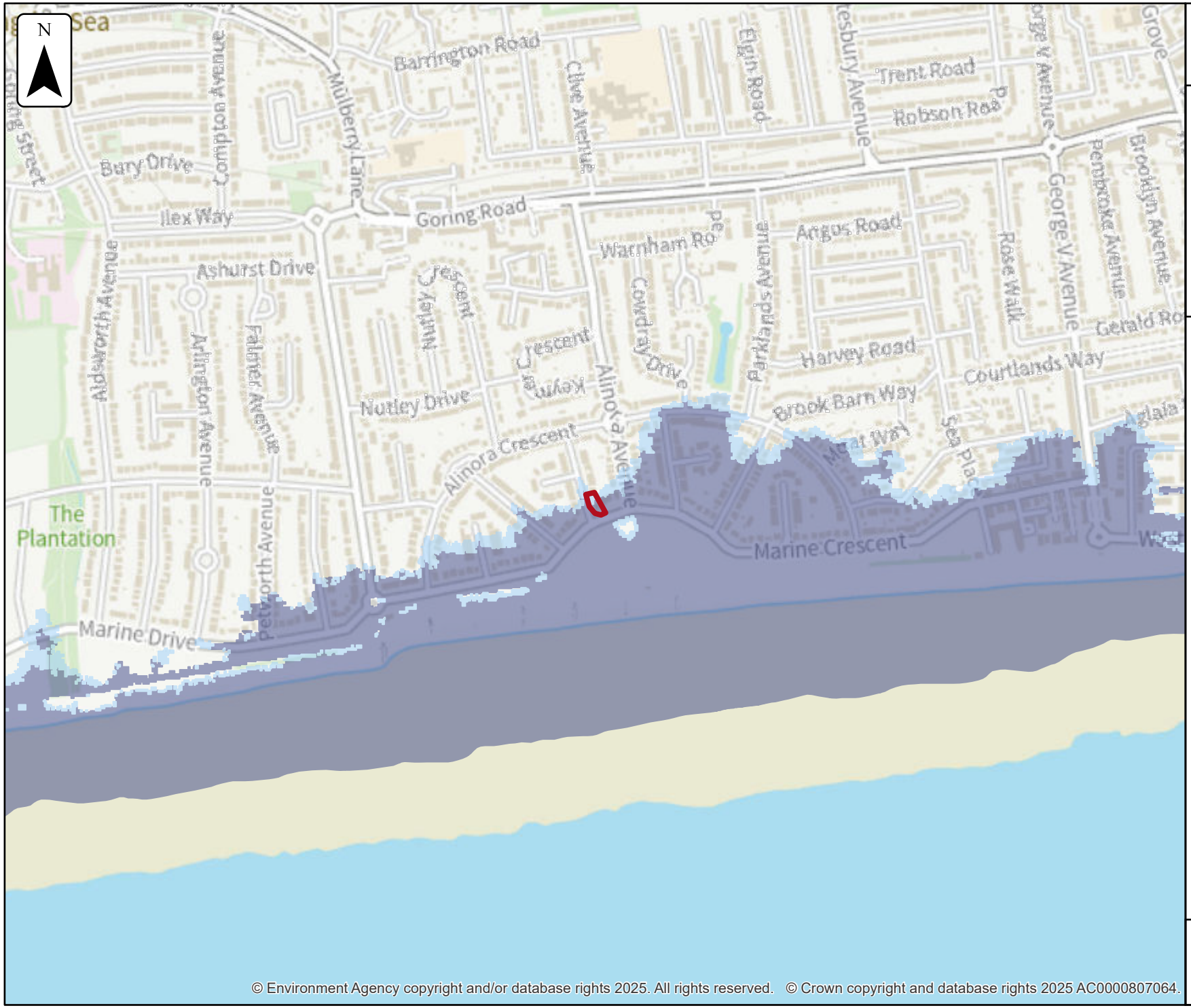
- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- do not take into account potential impacts of climate change


N
Barrington Road
Mulberry Lane
Clive Avenue
Elgin Road
Trent Road
Robson Road
George V Avenue
Pembroke Avenue
Brooklyn Avenue
Bury Drive
Ilex Way
Goring Road
Ashurst Drive
Aldsworth Avenue
Arlington Avenue
Palmer Avenue
Petworth Avenue
Nutley Drive
Alinora Crescent
Alinora Avenue
Cowdray Drive
Warnham Rd
Angas Road
Harvey Road
Brook Barn Way
Courtlands Way
Rose Walk
Marine Crescent
Marine Drive
The Plantation
Environment Agency
Flood map for planning
Location (easting/northing)
511648/102036
Scale
1:10,000
Created
13 Jun 2025
Selected area
Main river
Flood defence
Water storage area
Flood Zones 2 and 3
Rivers and Sea
Flood Zone 3
Flood Zone 2
0 100 200 300 400 500
metres
© Environment Agency copyright and/or database rights 2025. All rights reserved. © Crown copyright and database rights 2025 AC0000807064.

Modelled data

This section provides details of different scenarios we have modelled and includes the following (where available):

- outline maps showing the area at risk from flooding in different modelled scenarios
- map(s) showing the approximate water levels for the return period with the largest flood extent for a scenario and table(s) of sample points providing details of the flood risk for different return periods

Climate change

The climate change data included in the models may not include the latest flood risk assessment climate change allowances. Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

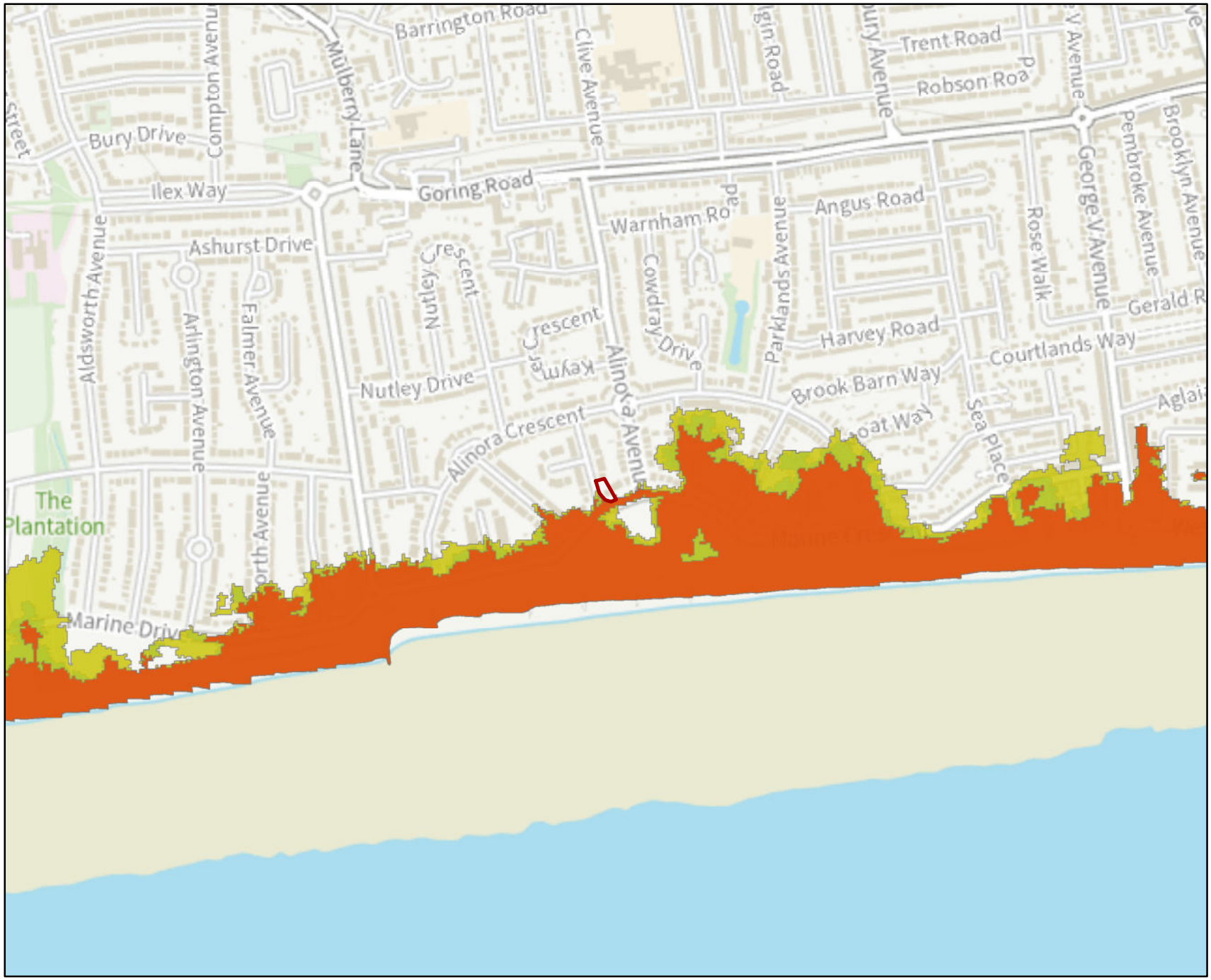
The Environment Agency will incorporate the new allowances into future modelling studies. For now, it's your responsibility to demonstrate that new developments will be safe in flood risk terms for their lifetime.

Modelled scenarios

The following scenarios are included:

- Defended modelled tidal: risk of flooding from the sea where there are flood defences
- Defences removed modelled tidal: risk of flooding from the sea where flood defences have been removed

Modelled Flood Outlines (Defended Tidal). Centred BN12 4JH. Created 13/06/2025.



Environment Agency

N

Legend

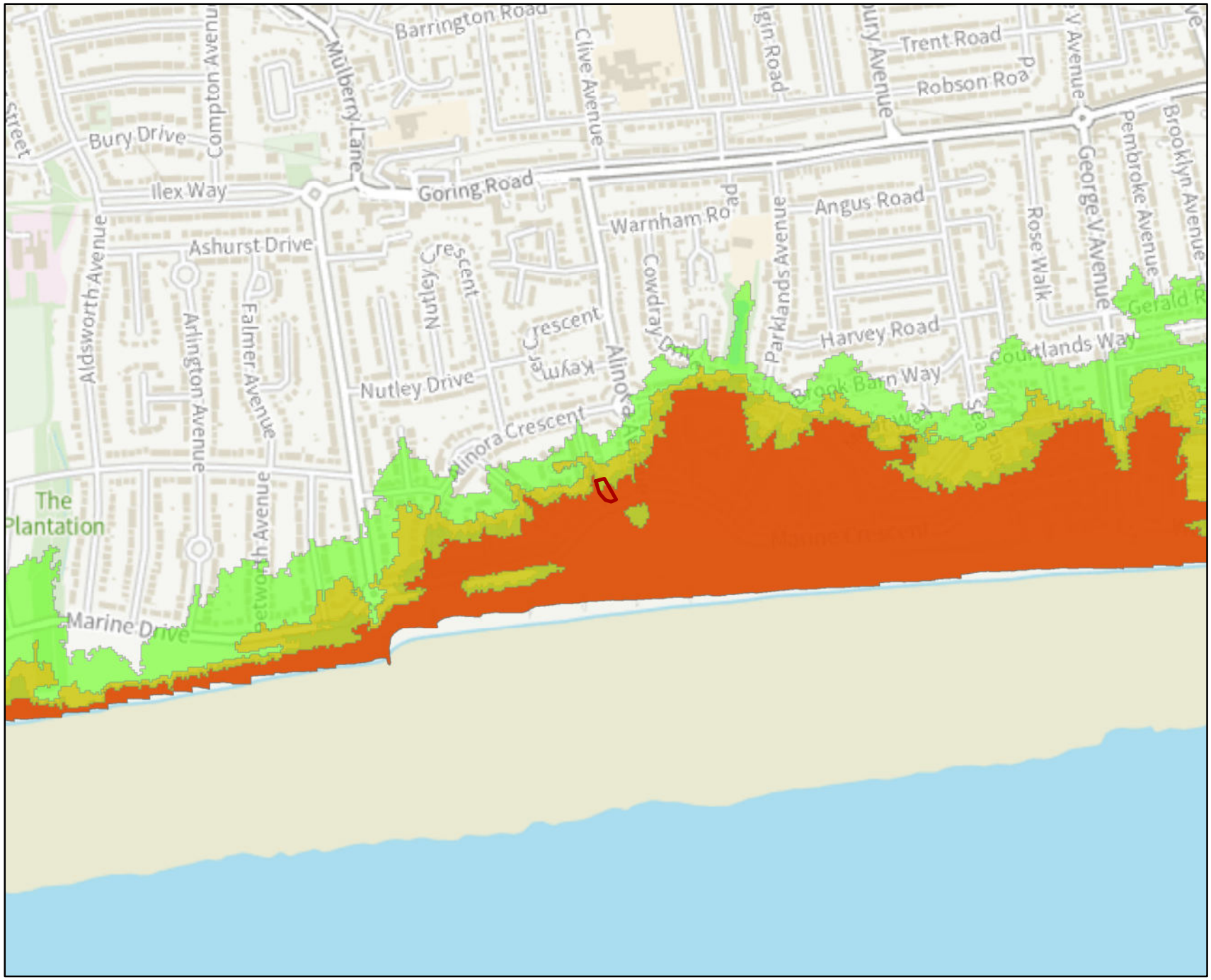
- Site Boundary
- 0.5% AEP (2012) (Defended)
- 0.5% AEP (2070) (Defended)
- 0.5% AEP (2115) (Defended)
- 0.1% AEP (2012) (Defended)

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

Scale: 1:10,000

0 0.225 0.45
Kilometers

Modelled Flood Outlines (Undefended Tidal). Centred BN12 4JH. Created 13/06/2025.



Environment Agency

N

Legend

- Site Boundary
- 0.5% AEP (2012) (Undefended)
- 0.5% AEP (2070) (Undefended)
- 0.5% AEP (2115) (Undefended)
- 0.1% AEP (2012) (Undefended)

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

Scale: 1:10,000

0 0.225 0.45
Kilometers

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

FRA Site Boundary & Node Points. Centred BN12 4JH. Created 13/06/2025.

Environment Agency

N

Legend

- Site Nodes
- Site Boundary

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

Scale: 1:500

0 0.01 0.02
Kilometers

Product 4 Flood Risk Data Requested by: Thomas Smith

Site: 94 Marine Crescent, Goring-by-Sea, Worthing, BN12 4JH

Table 1: Water Levels: Tidal Undefended

	NGR		Modelled Flood Levels in Metres AOD Undefended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)*	0.5% (2115)*	0.1%
1	511646	102057	-	4.56	5.19	4.26
2	511635	102044	4.07	4.56	5.19	4.26
3	511654	102038	4.07	4.56	5.19	4.26
4	511647	102024	4.07	4.56	5.19	4.26
5	511667	102020	4.07	4.56	5.19	4.26

Table 2: Water Levels: Tidal Defended

	NGR		Modelled Flood Levels in Metres AOD Defended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)*	0.5% (2115)*	0.1%
1	511646	102057	-	-	-	-
2	511635	102044	-	-	-	-
3	511654	102038	-	-	-	-
4	511647	102024	-	-	-	-
5	511667	102020	3.60	3.72	3.68	3.65

Table 3: Water Depths: Tidal Undefended

	NGR		Modelled Flood Depths in Metres Undefended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)*	0.5% (2115)*	0.1%
1	511646	102057	-	0.36	0.99	0.07
2	511635	102044	0.05	0.49	1.12	0.19
3	511654	102038	0.18	0.67	1.30	0.37
4	511647	102024	0.24	0.73	1.35	0.43
5	511667	102020	0.45	0.94	1.56	0.64

Table 4: Water Depths: Tidal Defended

	NGR		Modelled Flood Depths in Metres			
			Defended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)*	0.5% (2115)*	0.1%
1	511646	102057	-	-	-	-
2	511635	102044	-	-	-	-
3	511654	102038	-	-	-	-
4	511647	102024	-	-	-	-
5	511667	102020	0.06	0.16	0.12	0.10

All levels taken from: Arun to Adur Coastal Modelling (2012), completed by JBA Consulting.

Produced on: 13/06/2025

*** The flood risk data provided is based on existing EA hydraulic models with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 27 July 2021.**

You should refer to 'Flood risk assessments: climate change allowances' 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.

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

Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

Your Lead Local Flood Authority is West Sussex County.

About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

Find out more about flood risk activity permits

Help and advice

Contact the Solent and South Downs Environment Agency team at ssdenquiries@environment-agency.gov.uk for:

- more information about getting a product 5, 6, 7 or 8
- general help and advice about the site you're requesting data for

Appendix D

Personal flood plan

Name

Environment Agency

Are you signed up to receive flood warnings? ☐
If not call Floodline on 0345 988 1188 to see if your area receives free flood warnings.

Let us know when you've completed your flood plan by calling Floodline on **0345 988 1188.** This will help us learn more about how people are preparing for flooding.

General contact list	Company name	Contact name	Telephone
Floodline	Environment Agency		0345 988 1188
Electricity provider			
Gas provider			
Water company			
Telephone provider			
Insurance company and policy number			
Local council			
Local radio station			
Travel/weather info			

Key locations

Service cut-off	Description of location
Electricity	
Gas	
Water	

Who can help/who can you help?

Relationship	Name	Contact details	How can they/you help?
Relative			
Friend or neighbour			

Be prepared for flooding. Act now

Personal flood plan

What can I do NOW?

Environment Agency

- Put important documents out of flood risk and protect in polythene ☐
- Check your insurance covers you for flooding ☐
- Look at the best way of stopping floodwater entering your property ☐
- Make a flood plan and prepare a flood kit ☐
- Find out where you can get sandbags ☐
- Identify who can help you/ who you can help ☐
- Identify what you would need to take with you if you had to leave your home ☐
- Understand the flood warning codes ☐

What can you do if a flood is expected in your area?

Actions	Location
Home	
• Move furniture and electrical items to safety	
• Put flood boards, polythene and sandbags in place	
• Make a list now of what you can move away from the risk	
• Turn off electricity, water and gas supplies	
• Roll up carpets and rugs	
• Unless you have time to remove them hang curtains over rods	
• Move sentimental items to safety	
• Put important documents in polythene bags and move to safety	
Garden and outside	
• Move your car out of the flood risk area	
• Move any large or loose items or weigh them down	
Business	
• Move important documents, computers and stock	
• Alert staff and request their help	
• Farmers move animals and livestock to safety	
Evacuation - Prepare a flood kit in advance	
• Inform your family or friends that you may need to leave your home	
• Get your flood kit together and include a torch, warm and waterproof clothing, water, food, medication, toys for children and pets, rubber gloves and wellingtons	

There are a range of flood protection products on the market to help you protect your property from flood damage. A directory of these is available from the **National Flood Forum** at **www.bluepages.org.uk**

Be prepared for flooding. Act now

GEHO0709BQPU-E-E