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# Level 2 Strategic Flood Risk Assessment

# Site CA012

**Prepared for: Southend-on-Sea City Council**

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# 1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for CA012. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the Southend-on-Sea City Council Level 1 SFRA and read the Southend-on-Sea City Council Level 2 SFRA Main Report and is therefore familiar with the terminology used in this report.

## 1.1 Site details

- Location: Southend Central, Cluster Area 12: Kursaal
- Site area: 1.12ha
- Existing site use: Brownfield: supermarket, car park and former amusements within historical building
- Proposed site use: Mixed use: Commercial (leisure/tourism/cultural) with potential residential

## 1.2 Topography

Figure 1-1 shows the topography of the site represented by the Environment Agency (EA) 1m resolution LiDAR.

The site is situated on mostly flat, low-lying topography. There is approximately 2m difference between the lowest (3.16mAOD) and highest (5.18mAOD) ground levels within the site.

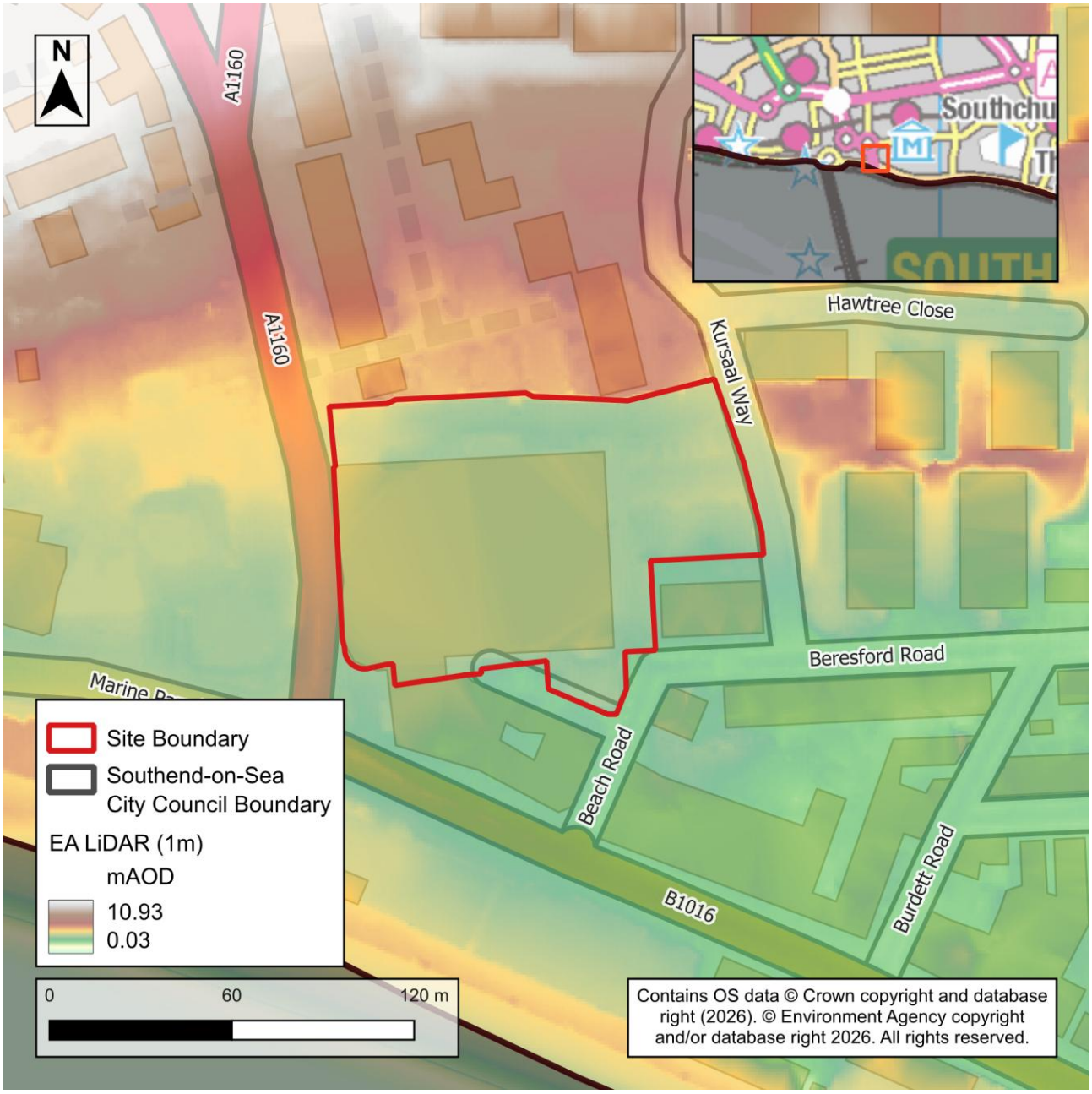



Figure 1-1: Topography of the site.

## 1.3 Geology and soils

Geology at the site consists of:

- Bedrock - London Clay Formation comprised of clay, silt and sand.
- Superficial - Tidal flat deposits comprised of clay and silt.

Soils at the site consist of:

- Freely draining slightly acid loamy soils along the northern site boundary.
- Loamy and clayey soils of coastal flats with naturally high groundwater across the rest of the site.

The likely impact of these on drainage within the site is discussed within Section 5.

# 2 Sources of flood risk

## 2.1 Location of site within the catchment

The site is located within the south of the study area. The site is not within a fluvial catchment and drains directly to the Thames Estuary to the south.

## 2.2 Existing drainage features

Based on online mapping, there are no existing drainage features within the site. However, as the existing land use is brownfield, there is likely to be existing drainage infrastructure present within the site.

The site is approximately 80m north of the Thames Estuary.

There is an unnamed watercourse which originates approximately 2km northeast of the site and flows in a south-westerly direction flowing as an open channel through the Thorpe Bay residential area and through Thorpe Hall Golf Course. The watercourse enters a culvert approximately 700m east of the site and discharges south into the Thames Estuary.

There is a lake located approximately 200m east of the site in Southchurch Park.

## 2.3 Fluvial and tidal

### 2.3.1 EA's Flood Map for Planning

Based on the EA's Flood Map for Planning (FMfP) Flood Zones (accessed 21 April 2026) and Flood Zone 3b (functional floodplain) defined in the Southend-on-Sea Level 1 SFRA, the percentage areas of the site within each Flood Zone are stated in Table 2-1 and can be viewed in Figure 2-1. The FMfP does not consider the benefits from flood defence infrastructure.

Flood Zone 3b is not shown to be present at the site. A small area of the southern site extent is located within Flood Zone 3a. However, the entire site is located within Flood Zone 2. The FMfP indicates that the source of flooding at the site is a combination of rivers and sea and sea only.

Table 2-1: Present day fluvial/tidal flood risk based on the EA's FMfP *.

| Flood Zones | Flood Zone 3b (%) | Flood Zone 3a (%) | Flood Zone 2 (%) | Flood Zone 1 (%) |
|---|---|---|---|---|
| Percentage of site at risk* (%) | 0 | 1 | 100 | 0 |

**This shows the percentage of the site at flood risk from a particular flood zone or event, including the percentage of the site at flood risk at a higher risk zone, e.g. Flood Zone 2 includes the Flood Zone 3a and 3b percentage. Flood Zone 1 + Flood Zone 2 = 100%.*

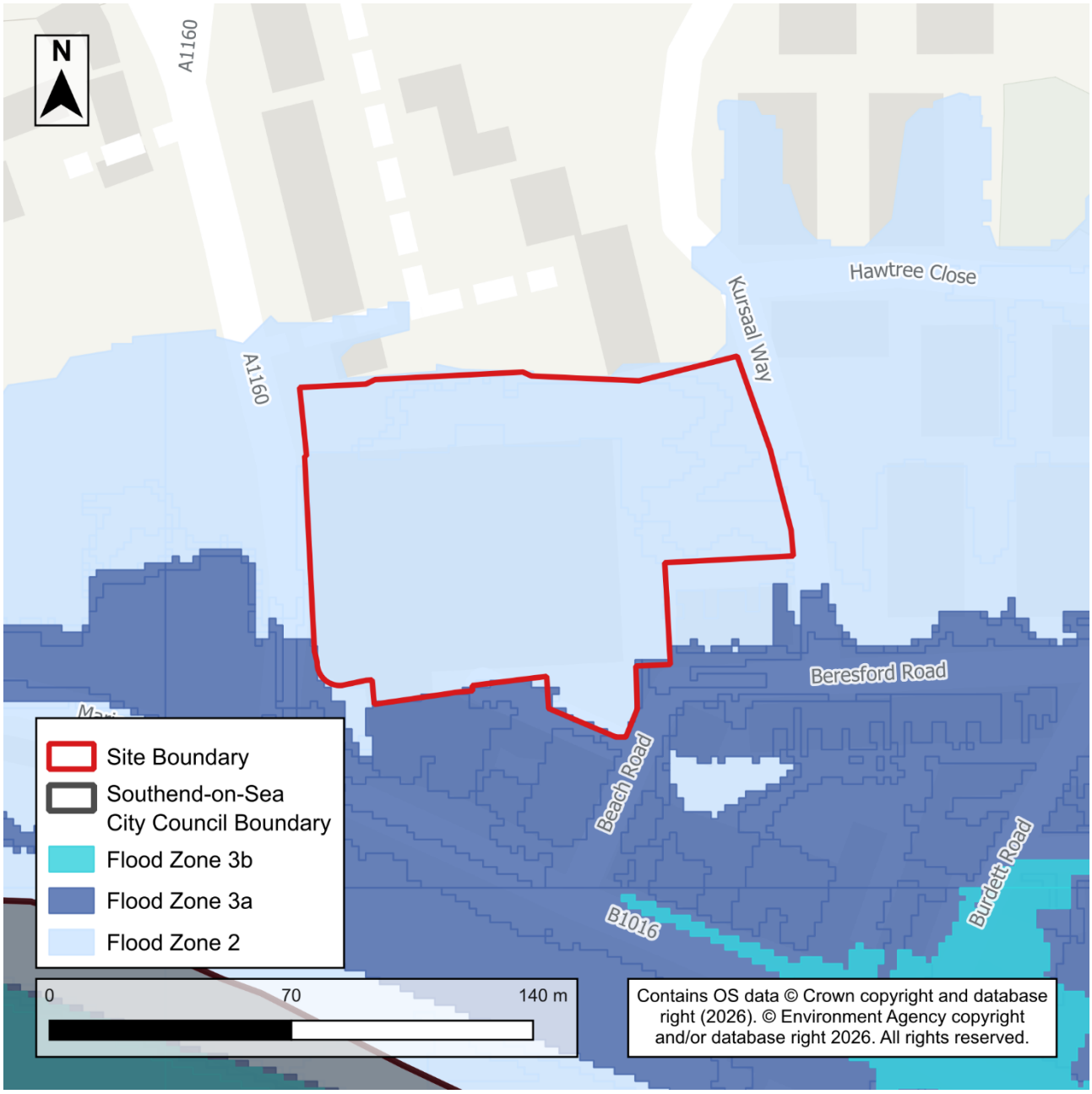



Figure 2-1: Present day fluvial flood risk, based on the EA FMfP and Rivers and Sea 3.3% AEP defended extent.

### 2.3.2 Fluvial

The EA's FMfP has been used within this assessment to assess fluvial risk as there is no detailed hydraulic modelling currently available for this site. Flood Zone 3b has been defined using the Rivers and Sea 3.3% AEP defended extent. There is currently no available depth, hazard, or velocity information available within the EA FMfP, therefore, detailed hydraulic modelling is likely to be required during a site-specific Flood Risk Assessment.

The fluvial risk to the site results from the unnamed watercourse described in Section 2.2. The watercourse is culverted when it exits the golf course in the west and there is a risk of

the site being impacted by overland flows. However, the predominant risk to this site is tidal risk from the Thames Estuary.

No fluvial model data is available to assess the implications of climate change on fluvial risk.

### 2.3.3 Tidal - present day (2026 epoch)

As part of this SFRA, the existing EA detailed hydraulic models of Southend and the Crouch and Roach estuary developed as part of the 2014 Essex, Suffolk and Norfolk Coastal modelling project were combined. The updated model has been used to assess the tidal risk to the site.

This site is shown to benefit from defences along the Thames Estuary which are described in Section 3.1. This section summarises both the defended and undefended risk.

**Undefended**

The undefended modelled flood risk extents show greater risk at the site than in the EA FMfP (Section 2.3.1). The site is almost completely inundated by the 0.5% and 0.1% AEP undefended events, except for a small area along the northern site boundary shown in Figure 2-2.

Maximum flood depths in the 0.1% AEP event are shown to mostly remain below 0.90m in the site, with areas in the west not exceeding 0.60m. However, there are some small areas in the east and north where depths are shown to exceed 0.90m. Maximum flood depths in the 0.1% AEP event are shown to exceed 0.90m with some areas in the east and north exceeding 1.20m.

Maximum velocities mostly remain below 0.25m/s during the 0.5% AEP event, with a small area in the west exceeding 0.25m/s but remaining below 0.50m/s. In the 0.1% AEP event, the area with velocities between 0.25m/s and 0.50m/s increases slightly.

The maximum hazard classification across the site is mostly 'Danger for Most' in the 0.5% AEP event with the exception of small areas in the west and northwest which are classified as 'Danger for Some' and a 'Very Low Hazard' respectively. In the 0.1% AEP event, the entire site is classified as at least 'Danger for Most' with small areas in the north and southeast which are classified as 'Danger for All'.

**Defended**

The site is not shown to be at tidal risk during the 3.3%, 0.5% and 0.1% defended scenarios.

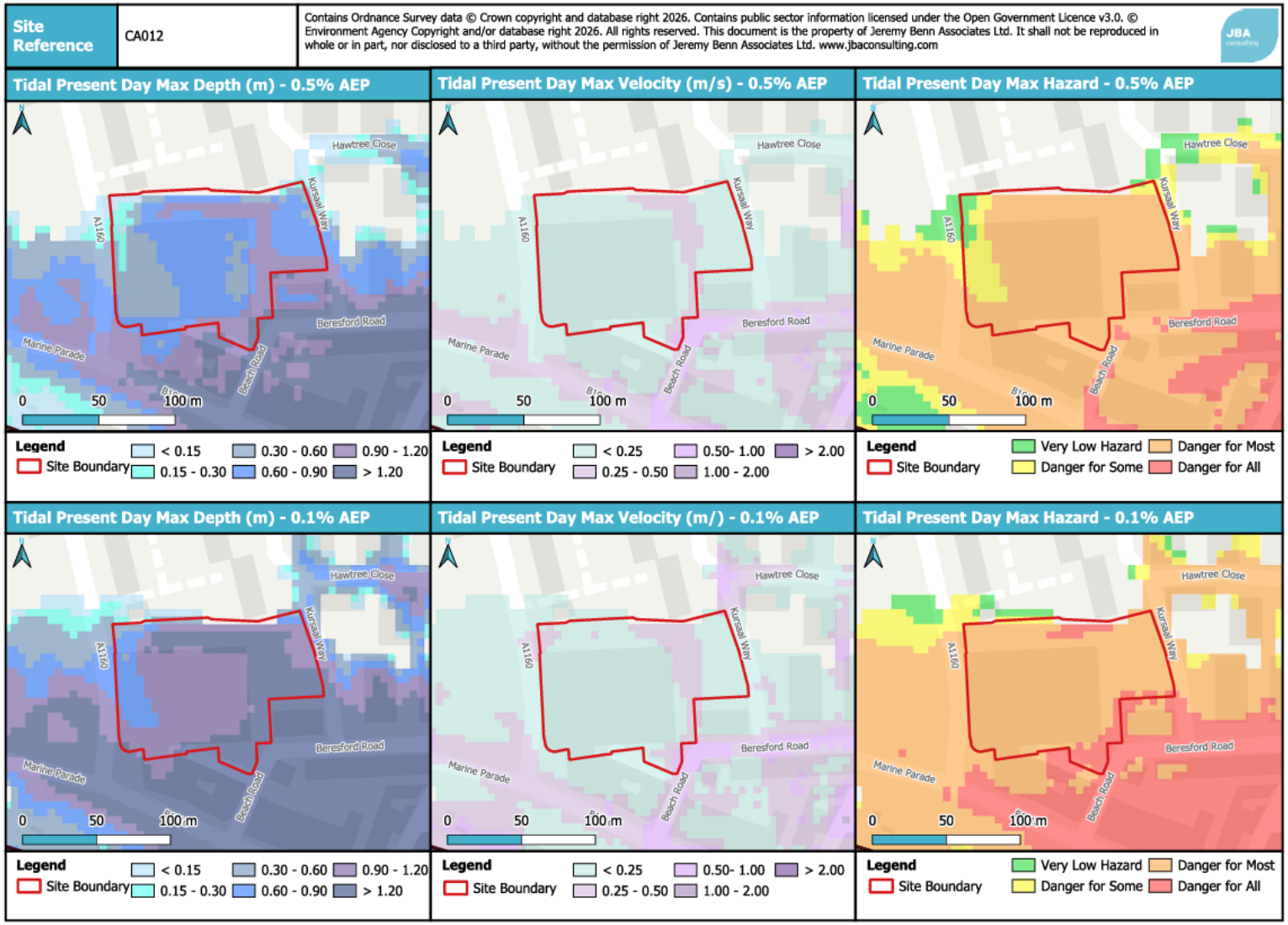



Figure 2-2: Present day tidal modelling for the 0.5% AEP and 0.1% AEP undefended events.

### 2.3.4 Tidal - future risk (2126 epoch)

The detailed tidal hydraulic model updated as part of this SFRA (see Section 2.3.3 for further details) was uplifted for the 2126 epoch for the higher central and upper end climate change scenarios.

**Undefended risk**

Figure 2-3 and Figure 2-4 show the undefended future tidal risk to the site. Most of the site is already shown to be at tidal risk in the present day however risk across the entire site is shown to increase with climate change. Flood depths across the entire site are predicted to increase from the present day and exceed 1.2m during all undefended 0.5% and 0.1% AEP climate change scenarios. Maximum velocities are also shown to increase. During the 0.5% AEP event plus higher central climate change scenario, the hazard classification is 'Danger for Most' in the centre and west of the site and a 'Danger for All' in the remainder of the site. During the other climate change scenarios hazard classification is 'Danger for All' across almost all of the site.

**Defended risk**

Figure 2-5 and Figure 2-6 show the defended future tidal risk to the site.

The site is not shown to be at tidal risk during the present day defended scenarios, but the entire site is shown to be at increased tidal risk in the climate change scenarios.

The site is not impacted during the defended 3.3% AEP higher central climate change scenario. However, in the 3.3% AEP upper end climate change scenario most of the site is at tidal risk with maximum depths of between 0.60m and 0.90m along the southern site boundary and a hazard classification of 'Danger for Most' in the south and east of the site.

Most of the site is at tidal risk in both the upper end and higher central 0.5% AEP climate change scenarios, excluding small areas along the northern boundary, and the entire site is at tidal risk in the 0.1% AEP climate change scenarios. Maximum depths are between 0.60m and 0.90m in the 0.5% AEP higher central scenario with hazard classification of 'Danger for Most' in the south and east of the site. There is a significant increase in risk to the site in the other scenarios, with maximum depths of 2.30m and hazard classification of 'Danger for All' across most of the site.

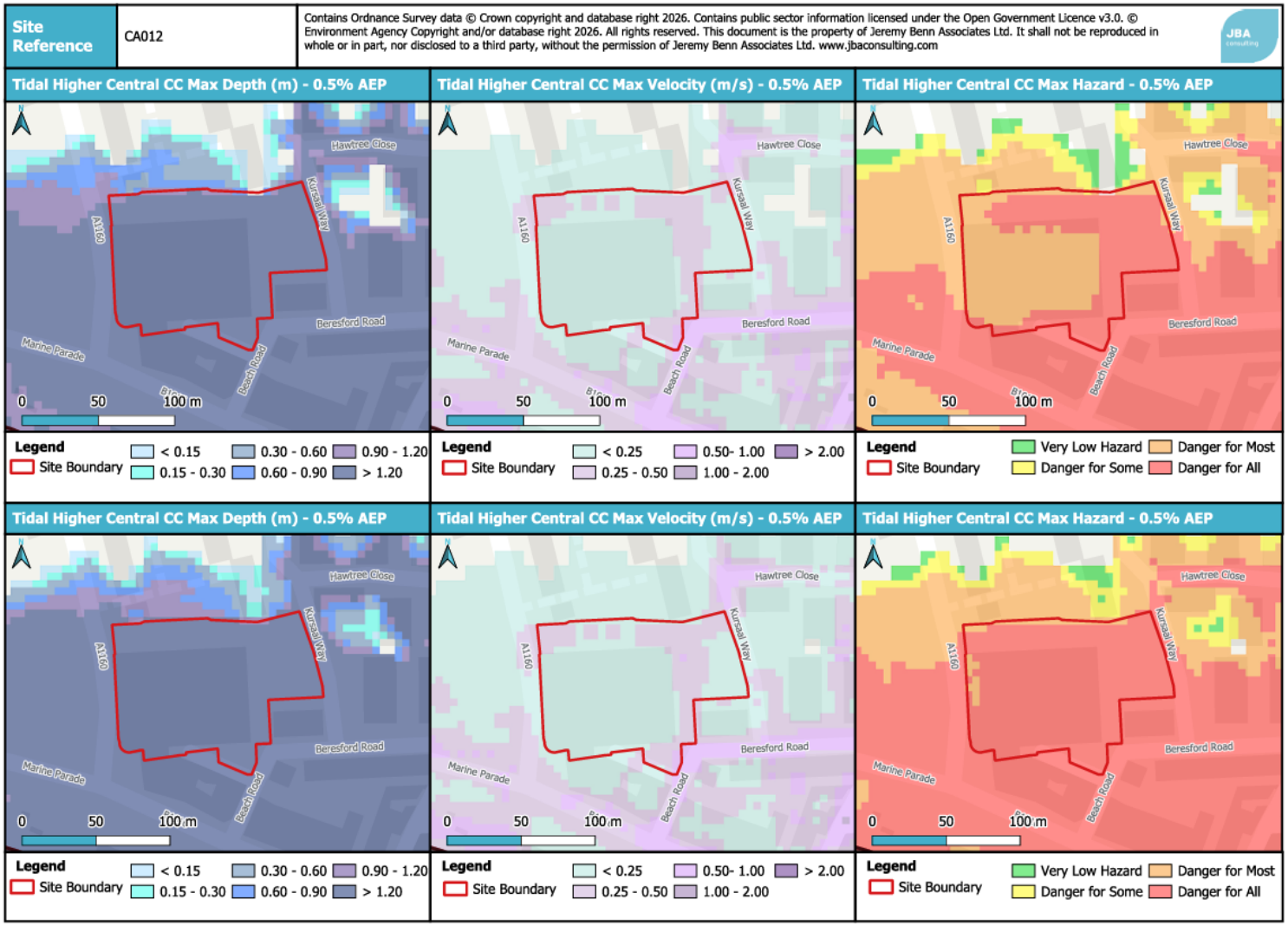



Figure 2-3: Tidal risk for the 0.5% AEP and 0.1% AEP higher central climate change undefended scenarios.

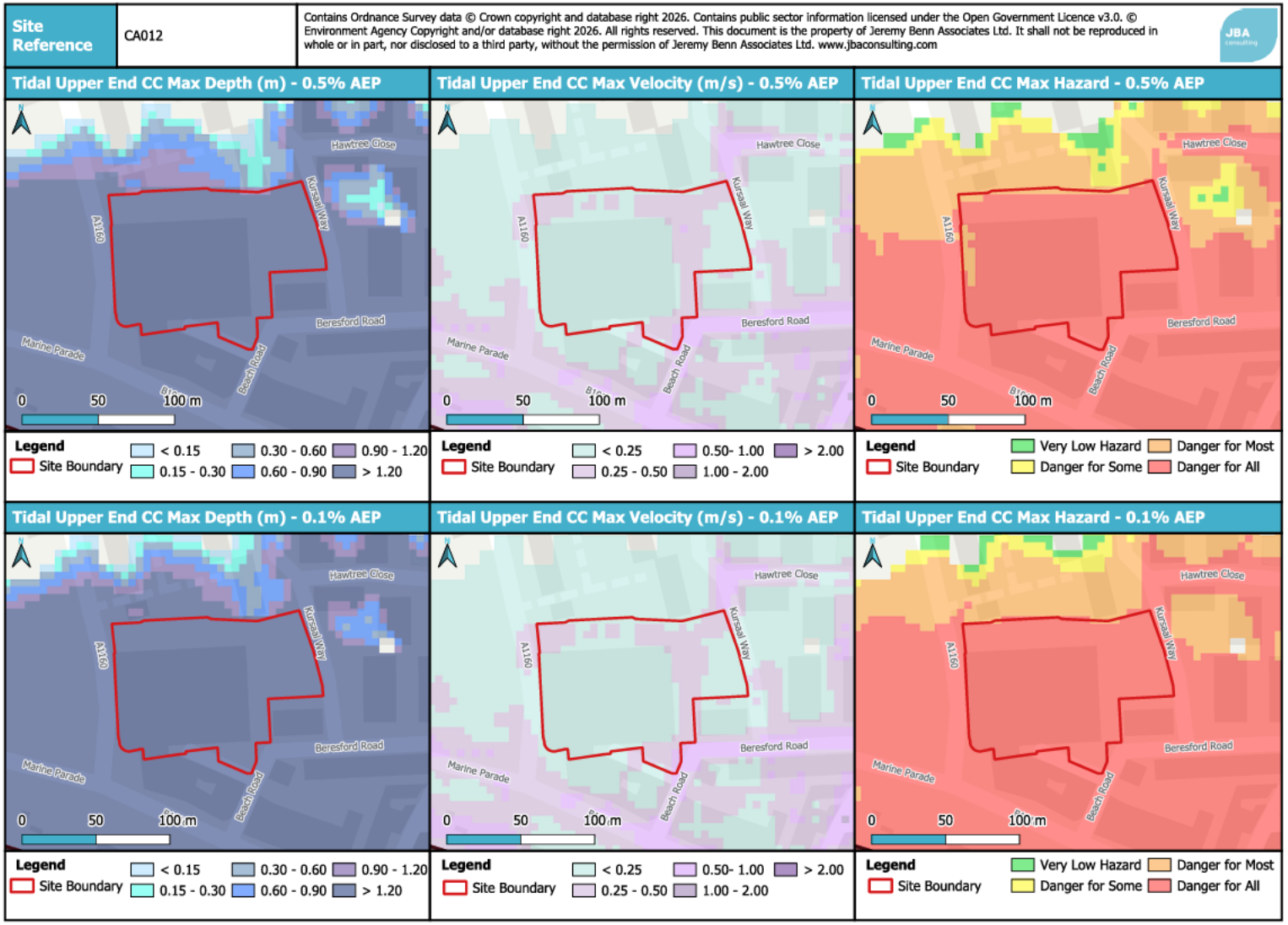



Figure 2-4: Tidal risk for the 0.5% AEP and 0.1% AEP upper end climate change undefended scenarios.

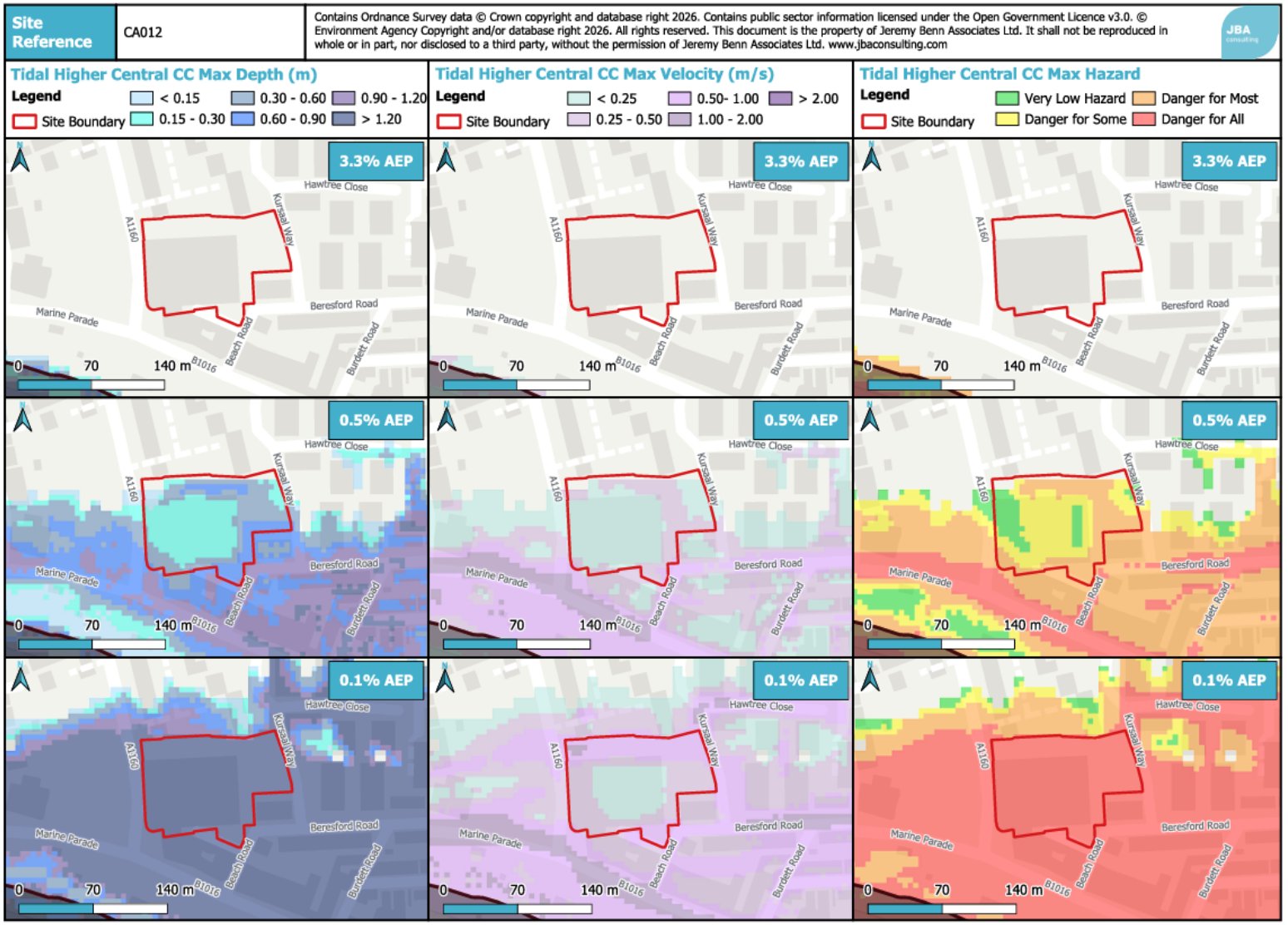



Figure 2-5: Tidal risk for the 3.3% AEP, 0.5% AEP and 0.1% AEP higher central climate change defended scenarios.

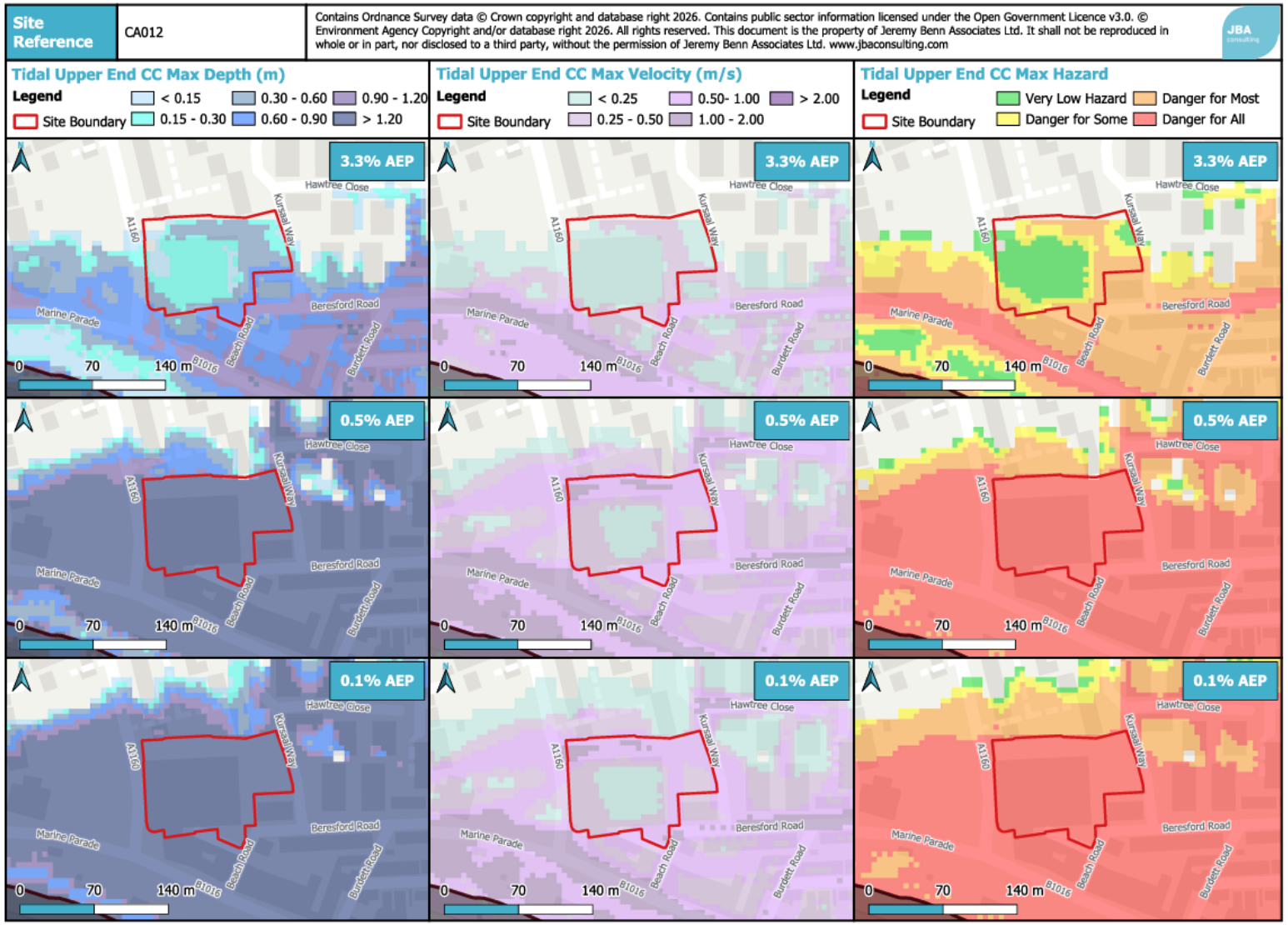



Figure 2-6: Tidal risk for the 3.3% AEP, 0.5% AEP and 0.1% AEP upper end climate change defended scenarios.

## 2.4 Surface water

### 2.4.1 Available data

The EA's FMfP Surface Water Spatial Planning Dataset, released in May 2026, has been used within this assessment to inform the extent and depth of the present day and future surface water risk. Climate change outputs are available for the 3.3%, 1%, and 0.1% AEP events with the Upper End climate change allowance for the 2070s epoch.

The Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment to inform the velocity and hazard of the present day surface water risk. There is currently no available velocity or hazard information to use to assess future surface water risk.

Descriptions refer to the maximum depth, velocity, and hazard values experienced in each area of the site within a given event.

### 2.4.2 Present day

Figure 2-7 shows the surface water flood risk at the site.

The surface water risk to the site during the 3.3% and 1% AEP events consist of a large area of ponding located along the northern site boundary and a smaller area of ponding in the eastern extent of the site. Both increase in size slightly from the 3.3% to the 1% AEP event. During the 0.1% AEP event, the two areas of ponding expand further and merge. There is also a new area of risk along the western site boundary.

Figure 2-8 shows the depth, velocity, and hazard across the site in each event. Maximum flood depths in the 1% and 0.1% AEP events exceed 0.30m in the north of the site. However, most of the flooding is shown to remain below 0.30m. Most of the flooding remains below 0.5m/s during the 0.1% AEP event and below 0.25m/s during the 3.3% and 1% AEP events. Most of the flooding during all AEP events poses a 'Very Low Hazard'. the most hazardous area of risk is shown to be the area of ponding in the north.

Table 2-2: Present day surface water flood risk based on the EA's FMfP Surface Water Spatial Planning dataset (extent, depth) and RoFSW dataset (velocity, hazard).

| Event | 3.3% AEP | 1% AEP | 0.1% AEP |
|---|---|---|---|
| Percentage of site at risk* (%) | 11 | 15 | 24 |
| Maximum depth (m) | 0.15 to 0.30 | 0.30 to 0.60 | 0.30 to 0.60 |
| Maximum velocity (m/s) | 0.50 to 1.00 | 0.50 to 1.00 | 1.00 to 2.00 |
| Maximum hazard classification | Danger for Some | Danger for Some | Danger for Most |

** The percentage surface water extents quoted show the percentage of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. the 1% AEP includes the 3.3% AEP percentage).*

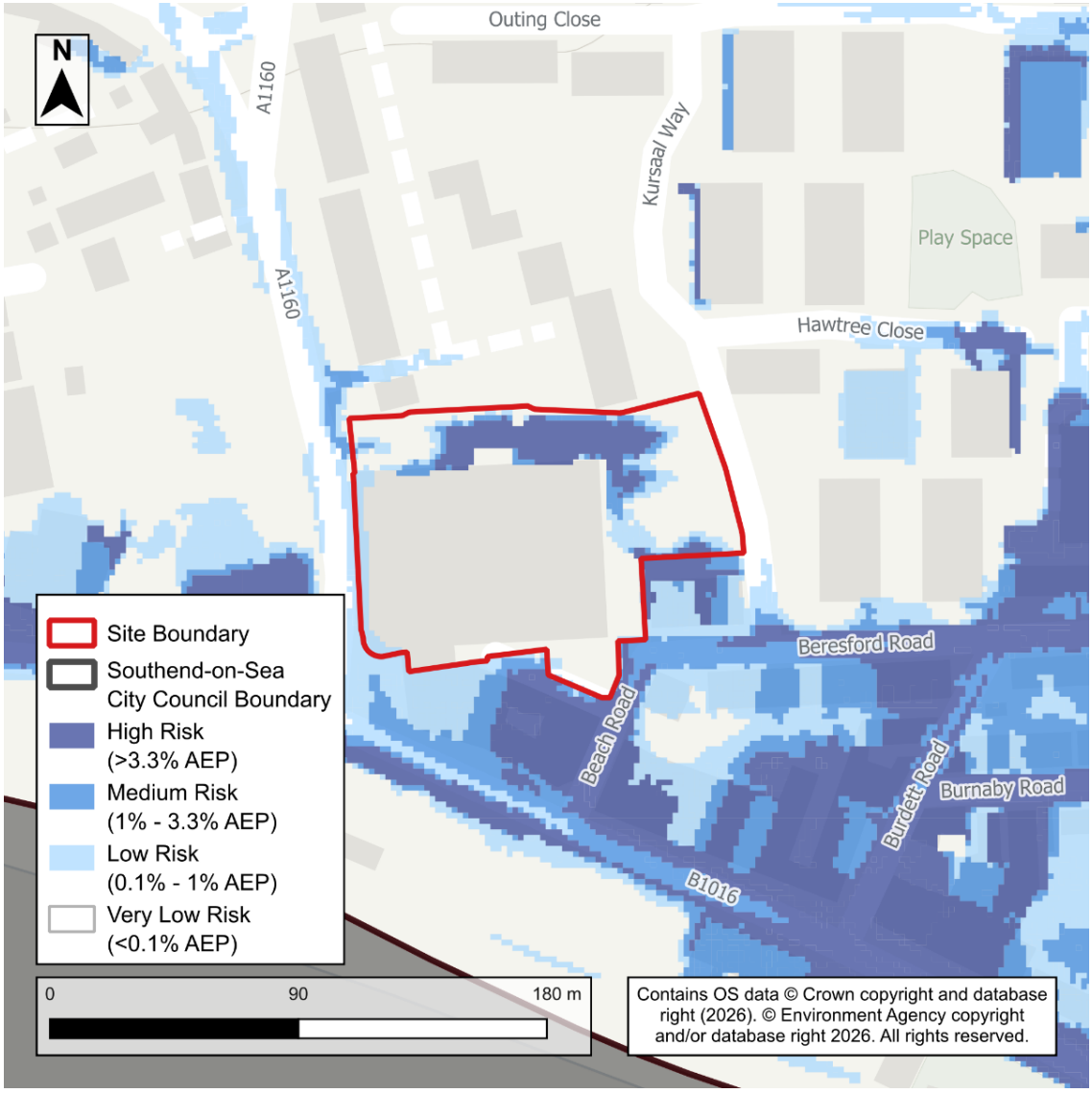



Figure 2-7: Present day surface water risk, based on the EA FMfP Surface Water Spatial Planning dataset.

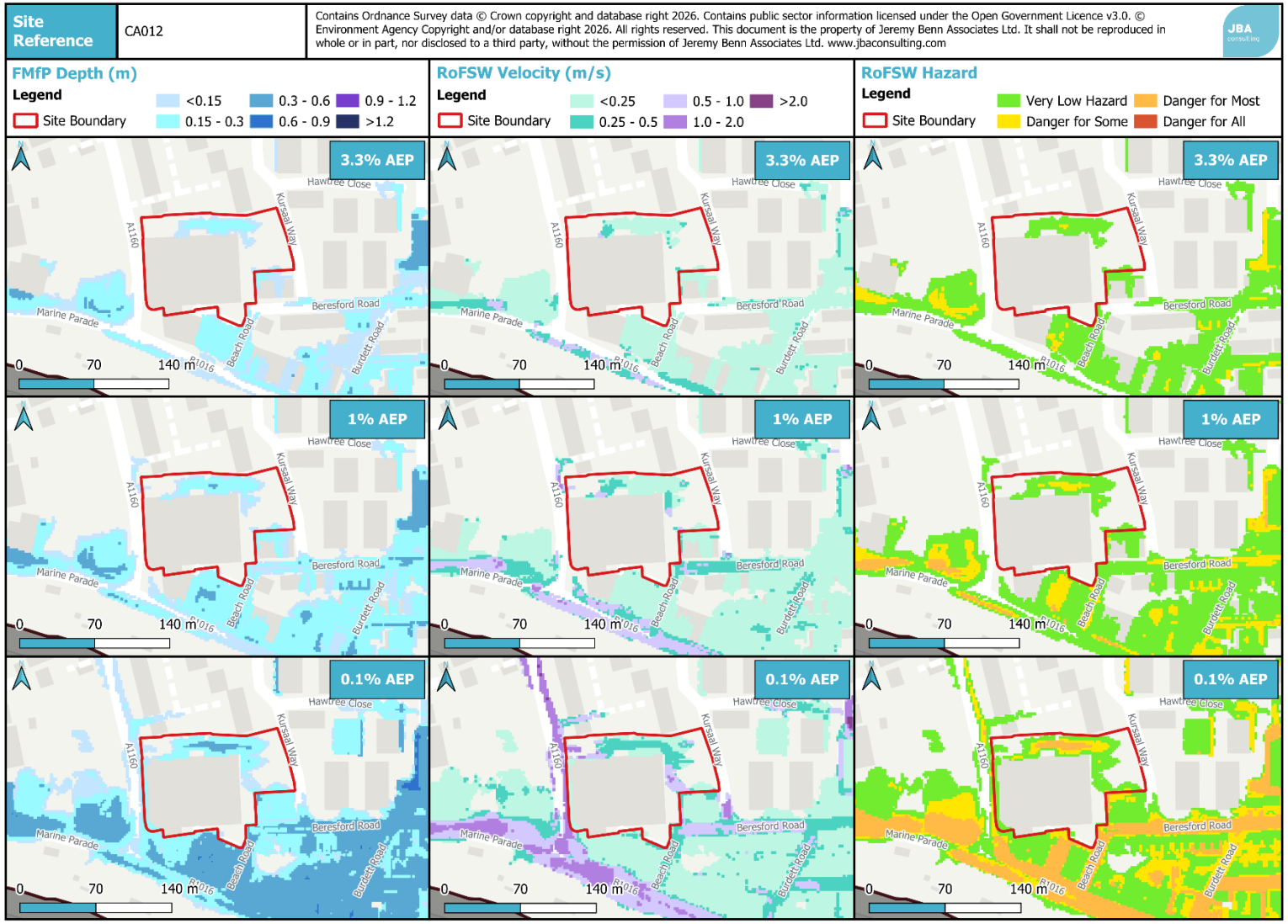



Figure 2-8: Present day surface water depth, velocity, and hazard for the 3.3%, 1%, and 0.1% AEP events.

### 2.4.3 Climate change - 2070s Upper End

The entire site is shown to be at increased risk of surface water flooding with climate change. The extents and depths are shown in Figure 2-9.

Between the 3.3% AEP present day and climate change events, the risk remains around the areas of ponding in the north and east of the site, with small increases in extent. Depths are mostly between 0.15m and 0.30m, with the maximum depth in a small area in the northern ponding between 0.30m and 0.60m.

In the 1% AEP present day event the risk remains within the northern and eastern areas of ponding. However, there is a significant increase in extent in the climate change scenario with the two areas of ponding merging and a flow path which forms along the western boundary. Maximum depths are between 0.30m and 0.60m in the areas of ponding, but most of the new areas of risk has depths which remain below 0.15m.

Most of the site is shown to be at surface water risk within the 0.1% AEP climate change event, with the footprint of the existing building within the west side of the site shown to be at risk. Depths across most of the site are predicted to be between 0.15m and 0.30m, with maximum depths between 0.30m and 0.60m in the north and east of the site.

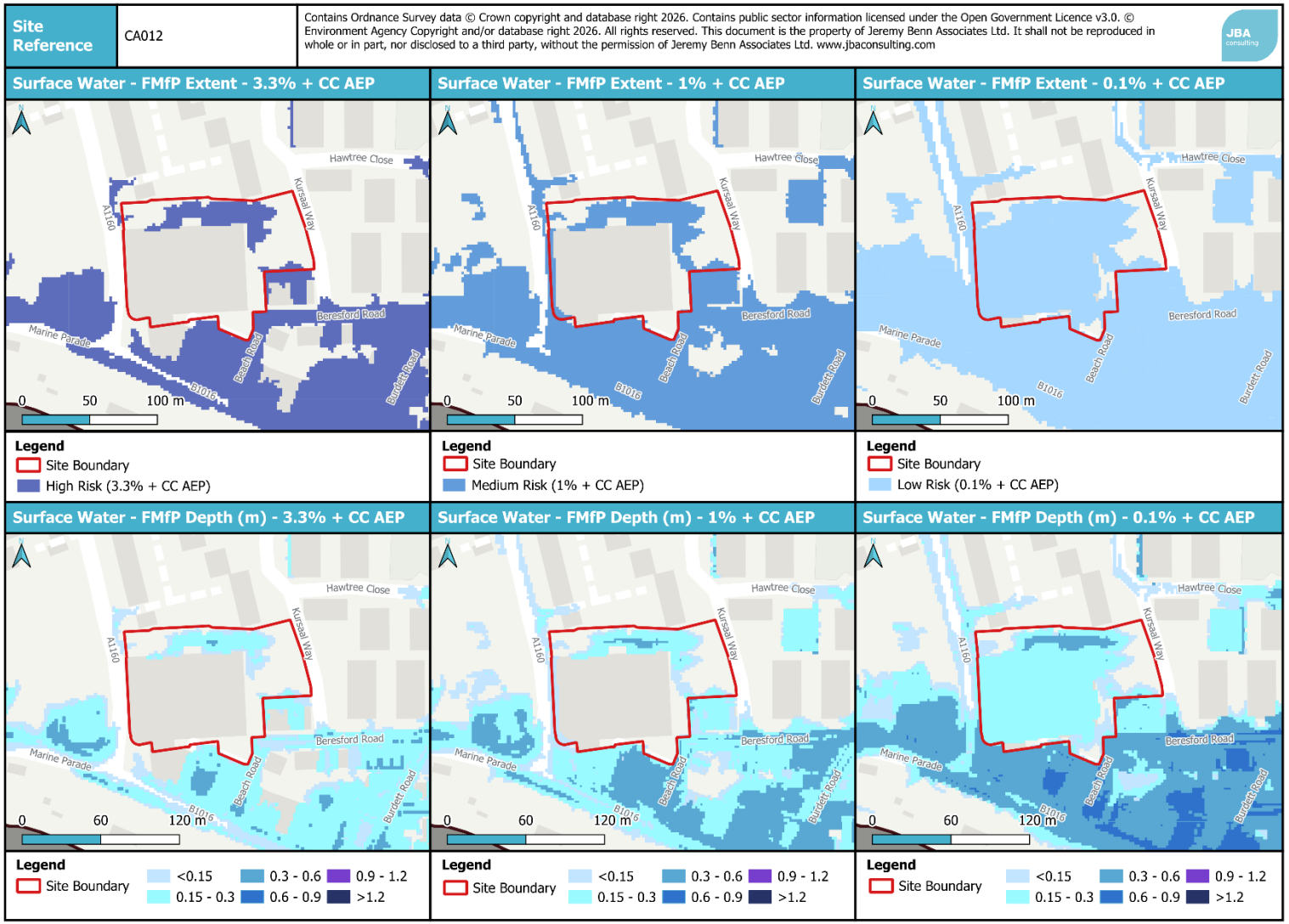



Figure 2-9: Surface water extents and depths for the 3.3%, 1%, and 0.1% AEP climate change events.

## 2.5 Groundwater

The JBA Groundwater Emergence Map shows that the site has a negligible risk of groundwater emergence due to the nature of the local geological deposits.

This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific Flood Risk Assessment (FRA) stage.

## 2.6 Sewers

Anglian Water provided a redacted GDPR compliant version of their DG5 dataset for the study area, which identifies internal and external historic sewer flooding records between 2022 and 2026.

There is one recorded sewer flooding incident in close proximity, approximately 40m southeast, of the site. This incident occurred in 2025 and is recorded to have not impacted any properties.

The available data should always be supplemented by direct consultation with Anglian Water to ascertain if there is any site-specific risk from a public sewer. This is because sewer flood risk information is not publicly available and would need to be considered on a site-specific basis.

## 2.7 Flood history

The EA's Historic Flood Map, shown in Figure 2-10, covers the southern site extent, showing historic flooding as a result of a tidal flood event in 1953.

Data provided by Essex County Fire and Rescue Service shows no records of flooding at the site.

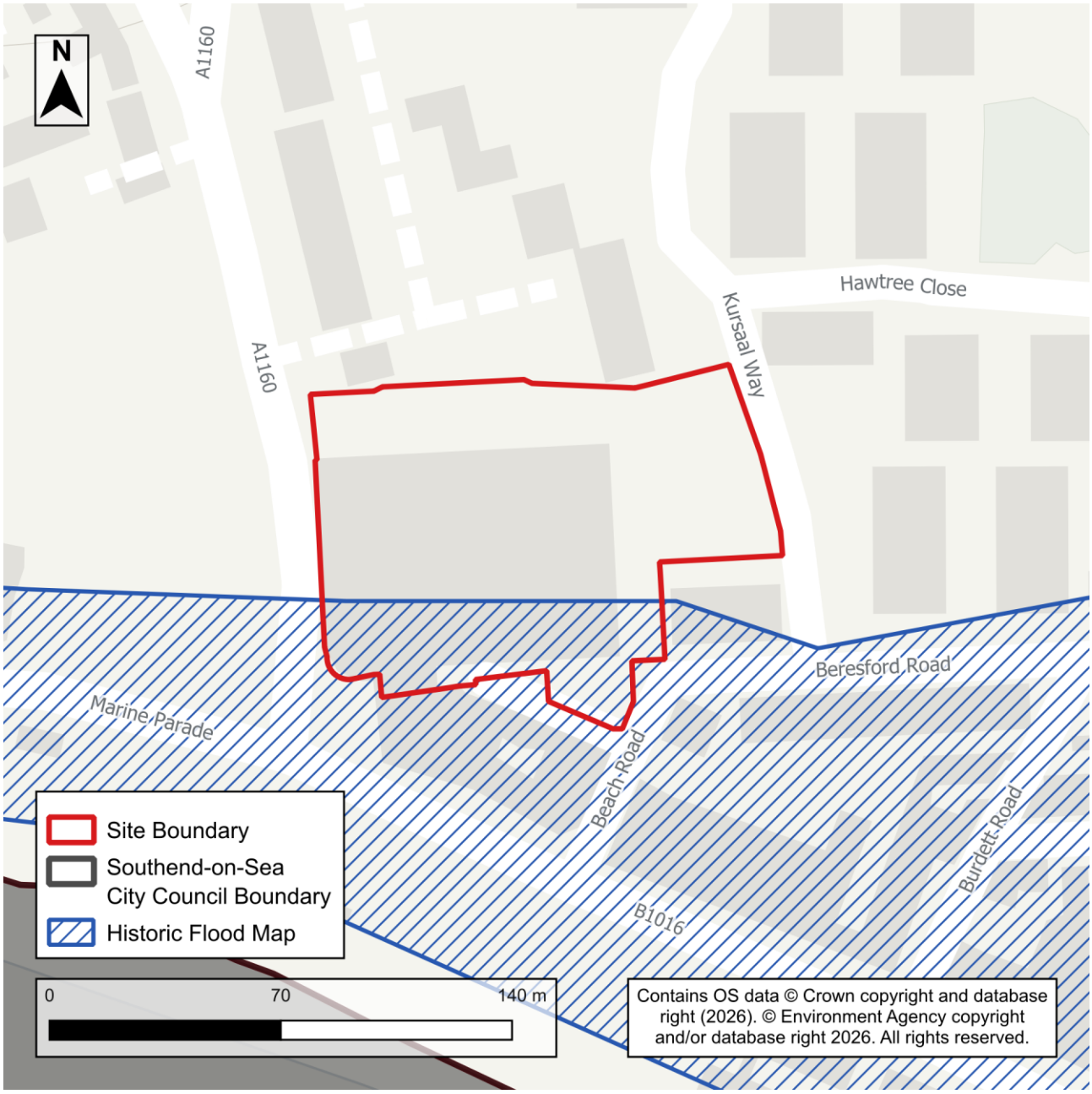



Figure 2-10: Historic flooding shown within the EA's Historic Flood Map.

# 3 Flood risk management infrastructure

## 3.1 Defences

The EA AIMS dataset, mapped in Figure 3-1, shows that the site is protected by a coastal flood wall to the south. The flood wall is privately owned and is designed to provide protection against a 0.1% AEP tidal event.

As discussed in Sections 2.3.3 and 2.3.4, detailed hydraulic modelling shows the site is protected by the defences in all present day scenarios and in the 3.3% AEP higher central climate change scenario. The defences are shown to overtop in the 3.3% AEP upper end climate change scenario, and the 0.5% AEP and 0.1% AEP climate change scenarios, with significant depths experienced across the site in these events.

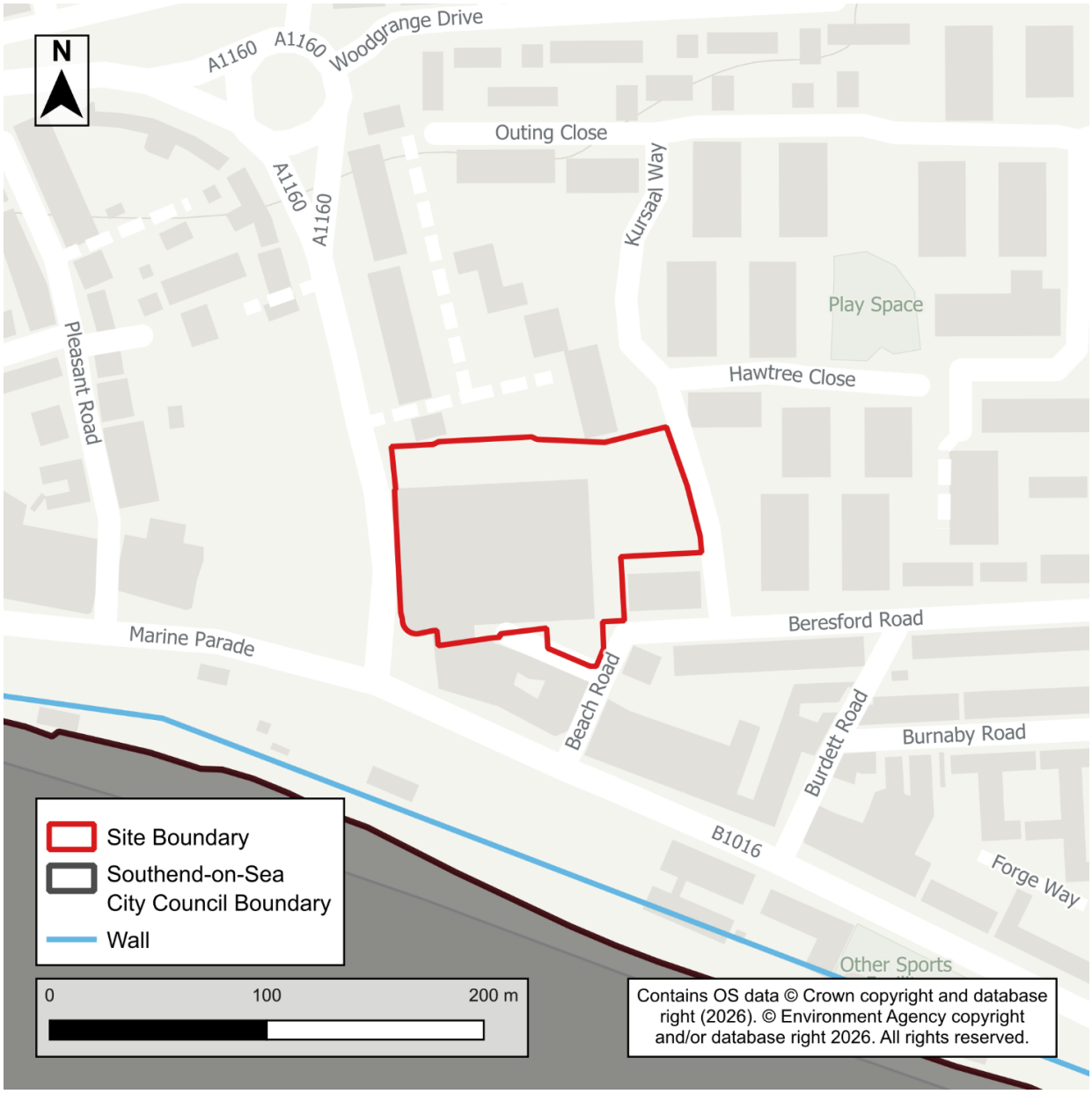



Figure 3-1: Flood defences as shown within the EA AIMS dataset.

## 3.2 Residual risk

Breach modelling has been carried out for the 3.3%, 1%, and 0.1% AEP events for present day and climate change scenarios for the higher central and upper end scenarios for the 2126 epoch. Three breach scenarios were considered. Details of the breaches are provided in Appendix D.

This site is shown to be impacted in all three breaches, during most modelled scenarios.

Table 3-1 provides the approximate rate of onset (time between the breach and the first flooding experienced at the site) and the maximum duration of the flooding at the site.

**Breach one**

The site is not predicted to be at risk in the present day scenarios or the 3.3% AEP higher central climate change scenario. In the 3.3% AEP upper end and 0.5% AEP higher central climate change scenarios there is a lead time of approximately 14 hours providing longer warning time, with a maximum flooding duration of around 30 hours. The larger events have a much shorter lead time of 2 to 3 hours and a maximum duration of up to 40 hours.

**Breach two**

The site is not predicted to be at risk in the present day scenarios or the 3.3% AEP higher central climate change scenario. Similarly to breach one, the 3.3% AEP upper end and 0.5% AEP higher central climate change scenarios provide warning time with a rate of onset of 12 to 13 hours. The larger events have a shorter lead time of approximately 1 hour.

**Breach three**

Breach three presents the greatest risk to the site. The site is not at risk in the 3.3% AEP present day scenario, but in all other scenarios this breach shows the fastest rate of onset between 12 and 18 minutes across giving little lead time. The maximum duration is up to 45 hours.

Table 3-1: Maximum depth, velocity, hazard, and rate of onset and duration of flooding for each breach scenario where the site is shown to be at risk of tidal flooding.

| Breach | Event | Maximum depth (m) (2dp) | Maximum velocity (m/s) (2dp) | Maximum hazard (2dp) | Rate of onset (hours) (1dp) | Maximum flooding duration (hours) (1dp) |
|---|---|---|---|---|---|---|
| 1 | 3.3% AEP Upper End CC | 0.84 | 0.81 | 1.71 | 14.7 | 31.1 |
| 1 | 0.5% AEP Higher Central CC | 0.92 | 0.65 | 1.80 | 14.2 | 31.2 |
| 1 | 0.5% AEP Upper End CC | 2.62 | 1.24 | 4.18 | 2.7 | 43.1 |
| 1 | 0.1% AEP Higher Central CC | 2.81 | 1.10 | 4.04 | 3.0 | 38.8 |
| 1 | 0.1% AEP Upper End CC | 3.19 | 1.24 | 3.91 | 2.5 | 43.7 |
| 2 | 3.3% AEP Upper End CC | 0.84 | 0.81 | 1.71 | 12.7 | 31.1 |
| 2 | 0.5% AEP Higher Central CC | 0.92 | 0.65 | 1.80 | 12.2 | 31.2 |
| 2 | 0.5% AEP Upper End CC | 2.62 | 1.24 | 4.18 | 0.9 | 43.1 |
| 2 | 0.1% AEP Higher Central CC | 2.81 | 1.10 | 4.04 | 1.0 | 38.8 |
| 2 | 0.1% AEP Upper End CC | 3.19 | 1.24 | 3.91 | 0.8 | 43.7 |
| 3 | 3.3% AEP Higher Central CC | 0.77 | 0.41 | 1.47 | 0.3 | 43.1 |
| 3 | 3.3% AEP Upper End CC | 1.39 | 0.61 | 2.07 | 0.3 | 43.7 |
| 3 | 0.5% AEP | 0.00 | 0.00 | 0.51 | 0.3 | 30.7 |
| 3 | 0.5% AEP Higher Central CC | 1.43 | 0.62 | 2.12 | 0.2 | 43.5 |
| 3 | 0.5% AEP Upper End CC | 2.77 | 0.98 | 3.97 | 0.3 | 43.9 |
| 3 | 0.1% AEP | 0.47 | 0.37 | 1.26 | 0.2 | 31.1 |
| 3 | 0.1% AEP Higher Central CC | 2.83 | 0.87 | 3.72 | 0.2 | 43.8 |
| 3 | 0.1% AEP Upper End CC | 3.19 | 1.00 | 3.86 | 0.3 | 44.4 |

# 4 Emergency planning

## 4.1 Flood warnings and alerts

The entire site is located in 'The Essex Coast at Shoeburyness to Southend Pier' EA Flood Warning Area (051FWCDV5A1) and 'The Essex Coast from Shoeburyness, to and including Southend Seafront, including Southchurch Park' Flood Alert Area (051WACDV5A).

## 4.2 Access and escape

Safe access and escape will need to be demonstrated in the 1% AEP plus climate change fluvial and surface water events and the 0.5% AEP plus climate change tidal event. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk elsewhere on the site and in the wider catchment.

### 4.2.1 Potential access

The existing access point to the site is in the northwest from the A1160. There are also potential access options from Kursaal Way to the east and Beach Road to the southeast.

All access routes are potentially impeded by the tidal risk to the site. All access routes are likely to be accessible within a surface water flood event other than via Beach Road in the southeast. The implications of each source of flood risk on access and escape are discussed in detail in the following sections.

### 4.2.2 Fluvial and tidal

Fluvial risk to the site is considered to be low and unlikely to impede access and escape.

However, the entire site and the surrounding roads are shown to be at tidal risk and inundated during the 0.5% AEP climate change scenarios in both the defended and undefended scenarios.

Access and escape may be possible via the northwest access point in the 0.5% AEP defended higher central scenario as depths of tidal flooding in this corner of the site are shown to remain below 0.15m and associated with 'Very Low Hazard'. However, in the other 0.5% AEP climate change scenarios depths in this area exceed 1.20m with a hazard classification of 'Danger for All' which will impede access and escape.

Due to the tidal risk surrounding the site, a Flood Warning and Evacuation Plan will be required to be prepared which considers the likely onset and duration of flooding and demonstrates how residents can safely be evacuated and/or shelter safely in situ during design events.

### 4.2.3 Surface water

The site is mostly surrounded by surface water risk during the 1% AEP plus climate change event, as shown in Figure 2-9.

Depths along the western site boundary remain below 0.15m so access and escape are likely to be possible from the A1160 at the existing access point in the northwest.

Access and escape to the west of the site via Kursall Way is likely to be possible via the residential area to the north as surface water depths are shown to remain below 0.30m. However, access and escape from the south along the B1016 and Beach Road is likely to be impeded as surface water depths are shown to exceed 0.30m.

Further assessment should be undertaken within a site-specific FRA, including an assessment of velocity and hazard as these are not currently available with the EA FMfP Surface Water Spatial Planning dataset.

## 4.3 Dry islands

The site is not located on a dry island.

# 5 Requirements for drainage control and impact mitigation

## 5.1 Broadscale assessment of possible SuDS

Surface water at the site should be discharged in accordance with the drainage hierarchy as set out in the National standards for SuDS (gov.uk). SuDS that provide opportunities to deliver multiple benefits including volume control, water quality, amenity, and biodiversity should be prioritised. SuDS proposals should be discussed with relevant stakeholders (Local Planning Authority (LPA), Lead Local Flood Authority (LLFA), and the EA) at an early stage to understand possible constraints.

Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA.

The site is located within the Southchurch Critical Drainage Area. The CDAs currently designated were identified in the Southend-on-Sea SWMP 2015 (southend.gov.uk). It is particularly important that any development within these CDAs will need to demonstrate an adequate surface water drainage system which is maintainable for the lifetime of the development within a site specific FRA. Developers will need to provide details of the long term maintenance of the surface water drainage system. Developers should collaborate with the LLFA to identify all sources of flood risk, help reduce risk to existing communities, and explore grant funding opportunities for these wider improvements. Furthermore, growth allocations should take CDAs into account when assessing site suitability for development, ensuring that flood risk is properly managed and mitigated during planning.

Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.

The following factors should be considered when assessing whether infiltration is suitable at the site:

- The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
- BGS data indicates that the underlying geology is clay, silt and sand which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
- The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality.
- The site is not located within a historic landfill site.

If it is proposed to discharge runoff to a sewer system, the condition and capacity or the receiving asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

SuDS assets should, where practicable, be located outside areas of flood risk in the 0.5% AEP plus climate change tidal event. As the entire site is shown to be at tidal risk within this event, this presents a significant constraint to the placement and design of sustainable drainage options at this site. SuDS features will need to consider above-ground storage and/or source control and be able to withstand the impacts of tide locking and saltwater ingress. The LLFA should be consulted at an early stage to discuss appropriate drainage options, and the acceptability of SuDS features for the site.

Surface water outfalls that discharge into the Thames Estuary may be susceptible to tide locking due to high water levels. The impacts of tide locking will need to be considered in terms of the attenuation storage requirements of the site and placement of the outfalls.

## 5.2 Opportunities for wider sustainability benefits and integrated flood risk management

The following are opportunities for wider sustainability benefits and integrated flood risk management at the site:

- It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
- Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered.
- The use of multistage SuDS treatment will improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies and can also contribute towards requirements for Biodiversity Net Gain.

# 6 NPPF and planning implications

## 6.1 Exception Test requirements

The Local Planning Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied.

The NPPF classifies mixed use development as 'More Vulnerable'.

The Exception Test is required if 'More Vulnerable' development is proposed within Flood Zone 3a. The Exception Test should be applied for this site as although the EA FMfP shows minimal risk to the site in Flood Zone 3a, the detailed modelling undertaken for this SFRA shows most of the site is located within the 0.5% AEP undefended tidal flood extent.

## 6.2 Requirements and guidance for site-specific Flood Risk Assessment

At the planning application stage, a site-specific FRA will be required as the proposed development site:

- in Flood Zones 2 and 3a
- at increased risk of flooding from rivers or sea in future
- in an area identified as having critical drainage problems
- at risk of flooding from surface water

All sources of flooding should be considered as part of a site-specific FRA.

Consultation with the LPA, LLFA, Anglian Water, and the EA should be undertaken at an early stage.

Any site-specific FRA should be carried out in line with latest guidance including the National Planning Policy Framework (NPPF), Flood Risk and Coastal Change Planning Practice Guidance (PPG), and Southend-on-Sea City Council Local Plan Policies.

The development should be designed with mitigation measures in place where required.

## 6.3 Guidance for site design and making development safe

The entire site is shown to be at significant tidal risk, and extensive mitigation will be required to make development safe at this site, particularly if residential development is proposed. Further hydraulic modelling of the tidal risk to the site will be required at FRA stage to make sure the development and any associated mitigation measures do not cause off site detriment and assist in the identification of safe access and escape routes and residual risk.

Finished Floor Levels should be raised above the expected height of flooding in line with the EA's guidance and any raising of ground levels should ensure that flood risk is not increased elsewhere. If this is not possible, additional resistance and resilience measures will need to be included as part of the building design to prioritise excluding floodwater where possible and reduce recovery time in the event of water ingress. Resistance

measures for flood levels beyond 0.6m can impact on the structural integrity of a building and are unlikely to be suitable.

The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to pre-development greenfield rates, with areas of surface water ponding used as open space and SuDS or water compatible/essential infrastructure uses only. The risk of tide locking will need to be considered within the drainage strategy.

Arrangements for safe access and escape will need to be provided for the 1% AEP fluvial and surface events and the 0.5% AEP tidal event with an appropriate allowance for climate change, considering depth, velocity, and hazard. Design and access arrangements will need to incorporate measures, so development and occupants are safe. Given the significant tidal risk on and surrounding the site a Flood Warning and Evacuation Plan will be required to ensure residents can be safely evacuated with sufficient warning and there is sufficient shelter space available if evacuation is not possible.

Provisions for safe access and escape should not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

# 7 Conclusions

Summary of the key areas of flood risk across the site:

- **Tidal**: The site is at significant risk of tidal flooding and is recorded to have previously experienced tidal flooding. Most of the site is shown to be impacted in the present day undefended events. The site is shown to be protected by tidal defences in the present day, but these are overtopped during the climate change events.
- **Residual**: The site is at residual risk of tidal flooding due to breach or overtopping of the tidal defences. Breach modelling has shown that breaches during the larger flood events provide little warning time at the site.
- **Surface water**: There is considerable surface water ponding predicted at the site in the present day, showing an increase with climate change shown the site. Surface water risk to the surrounding roads may impede some potential access and escape options.

The following points should be considered in development of this site:

- The Exception Test should be applied if 'More Vulnerable' development is proposed at the site.
- A site-specific FRA should be undertaken, which assess all sources of flood risk. This is likely to require further detailed tidal modelling to demonstrate that the development can be made safe throughout its lifetime and that proposed mitigation measures do not increase flood risk elsewhere.
- Safe access and escape should be considered in the design tidal and surface water events. Developers should demonstrate that safe access and escape routes can be achieved; however, any raising of access and escape routes must make sure that floodwater is not displaced elsewhere. Where safe access and escape is not possible, other means of safe refuge and evacuation must be considered. Due to the tidal risk surrounding the site, a Flood Warning and Evacuation Plan will be required to be prepared which considers the likely onset and duration of flooding and demonstrates how residents can safely be evacuated and/or shelter safely in situ during the design events.
- The tidal defence owner should be consulted at an early stage to determine defence ownership and understand future plans for the defences, including plans for ongoing maintenance or defence improvements.
- Habitable areas of residential ('More Vulnerable') development must be set above the design flood level (0.5% AEP plus a suitable climate change allowance).
- A carefully considered and integrated flood resilient and sustainable drainage design should be put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by detailed modelling. Infiltration testing should be undertaken to confirm the

groundwater levels and appropriateness of SuDS, to inform a sustainable drainage strategy in line with the SuDS hierarchy. The tidal risk at the site alongside the risk of tide locking of any outfalls may present a significant constraint to the implementation of SuDS at the site and will require early consultation with the LLFA to identify viable options.

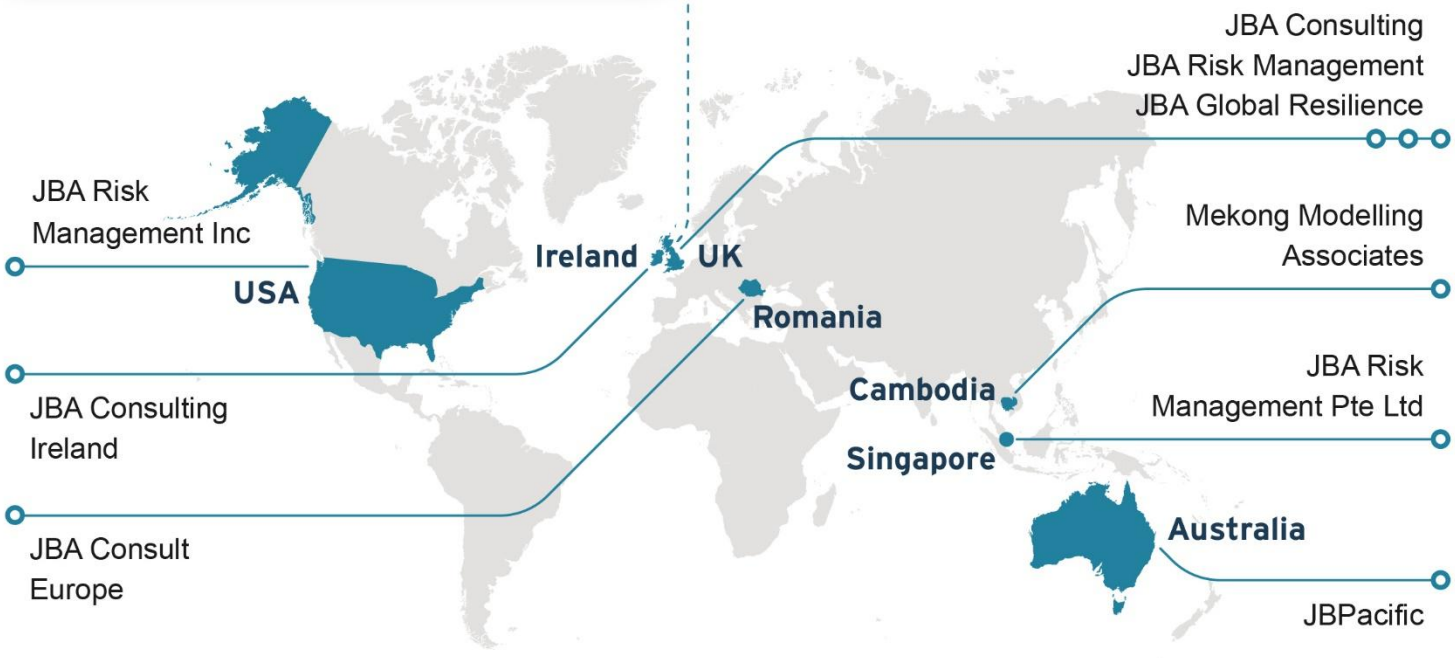
- Anglian Water should be consulted at an early stage on drainage proposals for the site to identify any potential constraints or existing sewer flooding issues that may not have been identified through this high level assessment.

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