

# **Brighton and Hove City Council Strategic Flood Risk Assessment Addendum**

## **Final Report**

**March 2021**

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**Brighton & Hove  
City Council**

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## Contract

This report describes work commissioned by Andy French of Brighton and Hove City Council, by an email dated 17 February 2021. Peter Rook, Ffion Wilson and Alastair Dale of JBA Consulting carried out this work.

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## Purpose

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## Abbreviations

	Definition
AEP	Annual Exceedance Probability
BHCC	Brighton and Hove City Council
DTM	Digital Terrain Model
FRA	Flood Risk Assessment
FZ	Flood Zone
GIS	Geographic Information Service
HC	Higher Central climate change allowances
JBA	Jeremy Benn Associates
LIDAR	Light Imaging Detection and Ranging
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
PFR	Property Flood Resilience
PPG	Planning Practice Guidance
RMA	Risk Management Authority
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
TIN	Triangular Irregular Network – a form of GIS analysis
UE	Upper End climate change allowances
UKCP18	United Kingdom Climate Projections 2018

## 1 Introduction

### 1.1 Purpose of the SFRA Addendum

JBA Consulting prepared the Brighton and Hove Level 1 and 2 Strategic Flood Risk Assessment (SFRA) for the City Council in 2018, supporting the evidence base behind Brighton and Hove's City Plan Part 2. At that time, the climate change flood mapping was based on UK Climate Predictions 2009 (UKCP09) guidance and UK Climate Predictions 2018 (UKCP18) with the supplementary guidance on its application was due to be published.

UKCP18 has since been published and the Environment Agency's guidance<sup>1</sup> has been updated in line with the latest predictions. JBA Consulting has now been instructed by Brighton and Hove City Council (BHCC) to prepare an addendum to the existing SFRA which outlines the implications of UKCP18 on the allocation of sites within the City Plan Part 2 and updates the assessment of flood risk in the SFRA.

This note has been prepared to present the changes in tidal climate change allowances affecting Brighton & Hove, and understand whether the changes affect previous Plan decisions made with respect to site allocations in the City Plan Part 2.

The Environment Agency Flood Zones are indicative of present-day flood risk, as a result these have not been updated with the new UKCP18 allowances.

The focus for the methods used in the technical assessment has been to prepare an initial "quick" assessment so that the implications of the changes to the climate change predictions can be taken into account in the plan process. The simplified methods used in the assessment will be updated and refined in a further future revision to provide higher resolution data that is associated with a lower level of uncertainty and commensurate with analyses performed elsewhere, but the analysis performed for the purpose of the addendum can be used to inform plan decisions with respect to flood risk implications.

## 2 Data used in the SFRA Addendum

This section outlines the climate change data used within the 2018 SFRA and the updates recently made by the Environment Agency following the publication of UKCP18.

### 2.1 Tidal flood data

The tidal flood data supporting the SFRA for most of the coastline was based on a simple comparison of the tide levels described by the JBA Extreme Sea Level Analysis (2004) and LIDAR data. The predicted cumulative sea level rise used in the 2018 SFRA was 1.21m (from 1990 to 2115) for the 0.5% Annual Exceedance Probability (AEP) flood event. Within the Shoreham Port / Aldrington Basin area, the Arun to Adur section of the East Sussex Coastal model (2012) was used to prepare flood level predictions for the same flood event.

The updated Environment Agency guidance is based on the UKCP18 and provides a range of allowances for each river basin district and epochs for sea level rise. Two allowances termed the "Higher central" and "Upper end" allowances are presented with different rates of net sea level rise for each. The two allowances are based on percentiles, which describe the proportion of possible range of statistically generated events that fall within specified allowance levels for respective predictions. The Higher central allowance is based on the 70<sup>th</sup> percentile (exceeded by 30% of the statistically generated results in the range) and the Upper end allowance is based on the 95<sup>th</sup> percentile (exceeded by 5% of the statistically generated results in the range). For flood risk assessments and strategic flood risk

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<sup>1</sup> Flood risk assessments: climate change allowances, last updated 22 July 2020, Available: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>



assessments, the Environment Agency guidance states that assessment of both the higher central and upper end allowances should be completed to understand the range of the potential effect. By virtue of the fact that the 95<sup>th</sup> percentile contains more extreme results it is associated with larger rises in sea level and so is a more precautionary estimate.

In addition to using updated data, the updated guidance assesses a slightly different time period and provides predicted cumulative sea level rise from 2000 to 2125.

For the south east river basin district, the predicted cumulative sea level rises are outlined in Table 2-1.

**Table 2-1: Environment Agency's predicted cumulative sea level rise**

Allowance	Cumulative rise 2000 to 2125 (metres)
Higher central	1.20
Upper end	1.60

If the yearly allowances from the previous guidance were extrapolated for the time period within Table 2-1, the total uplift would have equated to 1.32m.

The guidance also considered allowances for offshore wind speed and extreme wave height values, which influence overtopping. Within the SFRA, for most of the coastline, wave overtopping was excluded which was at the time considered appropriate when making land use planning decisions.

## 2.2 Surface water

Outputs in the 2018 SFRA used the Environment Agency's Risk of Flooding from Surface Water (RoFSW) model, which was run with 30% and 40% uplifts in peak rainfall intensity to account for the potential impacts of climate change.

The Environment Agency's guidance for rainfall allowances has not been updated since the publication of UKCP18. The rainfall intensities are outlined in Table 2-2.

**Table 2-2: Environment Agency's peak rainfall intensity guidance**

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

The RoFSW model was run for the 2018 SFRA with a 30% uplift in peak rainfall intensity for climate so that developers would consider this as a minimum.

As the RoFSW model was also run with 40% uplift in peak rainfall intensity, the SFRA has taken into account the most recent Environment Agency guidance for the Upper end allowance which would be the worst-case scenario. Therefore, no further work has been undertaken to assess the impacts on the allocation of sites as part of this Addendum.

### **2.3 Note for developers**

Developers should be aware that the Environment Agency updated their tidal climate change guidance in July 2020, and these allowances should be considered within Flood Risk Assessments.

Additionally, it is expected that the allowances for peak rainfall intensities will be updated by the Environment Agency during 2021 based on UKCP18. It is important that developers use the latest Environment Agency guidance when preparing Flood Risk Assessments.

### 3 Methodology for assessing potential impacts

#### 3.1 Level 1 SFRA update

The updated tidal climate change guidance sea levels for the 0.5% AEP event (Flood Zone 3a) to the year 2120 were estimated using the Coastal Flood Boundary Dataset (2018) extreme sea level information for the coastline at Brighton and Hove (which has a base year of 2017).

**Table 3-1: Datasets and assumptions made in the analysis of climate change on tidal flood risk in the Local Plan area**

Data	Datasets	Assumptions
Tide levels	Coastal Flood Boundary Dataset (2018)	These tide levels are for still water levels, consideration has not been made to overtopping or breach in this analysis.
Climate change allowances	Tide curve (JBA) Coastal Flood Boundary Dataset (2018)	A tide curve was generated for the marina, this was used to uplift values in Coastal Flood Boundary Dataset for the higher central and upper end
Interpolated grids	Breaks lines dataset	Break lines were assigned values based on uplifted values from the Coastal Flood Boundary Dataset.  Grids were generated using TIN interpolation in QGIS.
Depth grids	Environment Agency 1m LIDAR DTM (2019)	The 1m LIDAR DTM was subtracted from each of the grids to produce depth outputs, negative values were filtered from the datasets.
Hazard grids	Depth grids	Hazard values were calculated using the formula:  $\text{Depth} \times (\text{Velocity} + 0.5) + \text{Debris Factor}$ Where velocity is assumed to be zero and a Debris Factor of one was used.
Extent shapefiles	Depth grids	Depth grids were converted to a vector format, isolated extents and dry islands <200m <sup>2</sup> were removed from the data  For consistency, these extents were used to trim the extents of the depth and hazard grids.

This was adjusted to reflect the uplift to the year 2120 in accordance with the higher central and upper end sea level rise allowances for the period 2017-2120. Extreme sea levels for the 0.5% AEP event vary by 0.12m from the western (lower water levels) and eastern (higher water levels) extents of Brighton and Hove boundary. For the assessment described below, the highest predicted sea water levels were used as a precautionary approach, these levels are considered accurate to 0.01m.

For the purpose of the update to the SFRA the sea level values were simply extrapolated across the seafront of Brighton and Hove and used to provide an indicative assessment of the impacts of climate change on tidal flood risk in the Local Plan area. These levels were



then categorised into areas which were predicted to lie above or below the Environment Agency's 1m LIDAR DTM (2019) to determine potential flood extents, and assess whether changes to the guidance in future could potentially affect planning decisions made relating to the allocation of sites.

The following methodology and assumptions have been applied to derive extents, depths and hazards for the higher central and upper end climate change allowances:

- Generation of a tide curve and uplift of the 0.5% AEP values in the Coastal Flood Boundary dataset;
- TIN interpolation based on break lines from the uplifted Coastal Flood Boundary data;
- Subtraction of 1m LIDAR DTM (2019) to produce depth grids;
- Filtering processes applied to remove negative values from dataset;
- Hazard outputs calculated based on depth grids;
- Extents derived from depth outputs and filtering processes applied to clip extents where appropriate and remove dry islands.

It should be noted that the outputs associated with this analysis represent increases in sea level due to climate change, and do not represent any risks associated with wave overtopping or residual risk from breach that could be a potential impact in the Local Plan area.

A comparison has been made between flood zone 3a as defined in the 2018 SFRA, and the higher central and upper end climate change flood extents, to identify differences and understand whether there are potential effects on previous zoning decisions. This conservative approach is not considered to materially change the outcomes of the assessment as the relative level difference at the limits of the area under study are not substantial, but it is the intention to subsequently perform analysis that includes the effects to provide evidence to support this assumption. These extents are to be verified by the Environment Agency.

### **3.2 Level 2 SFRA flood depth and hazard updates**

Indicative depth values were extracted for the purposes of the updated Level 2 assessment for the Marina site, from the predicted climate change flood levels and the Environment Agency's 1m LIDAR DTM (2019). As these are based on LIDAR data, these values are not considered accurate beyond the shoreline. These indicative depth values were used to estimate flood hazard for the purposes of assessing flood risk to the Marina site. Considering the depths of water in the marina, a debris factor of 1 has been assumed for the derivation of the hazard outputs. It would be expected that if more detailed development proposals were brought forward the FRAs supporting such proposals would include higher resolution analyses.

## 4 Results

### 4.1 Differences in updated mapping of flood extents

An overview map comparing the predicted tidal 0.5% AEP climate change events is presented in Figure 4-1. The map provides a comparison of the predicted extents produced for the higher central and upper end sea level rise allowances using the latest Environment Agency guidance.

The mapping shows that throughout the city it is not anticipated there are would be substantive changes in the predicted tidal flood extents using the projected sea level method. As much of the city is protected by shingle beaches and/or cliffs, the flood extents do not significantly extend any further inland than those predicted within the 2018 SFRA. Minor differences in extents may also be expected due to the use of different LIDAR datasets (which might grid resolutions or collection dates that differ).

Figure 4-3 shows the comparison of the predicted flood extents for the Marina sites which was taken forward to the Level 2 SFRA. There is very little change shown between flood zone 3a defined in the 2018 SFRA and the extents predicted using the Environment Agency's latest guidance. Updates to flood depths and velocities at the Marina site are outlined in Section 6.

A map outlining the updated predicted tidal climate change extents is provided in Figure 4-1 and Figure 4-2.

Figure 4-1: Comparison overview map for areas east of the marina

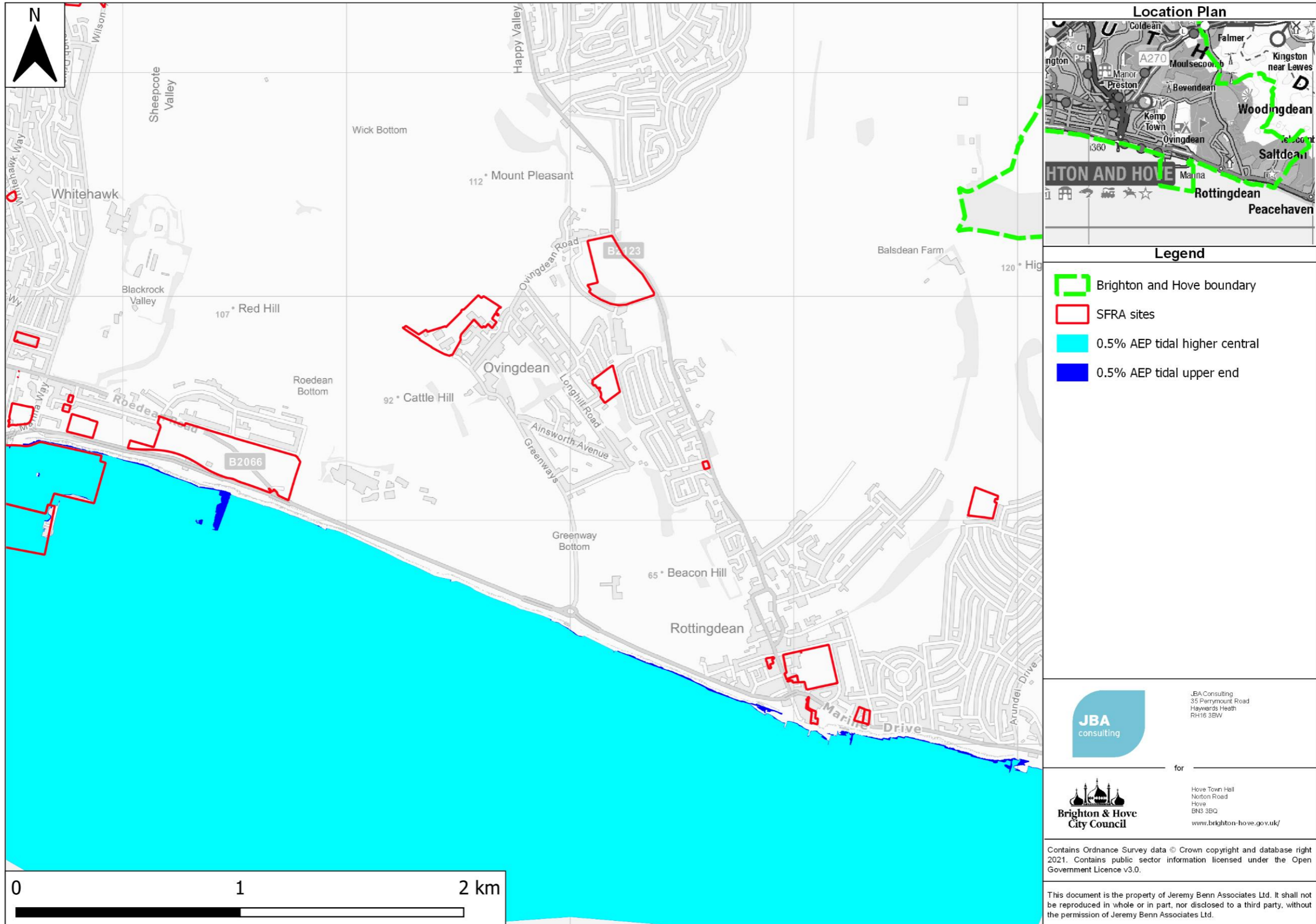
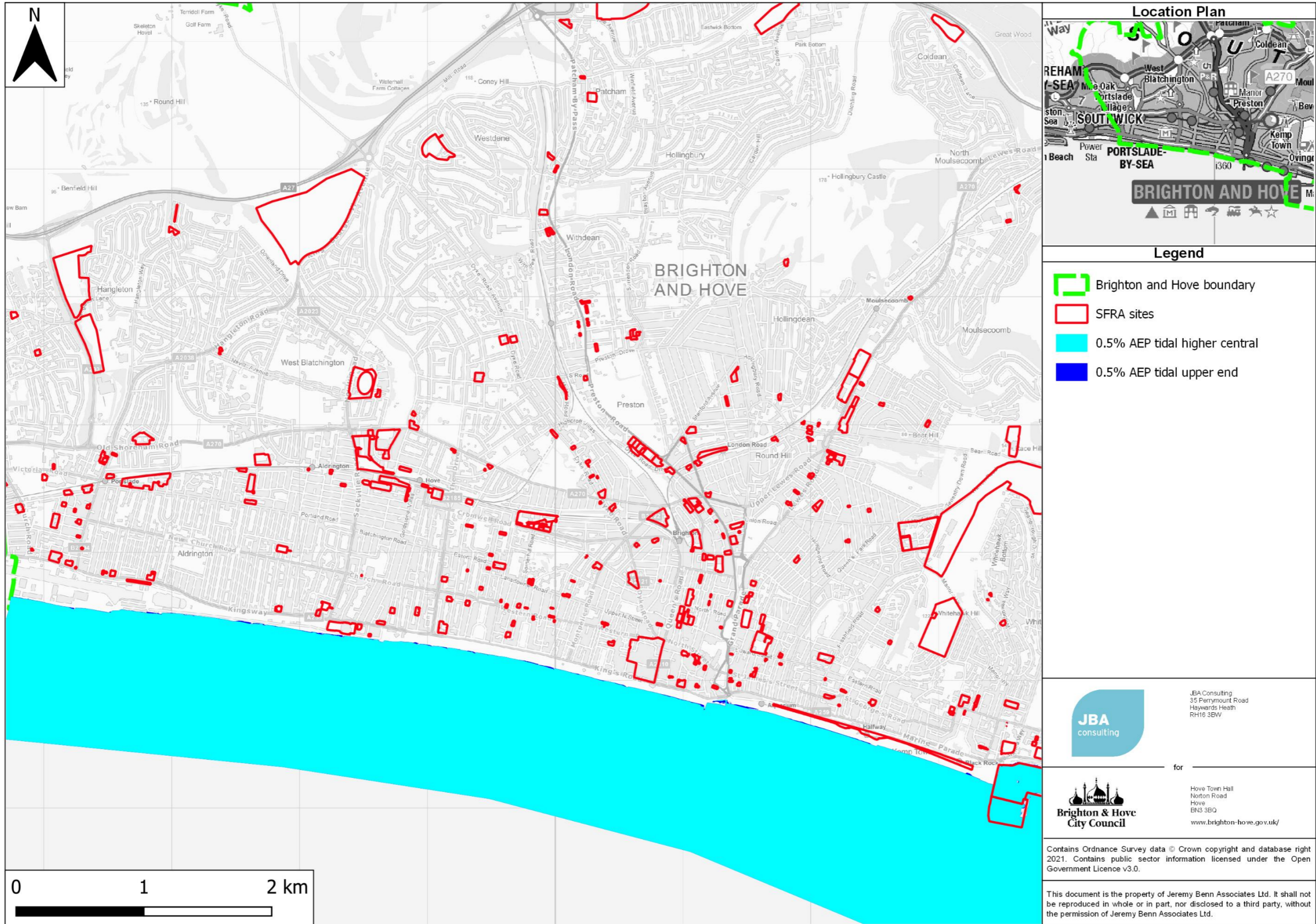


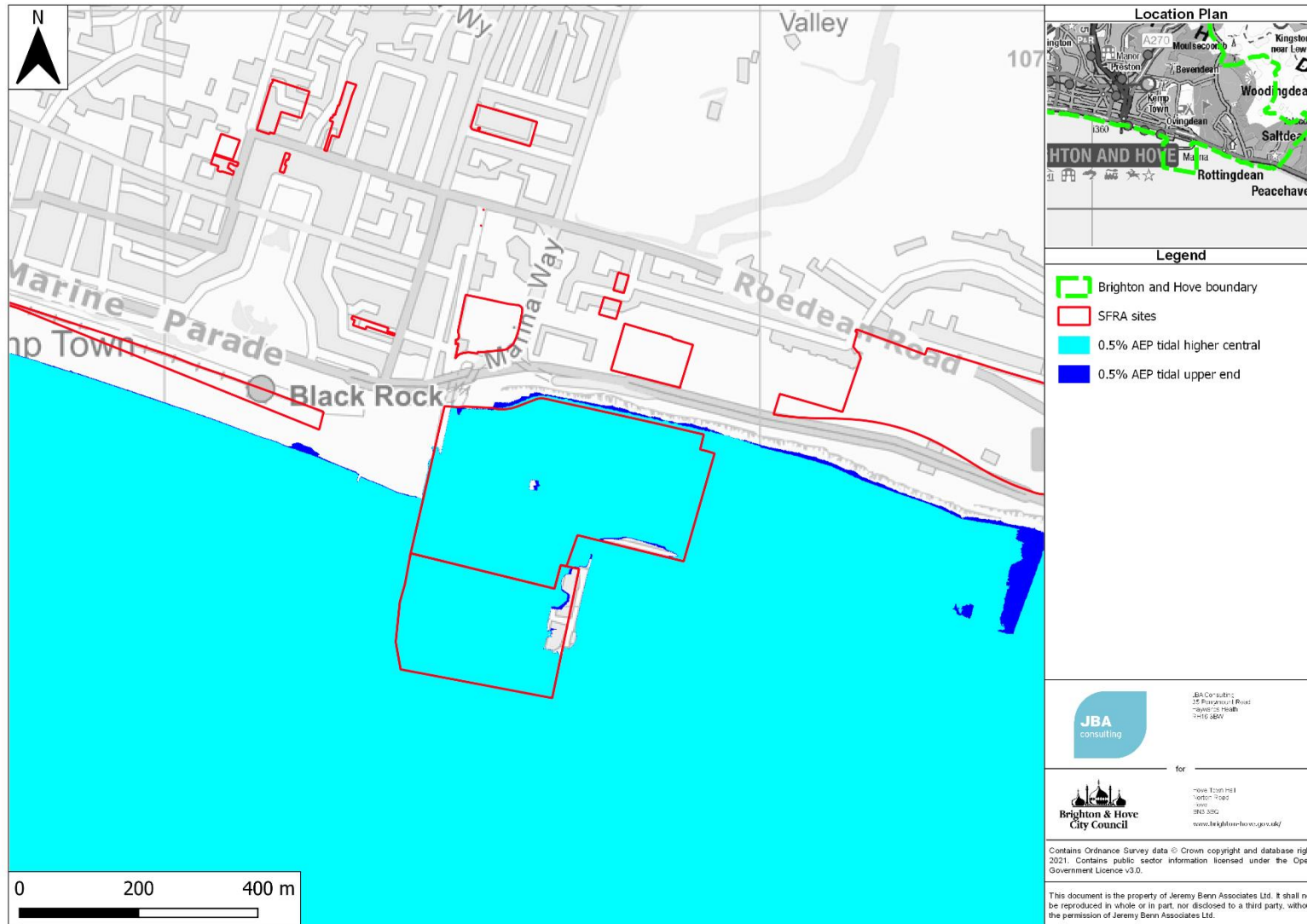


Figure 4-2: comparison overview map for areas west of the marina





**Figure 4-3: Comparison of extents at the Marina sites**



## 5 Updated Level 1 site screening

As part of the SFRA addendum, JBA have screened the allocated, committed and potential development sites using the updated tidal climate change data. The sites screened are those which were included in the 2018 SFRA. No updates have been made to the sites screened as part of this addendum. In addition, all flood risk data, excluding the updated tidal climate change information, has remained the same.

An updated site screening spreadsheet can be found in Appendix A.

**Table 5-1: Sites identified as being at potential risk from tidal flooding due to climate change**

Site code	Site name	Future tidal flood risk (0.5% AEP) Higher Central allowance	Future tidal flood risk (0.5% AEP) Upper End allowance
DA22	Land at Brighton Marina (Inner Harbour) Brighton	97%	98%
DA23	Land at Brighton Marina comprising Outer Harbour West Quay (and adjoining land) Br	92%	93%



## 6 Updated Level 2 assessment

### 6.1 Marina Development

As part of the Addendum, the Level 2 site summary sheet has been updated for the Marina Development with updated tidal flood depth and hazard information. The updated Level 2 site summary sheet can be found in Appendix B.

The results show that there are likely to be increases in the predicted flood depths and hazard at the site when considering circa 100-years in the future, taking account of UKCP18 and the latest Environment Agency climate change guidance. It should be noted that the majority of the site was previously considered to be at risk of tidal flood risk and the areas where there are the most significant increases in flood depths are already considered to be at risk of tidal flooding during the present day 0.5% AEP event. The conceptual approaches to flood risk management provided in the 2018 Level 2 SFRA remain appropriate.

## 7 Conclusion

### 7.1 Tidal flood risk

The results of the assessment described in this note show that there are no substantive changes in the predicted coastal/tidal flood extents for Flood Zone 3a when considered circa 100-years in the future, which take account of UKCP18 and the latest Environment Agency climate change guidance. This is due to most of the city being protected by shingle beaches and/or cliffs.

In light of the negligible changes to predicted extents, on the basis of this simplistic analysis it is not considered that the new climate change allowances give rise to material effects that would influence decisions on the allocation of sites through the City Plan Part 2, including the Marina or Kingsway sites. It is considered appropriate that this simple analysis is followed up with a more detailed approach that takes account of the other mechanisms that contribute to flooding from the sea, but on the basis of the simple analysis performed it is not anticipated that this further exercise will not materially change the flood risk information informing decisions on sites in the plan.

Note that the assessment has focused on Flood Zone 3a, and not Flood Zone 2, given the former is typically used to assess whether residential development is appropriate or not from a planning policy perspective.

This addendum to the SFRA has simply assessed changes in flood depths and hazard due to the updated climate change guidance at the Marina Development as part of a Level 2 SFRA. The results show that there are no substantive changes compared the to 2018 Level 2 SFRA.

### 7.2 Developers

Developers should consider the Environment Agency's updated tidal climate change modelling where appropriate. The analysis undertaken as part of this addendum is an assessment of the tide levels compared sea levels onto the ground level data described by LIDAR data. As part of an FRA detailed flood modelling would be required.

Developers should also be aware that the allowances for peak rainfall intensities will be updated by the Environment Agency during 2021 based on UKCP18. It is important that developers use the latest Environment Agency guidance when preparing Flood Risk Assessments.

## **Appendices**

### **A Updated Level 1 site screening**

## **B Updated Level 2 site summary**



# Brighton and Hove Council Level 2 SFRA Detailed Site Summary Tables



<b>Site details</b>	<b>Site Code</b>	DA2.C.1			
	<b>Site Name</b>	Brighton Marina			
	<b>Area (ha)</b>	16.84			
	<b>Current land use</b>	Brownfield			
	<b>Proposed site use</b>	<ul style="list-style-type: none"> <li>• 1,000 additional residential units</li> <li>• 5,000 sq m of new additional A1-A5</li> <li>• 3,500 sq m additional leisure and recreation use</li> </ul>			
<b>Environmental Descriptors</b>	<b>Bedrock Geology</b>	The geology of the site is predicted to be the Newhaven Chalk formation in a small portion of the site along the northern site boundary. This is a sedimentary chalk bedrock formed approximately 72 to 86 million years ago in the Cretaceous Period. Local environment is thought to be previously dominated by warm chalk seas.			
	<b>Superficial Geology</b>	There are no superficial geological deposits present at the site.			
	<b>Soil Type</b>	Freely draining lime-rich loamy soils are present in a small section of the centre and western boundary of the site.			
	<b>Typical Slope</b>	0.03			
	<b>Groundwater Source Protection Zone</b>	The site is not located within a groundwater source protection zone.			
	<b>Historic Landfill Site</b>	The site does not have a historic landfill site present.			
<b>Sources of flood risk</b>	<b>Coastal</b>	<b>Proportion of site at risk</b>			
		<b>FZ3b</b>	<b>FZ3a</b>	<b>FZ2</b>	<b>FZ1</b>
		31%	37%	5%	27%
		The site is predicted to be at risk from coastal flooding. The southern half of the site is shown to be within Environment Agency Flood Zone 3b and the northern half of the site is located within large areas of Flood Zone 3 and 2. Small isolated areas in the northern half of the site are also situated within Flood Zone 1.			
	<b>Fluvial</b>	<b>Proportion of site at risk</b>			
		<b>FZ3b</b>	<b>FZ3a</b>	<b>FZ2</b>	<b>FZ1</b>
		0%	0%	0%	100%
		The site is not at risk from fluvial flooding.			
	<b>Surface Water</b>	<b>Proportion of site at risk (RoFSW)</b>			
		<b>3.33% AEP</b>	<b>1% AEP</b>	<b>0.1% AEP</b>	
26%		32%	42%		
<b>Proportion of site within a Surface Water Flood Zone</b>					
<b>Accumulation Flood Zone</b>		<b>Conveyance Flood Zone</b>			
32%		20%			



## Brighton and Hove Council Level 2 SFRA Detailed Site Summary Tables



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	<b>Site Name</b>	Brighton Marina		
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	<b>Current land use</b>	Brownfield		
	<b>Proposed site use</b>	<ul style="list-style-type: none"> <li>1,000 additional residential units</li> <li>5,000 sq m of new additional A1-A5</li> <li>3,500 sq m additional leisure and recreation use</li> </ul>		
		<p>The site is shown to be at risk from surface water flooding. The north west corner of the site is shown to be flooded during the 3.33% AEP event where flow accumulated from here and down Palm Drive. The rest of the site has small pockets of flow accumulation during the 1% AEP and 0.1% AEP events around roads and carpark areas. The site is also situated in both Accumulation and Conveyance Surface Water Flood Risk Zones.</p>		
	<b>Groundwater</b>	<b>Proportion of site at risk in JBA Groundwater Map 1 in 100-year risk categories</b>		
		<b>Depth below surface 0-0.025m</b>	<b>Depth below surface 0.025 to 0.5m</b>	<b>Total in highest risk categories</b>
		0%	0%	0%
	<b>Reservoir</b>	The site is not within the flood inundation extent in the event of reservoir failure.		
	<b>Watercourse</b>	The site is not situated in proximity of a watercourse.		
	<b>Existing drainage features</b>	The foul sewer network is shown to be present within the site along Palm Drive. A number of gullies are located to the north of the site along Marine Drive where the combined sewer network is also present. Surface water sewer network also runs along and adjacent to the west site boundary.		
	<b>Flood history</b>	No historical incidents of flooding have been identified at the site.		
	<b>Sewer incidents</b>	No incidents of sewer flooding have been reported by Southern Water at the site.		
<b>Flood mechanism</b>	The dominant flood mechanism for the site is tidal flooding as it covers the largest extent within the site boundary and would have the highest impact. There is also surface water flood risk to the site. It is unlikely that these flood mechanisms will interact as they are driven by different circumstances.			
<b>Flood risk management infrastructure</b>	<b>Defences</b>	<b>Defence Type</b>	<b>Standard of Protection</b>	<b>Condition</b>
		Flood Wall	0.5% AEP	Good
	Concrete walls with steel toe piling, concrete caisson and mass concrete breakwaters flood defences provide protection to the site.			
<b>Residual risk</b>	Overtopping of flood defences present a residual risk to the site.			
<b>Emergency planning</b>	<b>Flood warning</b>	The site is situated within the Environment Agency's Brighton Marina and Coastal Areas of Brighton Marina flood warning and alert service.		
	<b>Access and egress</b>	Safe access and egress can be available to the site during a tidal flood event along Marine Drive. Safe access and egress during a surface water flood event is predicted to be problematic for all modelled return periods and therefore should be investigated at a site-specific flood risk assessment by the developer.		



## Brighton and Hove Council Level 2 SFRA Detailed Site Summary Tables



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<b>Climate Change</b>	<b>Climate change allowances for '2080s'</b>	<b>Allowance</b>	<b>Flood extent</b>	
		Higher central	96%	
		Upper end	97%	
	<b>Increase in flood extent compared to Flood Zone 3a for the upper end allowance</b>		22%	
	<b>Implications for the site</b>	A significant increase in the extent of the future extent of Flood Zone 3a has been mapped therefore suggesting that the site's risk of coastal flooding will increase in the future.		
	<b>Impact of climate change on risk from surface water</b>	<b>Increase in flood extent compared to 1% AEP event</b>		
		<b>30%</b>	<b>40%</b>	
	31%	31%		
<b>Implications for the site</b>	An increase in the extent of the 1% AEP surface water flood event has been modelled to increase in the future therefore suggesting that the site will be at a higher risk from surface water flooding in the future.			
<b>Requirements for drainage control and impact mitigation</b>	<b>Broad scale assessment of possible SuDS</b>	<ul style="list-style-type: none"> <li>• Due to the existing flood risk to properties surrounding the site, surface water discharge should be restricted to greenfield runoff rate. As a minimum SuDS should be designed around existing surface water flow paths and areas of ponding.</li> <li>• Source control techniques are likely to be suitable such as rain gardens, green roofs, rainwater harvesting and reuse and permeable paving may be suitable depending on the proposed development.</li> <li>• Detention features and infiltration systems may be feasible at locations where the slopes are &lt;5%. If there is groundwater risk (where the depth of water table is less than 1m) and potential for contamination, then a liner may be required.</li> <li>• Surface based SuDS and conveyance features (such as swales and attenuation ponds) are likely to be suitable for this site, following natural flow paths where possible.</li> <li>• Opportunities should be taken to deliver SuDS with multiple benefits, such as biodiversity, recreation, water quality and provide public awareness through water resource education and SuDS integration within greenspace.</li> </ul>		
	<b>Exception Test requirements</b>	The Sequential and Exception Test has been completed by Brighton and Hove City during the City Plan Part 1. However, it is recommended that Brighton and Hove City Council confirm that the conclusions are still valid based on the updated evidence in this SFRA.		





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	<b>Current land use</b>	Brownfield
	<b>Proposed site use</b>	<ul style="list-style-type: none"> <li>1,000 additional residential units</li> <li>5,000 sq m of new additional A1-A5</li> <li>3,500 sq m additional leisure and recreation use</li> </ul>
<b>NPPF and planning implications</b>	<b>Requirements and guidance for site-specific Flood Risk Assessment</b>	<ul style="list-style-type: none"> <li>At the planning application stage, a site-specific Flood Risk Assessment will be required if any development is located within Flood Zones 2 or 3 and/or Surface Water Flood Zones a or b. Other sources of flooding should also be considered.</li> <li>Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage.</li> <li>Resilience measures will be required if buildings are situated in the flood risk area.</li> <li>Reference should be made to the SuDS SPG regarding SuDS techniques in new or re-development sites.</li> <li>At the planning application stage, a site-specific Flood Risk Assessment will be required if any change of use is within a SWFZ.</li> <li>As the site is partially located within Surface Water Flood Zone a (Accumulation), FRA requirements include:             <ul style="list-style-type: none"> <li>Assessment of flood risk from all sources.</li> <li>Consideration of flow paths across the site and how the proposed development may alter these.</li> <li>Demonstration that ground floor levels should be a minimum of whichever is higher of:                 <ul style="list-style-type: none"> <li>300 mm above the general ground level of the site</li> <li>600mm above the estimated surface water level in the 1% AEP event with drainage plus 30% uplift to account for climate change</li> </ul> </li> <li>Consideration of other surface water flood resilience measures.</li> </ul> </li> <li>As the site is partially located within Surface Water Flood Zone b (Conveyance), FRA requirements include:             <ul style="list-style-type: none"> <li>Assessment of flood risk from all sources.</li> <li>Consideration of flow paths across the site and how the proposed development may alter these. Overland flow modelling maybe required to demonstrate this.</li> <li>Consideration of surface water flood resilience measures.</li> </ul> </li> <li>The site layout should be designed sequentially to avoid surface water flood risk.</li> <li>Evidence shall be included to confirm that the appropriate commitment is made by the parties with responsibility for assets required to manage the risk of surface water flooding for the lifetime of the development.</li> </ul>



## Brighton and Hove Council Level 2 SFRA Detailed Site Summary Tables



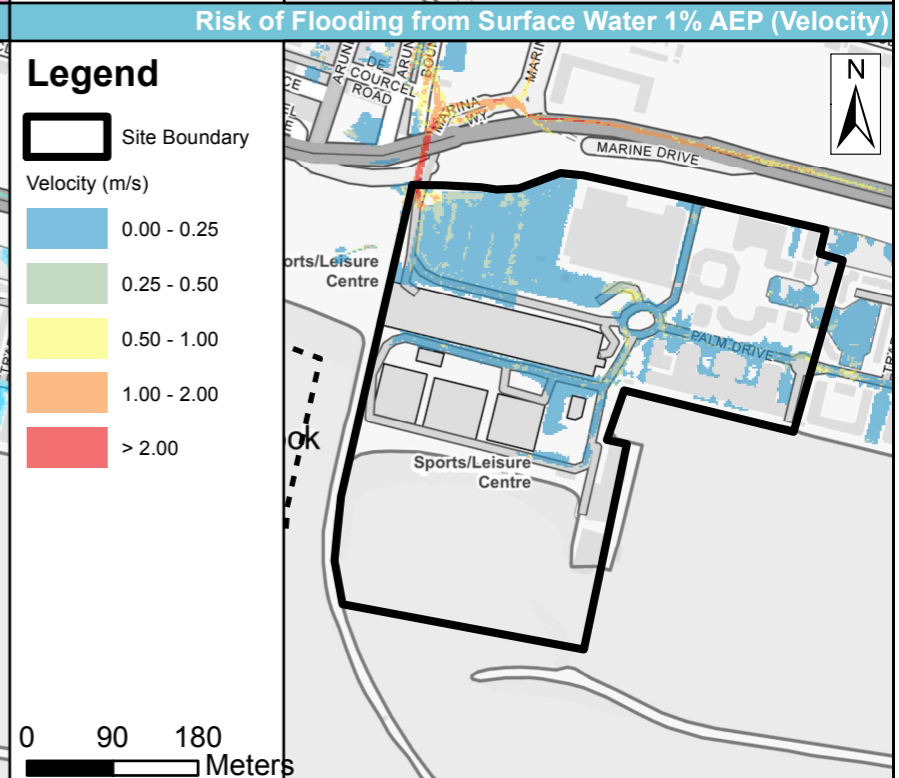
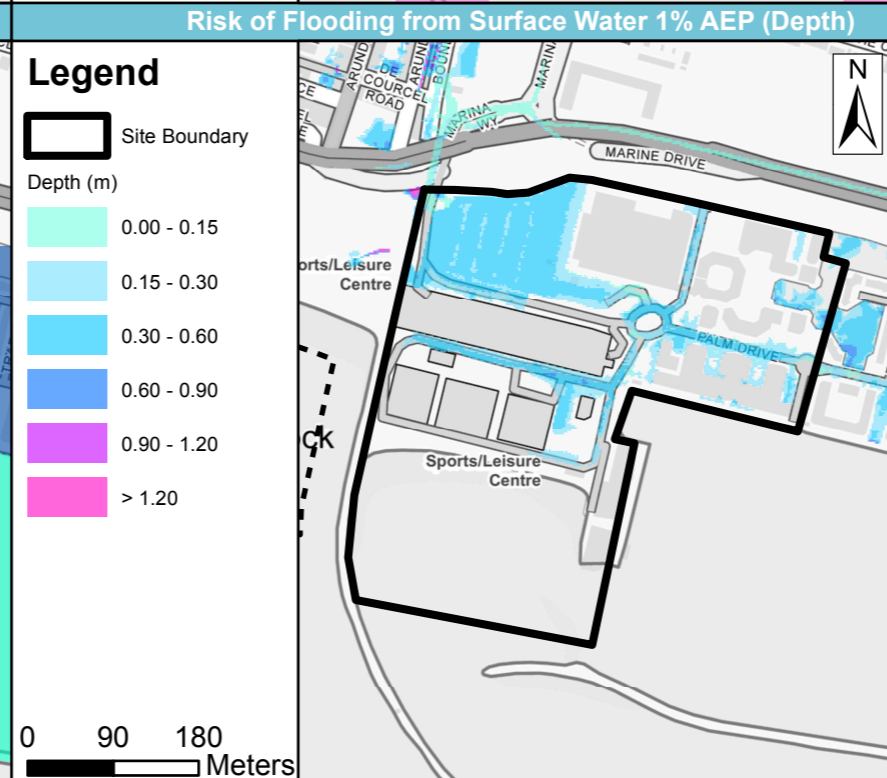
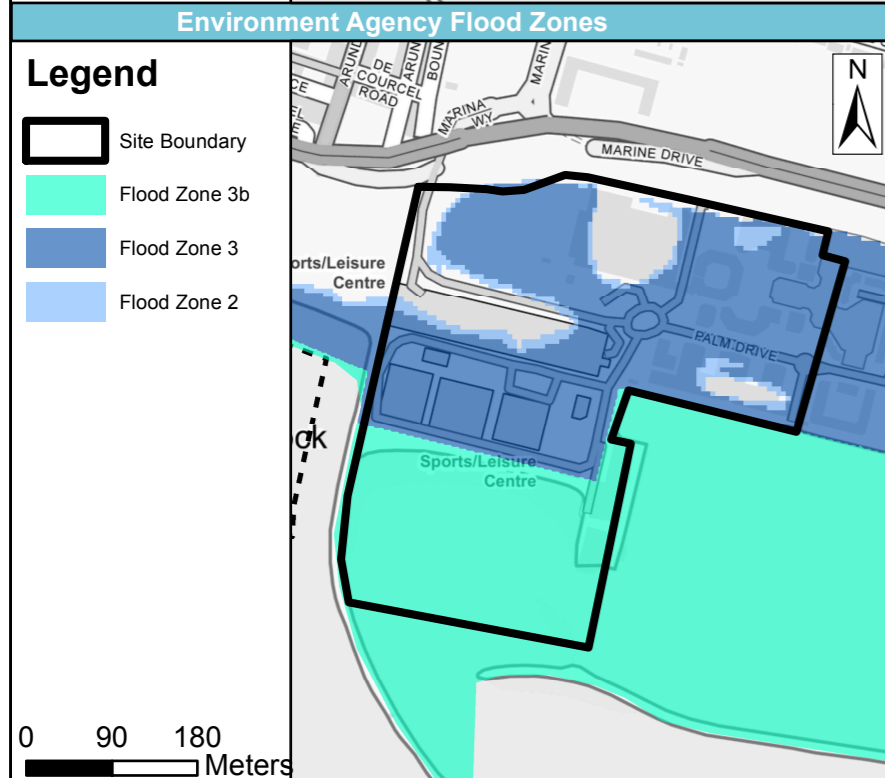
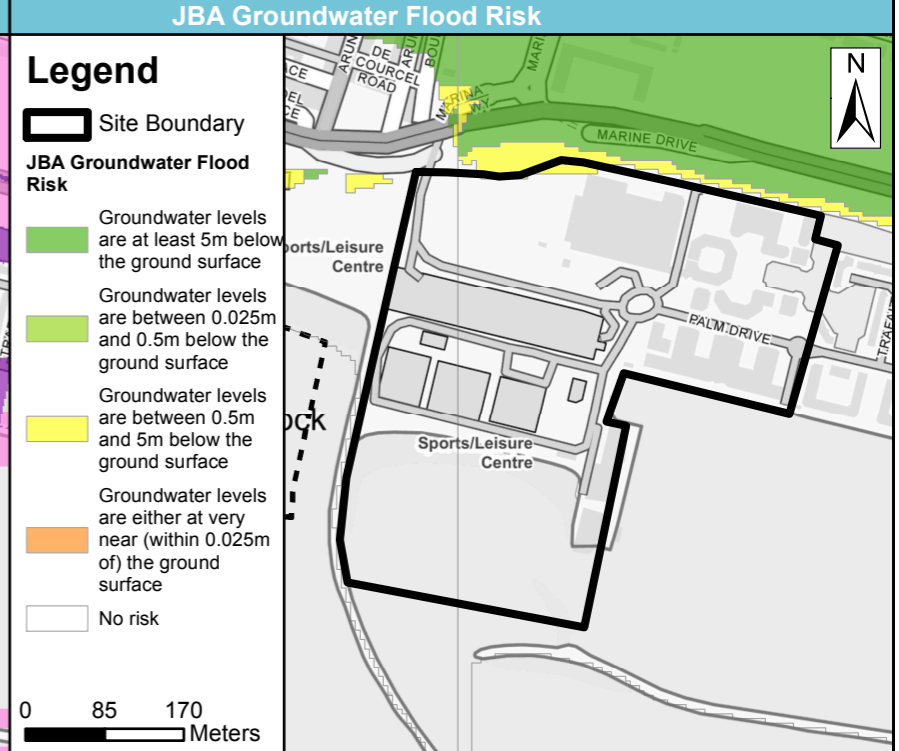
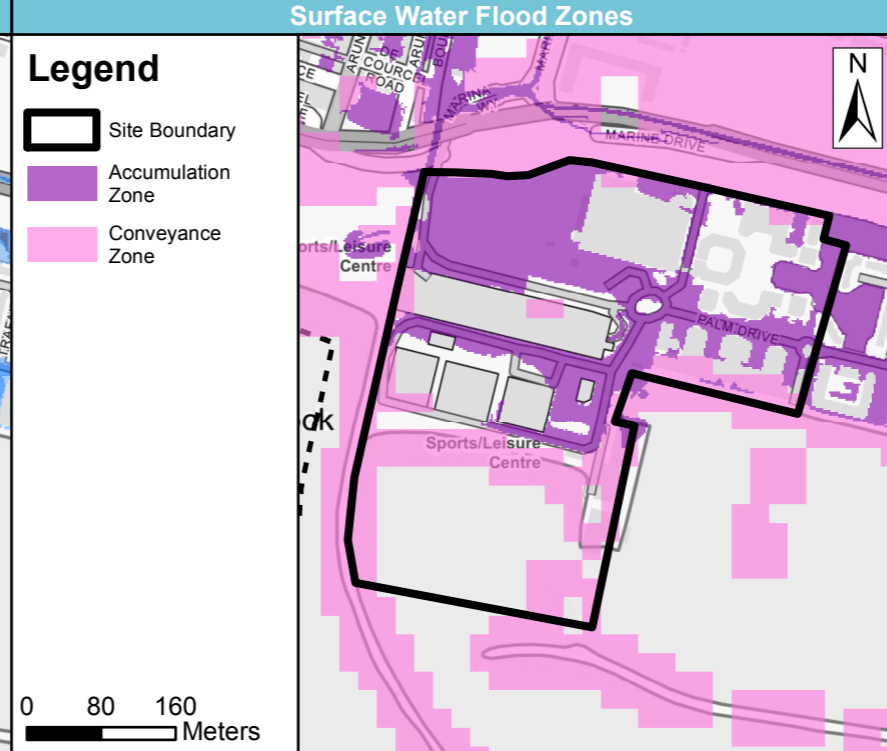
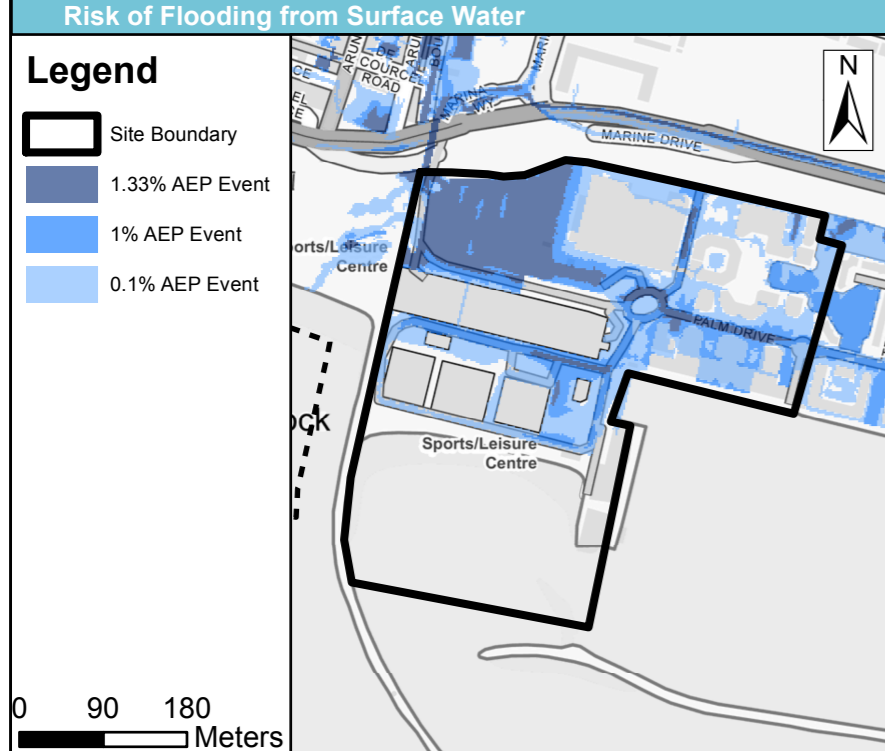
Site details	Site Code	DA2.C.1
	Site Name	Brighton Marina
	Area (ha)	16.84
	Current land use	Brownfield
	Proposed site use	<ul style="list-style-type: none"> <li>• 1,000 additional residential units</li> <li>• 5,000 sq m of new additional A1-A5</li> <li>• 3,500 sq m additional leisure and recreation use</li> </ul>
	<b>Cumulative effects</b>	The site is the only City Plan Phase 2 development site located within a watershed and therefore cumulative impacts are considered to be negligible.
	<b>Conceptual approaches to Flood Risk Management</b>	<p>Conceptual approaches to flood risk management should be considered for the site as part of initial development design and site-specific flood risk assessment. These include:</p> <ul style="list-style-type: none"> <li>• Raised walkways</li> <li>• Development design so that water can flow and move around the development</li> <li>• Address safe access and egress to the site</li> <li>• Other resilient measures</li> </ul>
<b>Mapping Information</b>		
Tidal Flood Zones	<p>Flood Zones 2 and 3a are based on the Environment Agency's Flood Zones 2 and 3.</p> <p>Flood Zone 3b has been derived as follows:</p> <p><b>For Brighton Marina:</b> Analysis was carried out using the tide level from JBA Extreme Sea Level Analysis (2004) and LiDAR as prepared for the 2008 SFRA.</p> <p><b>For Shoreham Port/ Aldrington Basin:</b> Arun to Adur section of the East Sussex Coastal modelling (2012).</p> <p>The Functional Floodplain for the rest of the coastline within Brighton and Hove has been represented using Flood Zone 3a.</p>	
Surface Water Flood Zones	<p>Surface Water Flood Zones have been derived as follows:</p> <p><b>Accumulation Zone (SWFZa):</b> RoFSW without an allowance for drainage</p> <p><b>Conveyance Zone (SWFZb):</b> All areas that have a gradient steeper than 1 in 20 (or gradient of 5%) using 5m DTM data</p>	
Surface Water	The Risk of flooding from Surface Water (RoFSW) has been used to define areas at risk from surface water flooding.	
Surface water climate change Modelling	RoFSW plus 30% and 40% climate change allowance	
Groundwater	Groundwater flood risk data has been derived using the JBA Groundwater flood risk map.	
Tidal Flood depth, hazard and velocity mapping	Flood depths are available for the 0.5% AEP tidal event and the 0.5% AEP climate change scenarios as a result of the analysis outlined in the SFRA Addendum.	

Site name	Marina Development
Site Code	-

# Brighton and Hove Strategic Flood Risk Assessment Level 2 - Site Summary Sheet mapping




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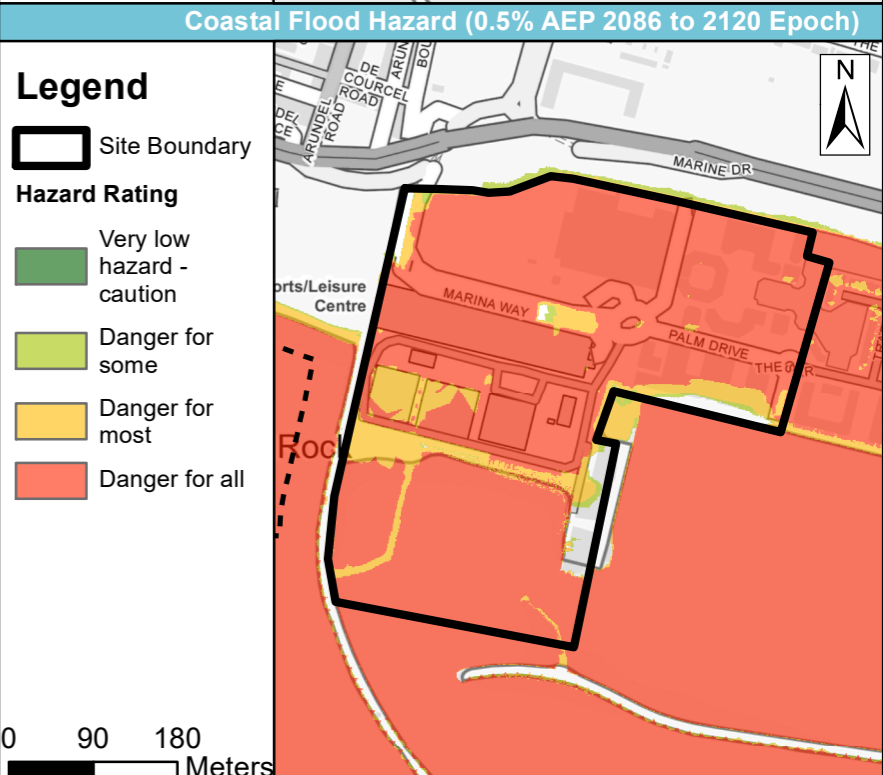
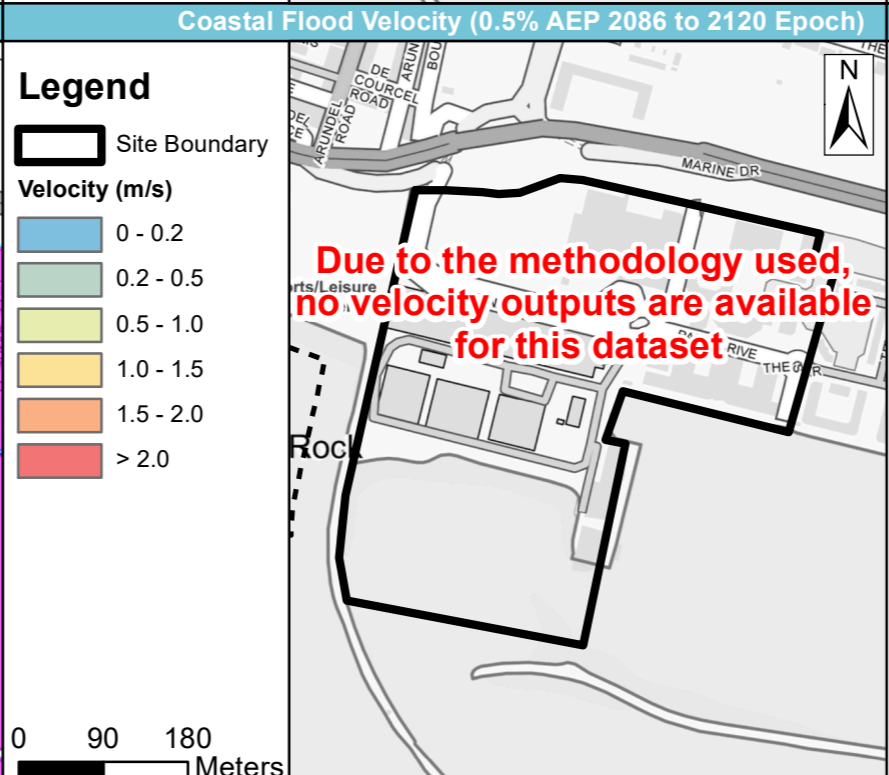
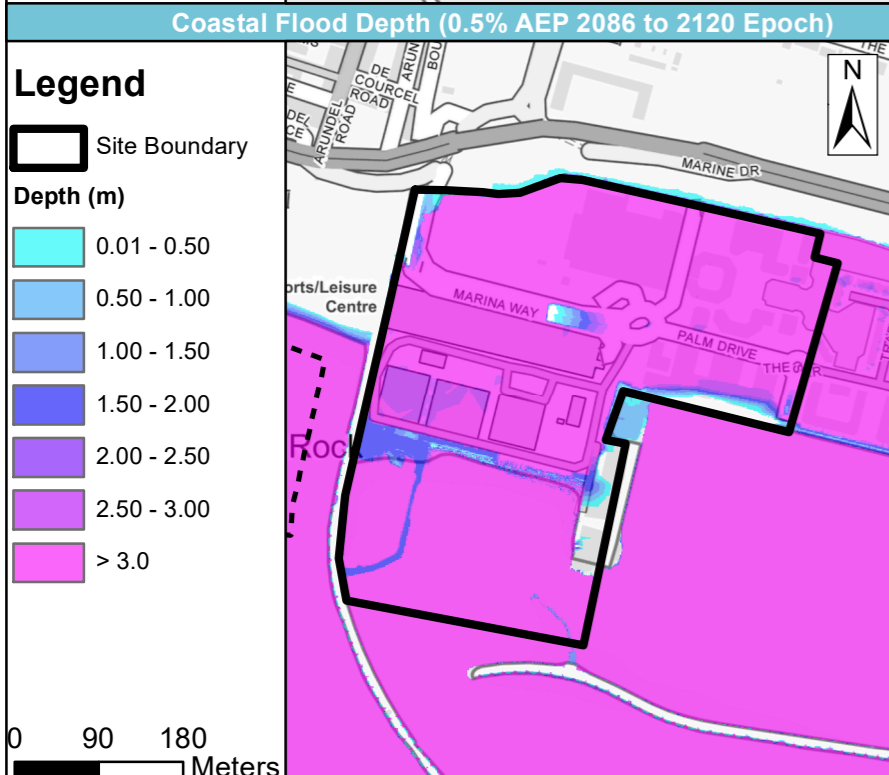
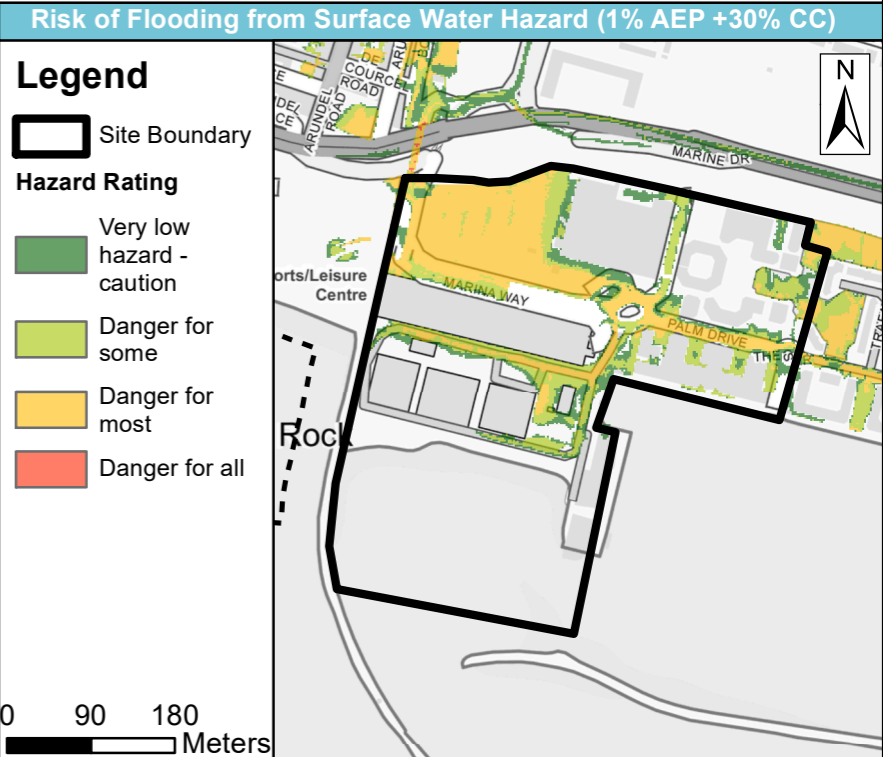
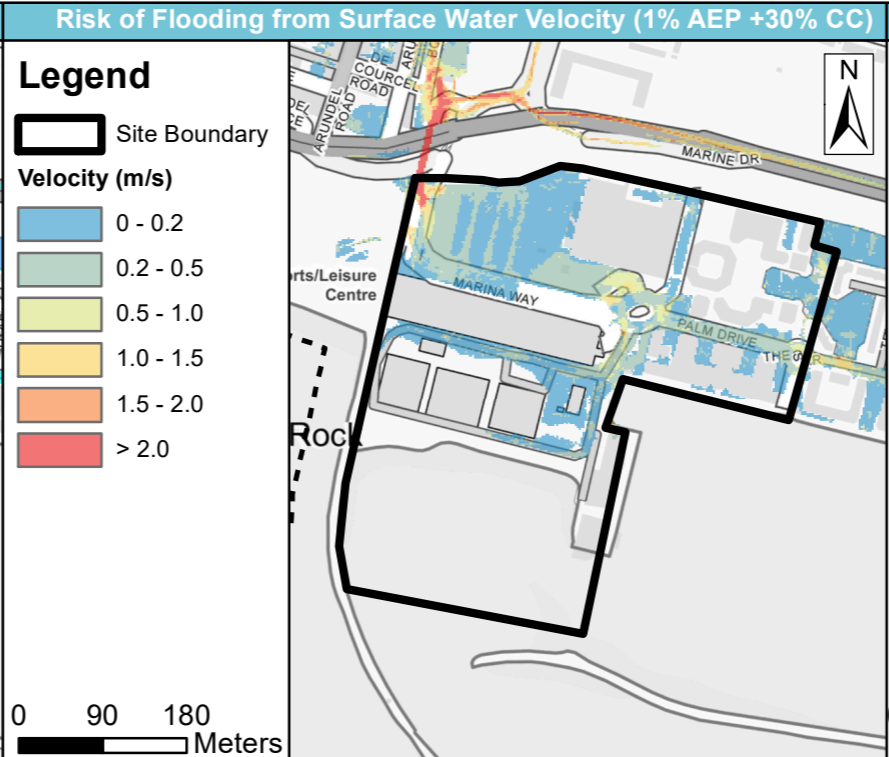
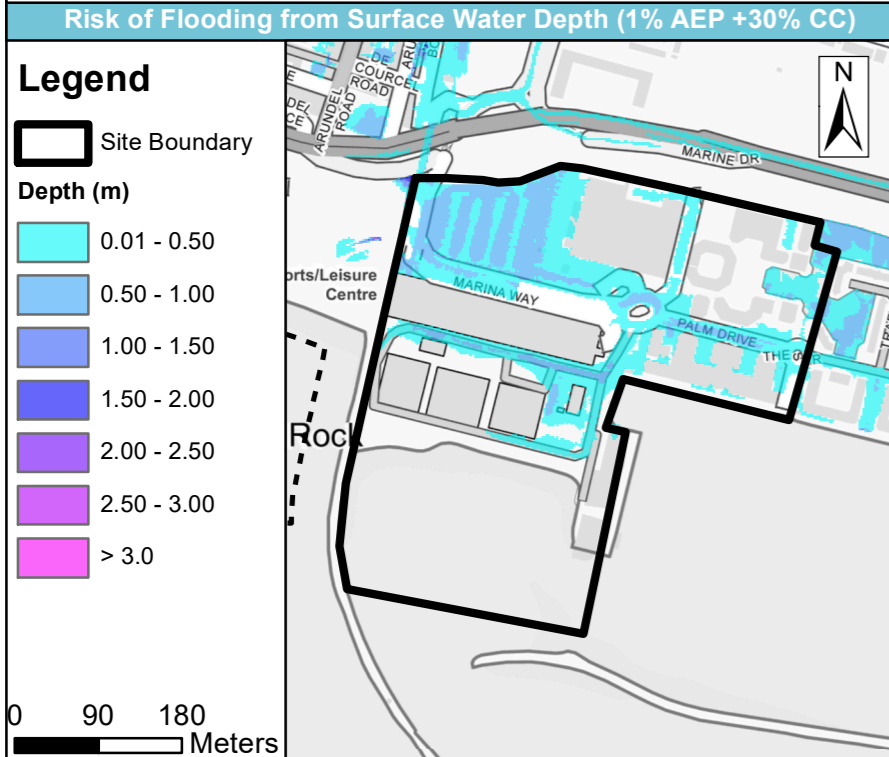


Site name	Marina Development
Site Code	N/A

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