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Level 2 Strategic Flood Risk Assessment - Site SHELAA/217

South of Queenborough Creek

Final

Prepared for
Swale Borough Council

Date
October 2026

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1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for site SHELAA/217. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the Swale Borough Council Level 1 SFRA and read the Swale Borough Council Level 2 SFRA main report and is therefore familiar with the terminology used in this report.

1.1 Site details

- Location: South of Queenborough Creek, ME11 5HN
- Site area: 7.06ha
- Existing site use: Greenfield
- Proposed site use: Residential
- Proposed use flood risk vulnerability classification: More Vulnerable

The site is located in Queenborough and comprises predominantly greenfield land, with an existing unnamed road running through the site from the southeast to the northwest. It is bounded by Rushenden Road to the southeast, and Queenborough Creek, including a harbour, to the north, east and west. The Swale lies to the west of the site, while additional greenfield land is situated to the south. Queenborough Railway Station and the associated railway line are located approximately 220m east of the site. Residential properties are present beyond Queenborough Creek on the opposite bank.

1.2 Topography

Figure 1-1 shows the topography of the site represented by the Environment Agency (EA) 1m resolution LiDAR. This LiDAR dataset used in this report was flown in May 2023 and shows that the site's topography is relatively low lying throughout and typically lies at 5.0-5.9mAOD. There is a small ridge of higher elevation in the south which reaches up to 7.8mAOD. Within the western edge of the site, ground levels are shown to be lower at 2.0-4.7mAOD. There is also a lower area of land in the southeast which reaches 4.0-4.8mAOD.

Homes England has confirmed that the site had planning consent (reference: SW/13/1550) to land raise to a minimum level of 4.9mAOD and maximum of 5.4mAOD. This was substantially completed in August 2022. Some surcharge material is yet to be removed in some areas which may explain the higher levels observed in the LiDAR data.

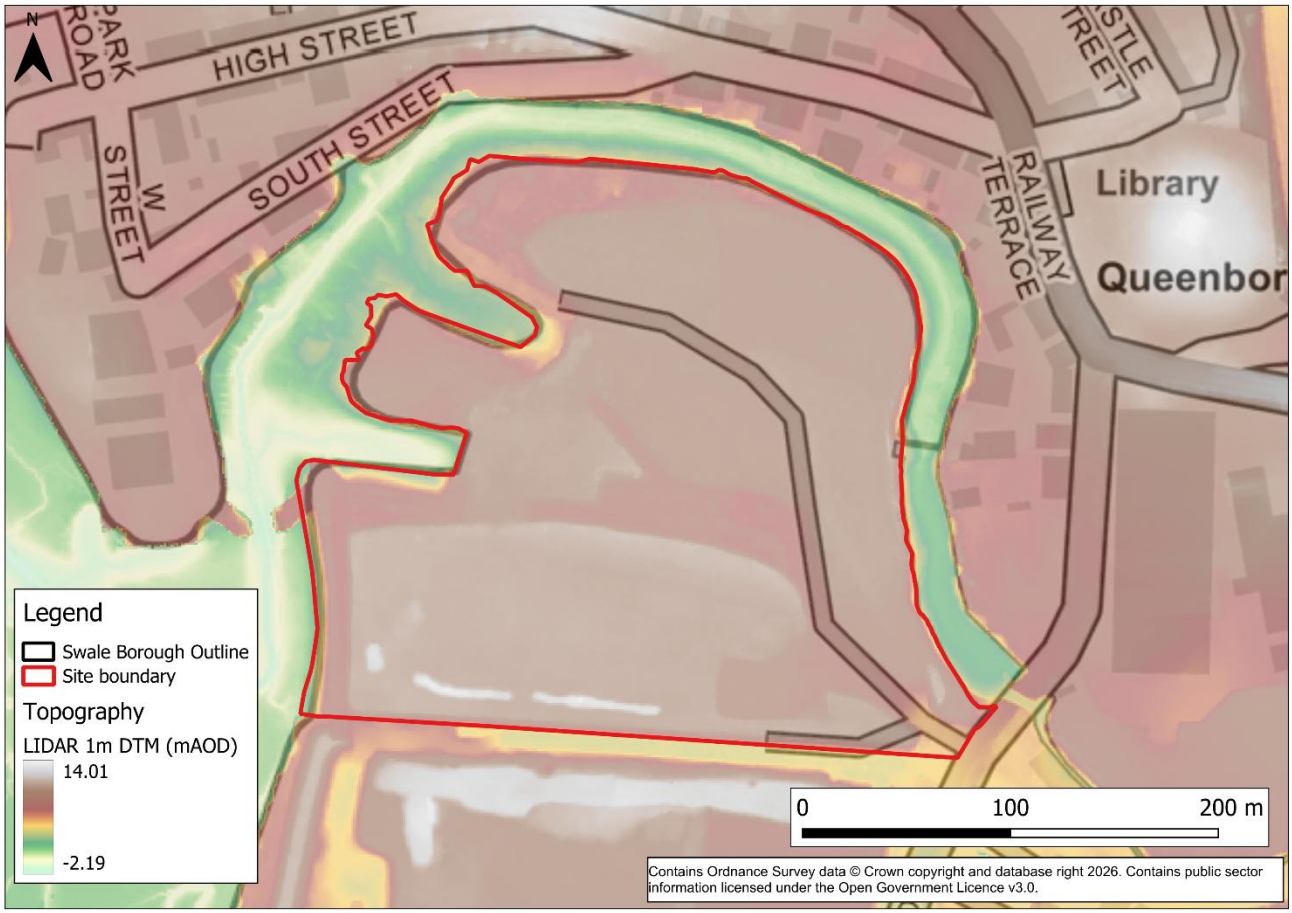


Figure 1-1: Topography of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock - London Clay Formation consisting of clay, silt and sand.
- Superficial - Alluvium consisting of clay, silt, sand and peat

Soils at the site consist of:

- The majority of the site has loamy and clayey soils of coastal flats with naturally high groundwater while the eastern and northeastern extent of the site has slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

The likely impact of these on drainage within the site is discussed within Section 7.

2 Sources of flood risk

2.1 Existing drainage features

The Swale, a statutory Main River, flows parallel to the western site boundary, while Queenborough Creek lies to the east, north and northwest. An additional watercourse is located approximately 20 m east of the site and flows beneath Rushenden Road. Based on available mapping, this watercourse appears to originate from a pond and subsequently discharge into Queenborough Creek.

The site is within the North Kent Marshes Water Level Management Board district.

2.2 Flood Zones

2.2.1 Available data

The Environment Agency's Flood Map for Planning (FMfP) has been used within this assessment to determine Flood Zones 2 and 3a. Flood Zones 2 and 3a do not consider defences.

The Environment Agency Rivers and Sea 3.3% AEP defended flood risk extents - present day mapping and the 3.3% AEP (1 in 30-year) defended extent from North Kent Coastal model has been used to determine Flood Zone 3b in this area.

2.2.2 Description of risk to the site

A small portion of the southwestern corner is within Flood Zone 3b. Flood Zone 3a covers a large area of the site and the areas of higher elevation in the south and northeast are within Flood Zone 2.

The flooding predicted is due to tidal flood risk.

Table 2-1: Existing fluvial and tidal flood risk based on Flood Zones

Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
0	40	59	1

The ground levels at the site have been raised since the LiDAR in the model was flown. As such, the model over estimates the risk at the site. A comparison of the predicted future flood levels and the ground levels confirmed by Homes England can be found in Section 3.3.3, along with a summary of changes to the ground levels and available data.

2.3 Fluvial present day defended risk

It is understood that the Queenborough Creek and the watercourse north of the site's fluvial flood risk has been modelled in the Environment Agency Rivers and Sea 3.3% AEP (1 in 30-year) defended flood risk extents - present day mapping using generalised modelling and no detailed fluvial modelling is readily available. However, the tidal risk is dominant at the site so detailed fluvial modelling is unlikely to make a difference to the risk.

2.4 Tidal/coastal present day defended risk

2.4.1 Available data

The North Kent Coast coastal modelling study (2024) has been used to understand the coastal flood risk.

2.4.2 Description of risk to the site

According to the North Kent Coast model, the southwestern corner is predicted to flood in the defended 3.3% (1 in 30-year), 1% (1 in 100-year) and 0.1% AEP (1 in 1000-year) events.

Table 2-2: Existing tidal flood risk based on the North Kent Coast model*

<0.1% AEP (1 in 1000-year) (%)	0.1% AEP (1 in 1000-year) (%)	0.5% AEP (1 in 100-year) (%)	3.3% AEP (1 in 30-year) (%)
99	1	1	1

** The percentage of tidal extents quoted show the percentage of the site at risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g., 0.5% AEP (1 in 200-year) includes the 3.3% AEP (1 in 30-year) percentage). The <0.1% AEP (1 in 1000-year) event shows the area of the site not predicted to be impacted by tidal flooding.*

The ground levels at the site have been raised since the LiDAR in the model was flown. As such, the model over estimates the risk at the site. A comparison of the predicted future flood levels and the ground levels confirmed by Homes England can be found in Section 3.3.3, along with a summary of changes to the ground levels and available data.

2.5 Surface water

2.5.1 Available data

The Environment Agency's Flood Map for Planning – Surface Water Spatial Planning map has been used within this assessment to inform the extent and depth of surface water risk. Velocity and hazard data is not currently available from the Environment Agency for this dataset.

2.5.2 Description of risk to the site

During the 3.3% (1 in 30-year) and 1% AEP (1 in 100-year) events, ponding is predicted in the south and east of the site within the areas of lower topography. There is also flooding predicted along the unnamed road which leads into the site in the southeastern area of the site. The maximum flood depth for both events is between 0.15m and 0.30m, predicted in the southern extent of the site.

In the 0.1% AEP (1 in 1000-year) event, there is further ponding predicted in the south and east, as well as patches of flooding in the northwest adjacent to Queenborough Creek in

the north. The maximum flood depth is predicted to increase to between 0.30m and 0.60m in the east and northwest.

Table 2-3: Existing surface water flood risk based on the Flood Map for Planning map*

Event	<0.1% AEP (1 in 1000-year) (%)	0.1% AEP (1 in 1000-year) (%)	1% AEP (1 in 100-year) (%)	3.3% AEP (1 in 30-year) (%)
Percentage of site at risk* (%)	93	7	4	3
Maximum depth (m)	N/A	0.30-0.60	0.15-0.30	0.15-0.30

** The percentage of 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., 1% AEP (1 in 100-year) includes the 3.3% AEP (1 in 30-year) percentage). The <0.1% AEP (1 in 1000-year) event shows the area of the site not predicted to be impacted by surface water flooding.*

2.6 Reservoir

The site is not shown to be at risk of reservoir flooding during the 'dry day' or 'wet day' scenarios within the EA's Reservoir Flood Maps, although the site boundary lies adjacent to The Swale where there is a risk.

2.7 Groundwater

The JBA Groundwater Emergence Map shows there is negligible risk to groundwater flooding during a 1% AEP (1 in 100-year) groundwater event.

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.

2.8 Sewers

Southern Water have not provided any additional information regarding sewers at the site.

2.9 Flood history

According to the EA's Historic Flood Map, nearly the entire site flooded in 1978 due to overtopping of the sea defences.

The Kent County Council historic data was provided as point data with an easting and northing. Due to the protection of data, the eastings and northings were plotted on GIS and the number of incidents recorded within a 0.85km^2 area was calculated. Kent County Council's records indicate that the site lies across two areas that have had 6 and 10 flood incidents respectively.

According to Southern Water's Sewer Incident Report Form (SIRF), there have been 4 sewer flood incidents in the ME11 5 postcode area since 2015.

3 Climate change

Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of fluvial, tidal and surface water flooding.

Climate change allowances are determined by the management catchment in which the site is located. The site lies within the North Kent Management Catchment. Please see Section 6 of the Swale Borough Council Level 2 SFRA main report for information on climate change allowances.

Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and escape must also address the potential increase in severity and frequency of flooding.

3.1 Flood Zones plus climate change

3.1.1 Available data

The Environment Agency's Flood Map for Planning (FMfP) plus climate change has been used within this assessment. This shows the combined extent of Flood Zones 2 and 3 using the following climate change allowances:

- 'Central' allowance for the 2080s epoch (2070-2125) for risk of flooding from rivers
- 'Upper End' allowance for risk of flooding from the sea, accounting for cumulative sea level rise to 2125.

3.1.2 Description of risk to the site

The present-day Flood Zones are included in Table 3-1 as a comparison to the Flood Zones plus climate change dataset. Both present-day Flood Zones and the Flood Zones plus climate change inundate the entire site due to the close proximity to The Swale and nearby watercourses.

Table 3-1: Present day Flood Zones compared to Flood Zones plus climate change

Event	Flood Zones	Flood Zones plus climate change
Percentage of site at risk (%)	100	100

The ground levels at the site have been raised since the LiDAR in the model was flown. As such, the model over estimates the risk at the site. A comparison of the predicted future flood levels and the ground levels confirmed by Homes England can be found in Section 3.3.3, along with a summary of changes to the ground levels and available data.

3.2 Fluvial

It is understood that Queenborough Creek and the watercourse north of the site's fluvial flood risk has been modelled in the Environment Agency Rivers and Sea 3.3% AEP (1 in 30-year) defended flood risk extents - present day mapping using generalised modelling and no detailed fluvial modelling is readily available. However, the tidal risk is dominant at the site so detailed fluvial modelling is unlikely to make a difference to the risk.

3.3 Tidal

3.3.1 Available data

The North Kent Coast modelling study (2024) has been used to understand the tidal and coastal flood risk within the Local Plan area. The mapping provides information for present day and for the Upper End climate change event for the years 2100 and 2125. Only the 2125 event has been assessed in this site summary sheet due to the likely lifetime of development (100-years) for residential sites.

3.3.2 Description of risk to the site

The North Kent Coast model shows that during the defended 0.5% AEP (1 in 200-year) tidal event the southwestern corner is predicted to flood. However, in the defended 0.5% AEP (1 in 200-year) 2125 Upper End event, the entire site is predicted to flood.

The maximum flood depths are predicted along the boundaries of the site, reaching 4.12m, with lower depths moving into the site. The lower depths are predicted in the northeast and southwest, reaching between 0.07m and 0.41m. A danger for all hazard classification is predicted on the outskirts of the site and it reduces as the flooding encroaches further into the centre.

Table 3-2: Tidal flood risk to the site in the defended 0.5% AEP 2125 Upper End climate change event.

Event	Defended 0.5% AEP (1 in 200-year) 2125 UE
Percentage of site at risk (%)	100
Maximum depth (m)	4.12
Maximum velocity (m/s)	3.50
Maximum hazard classification	5.97 - Danger for all

3.3.3 Predicted flood levels compared to ground levels

It is understood from information provided by Homes England that land raising has taken place since the LiDAR used within the North Kent Coast model (which has been incorporated into the FMfP) was flown. Therefore, the flood depths and hazard shown in the North Kent Coast model are now over predicting the flood depths and hazard at the site.

A summary of the changes that have taken place is provided below:

- The North Kent Coast modelling (2024) used in this assessment was updated using LiDAR data flown in 2018, which was the most recent at the time.
- Homes England has confirmed that ground raising was completed in August 2022 to levels of 4.9-5.4m AOD.
- The LiDAR was then flown again in May 2023 and released by the Environment Agency in 2025. This latest LiDAR data can be found in Figure 1-1.

A comparison of the ground levels reported by Homes England and predicted flood levels can be found below:

Table 3-3: A comparison of the ground levels reported by Homes England and future predicted flood levels

Homes England confirmed ground level (mAOD)	Flood level predicted in the defended 0.5% AEP (1 in 200-year) 2125 UE event (mAOD)
4.9-5.4	5.8-6.2

The comparison shows that a future defended tidal flood risk to the site remains, but the predicted flood depths are not as great as shown in the outputs from the North Kent Coast model. It is likely that any Flood Risk Assessment prepared for the ground raising undertaken in 2022 used an older version of the North Kent Coast model.

As such, a Flood Risk Assessment should incorporate the revised ground levels to ensure that the assessment accurately represents current site conditions.

3.4 Surface water

3.4.1 Available data

The Environment Agency's Surface Water Spatial Planning Dataset, released in May 2026, has been used within this assessment to inform the extent and depth of surface water risk with climate change. Climate change outputs are available for the 3.3% (1 in 30-year), 1% (1 in 100-year), and 0.1% AEP (1 in 1000-year) events with the Upper End climate change allowance for the 2070s epoch. Velocity and hazard data is not currently available from the Environment Agency for this dataset.

It should be noted that the Environment Agency's Upper End allowance for the 2050s epoch for the 1% AEP (1 in 100-year) event in the North Kent Management Catchment is greater than the 2070s epoch for the 1% AEP (1 in 100-year) event so the climate change uplift may be slightly underestimated.

3.4.2 Description of risk to the site

Surface water flooding in the 1% AEP (1 in 100-year) plus climate change event is predicted to increase slightly compared to the 1% AEP (1 in 100-year) event, particularly in the south, east and northwest, where there is more extensive pooling predicted. The

maximum flood depth is predicted to increase from 0.15-0.30m to 0.30-0.60m, in the south and northwest and east respectively.

Table 3-4: Comparison of surface water flood risk to the site between the 1% AEP (1 in 100-year) and 1% AEP (1 in 100-year) plus climate change events.

Event	1% AEP (1 in 100-year)	1% AEP (1 in 100-year) plus climate change
Percentage of site at risk (%)	4	6
Maximum depth (m)	0.15-0.30	0.30-0.60

4 Flood risk management infrastructure

4.1 Defences

The Environment Agency AIMS (Asset Information Management System) dataset shows the site is protected by engineered high ground which runs along the western, northern and eastern boundaries and walls protecting Queenborough Creek to the west with conditions (rated where 1 is good and 5 is bad) of unknown and 2 respectively. The standard of protection of the defences is for a 0.1% AEP (1 in 1000-year) event.

In addition, the Environment Agency identifies the Queenborough tidal gate/barrier as part of the flood defence infrastructure protecting Sheerness and Queenborough from coastal flooding although not included in the AIMS dataset.

4.2 MEAS Hold the Line Benefit Area

The Medway Estuary and Swale flood and coastal risk management Strategy (MEAS) sets out the Environment Agency's plan to sustainably manage the coastline and tidal defences in the Medway estuary and Swale area. It aims to protect people, properties, designated habitat and agricultural land over the next 100 years.

The site is within a MEAS Hold the Line Benefit Area. This means the site lies within an area where the long-term strategic intention is to continue maintaining or improving flood defences, subject to future funding and review.

4.3 Residual risk

There is a risk of the defences to the west, north and east being breached by The Swale or Queenborough Creek, which could cause tidal flooding. There is breach modelling available for the North Kent Coast model for the 0.5% AEP (1 in 200-year) 2075 Upper End event which shows the periphery of the site would be at risk of flooding. However, for this site, as the proposed land use is residential development, the 2125 0.5% AEP (1 in 200-year) flood event should be assessed within a breach model as part of a detailed Flood Risk Assessment.

Queenborough Creek is also culverted underneath Rushenden Road just east of the site. There is potential for the culvert to collapse or build-up of debris causing water levels to exceed the bank levels and flow overland which may impact the site.

5 Coastal Change Management Area

The site is 110m north of the Coastal Change Management Area (CCMA). This has been defined by the North Kent Coast 2125 Upper End defended 3.3% AEP flood extent zone. The implications of the CCMA can be found within Appendix J of the Level 1 SFRA.

6 Emergency planning

6.1 Flood warnings and alerts

The site is located in the Environment Agency "Sheerness, Minster and Queenborough Flood Warning Area" and the "Isle of Sheppey and coast from Kemsley to Seasalter Flood Alert Area".

6.2 Access and escape

Safe access and escape will need to be demonstrated in the 1% AEP plus climate change fluvial and surface water events as well as 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.

6.2.1 Current and potential access to the site

Current and future access and escape to and from the site can be achieved via the unnamed road off of Rushenden Road in the southeast of the site.

6.2.2 Fluvial

There is flood free access and escape via the unnamed road in the southeast in all fluvial events.

6.2.3 Tidal

Safe access and escape is not viable during the 0.5% AEP (1 in 200-year) 2125 Upper End event as Rushenden Road is predicted to be inundated with flood depths over 2.5m to the south and at the access point and between 1m and 1.5m to the north. The hazard classification is also a danger for all along the access road and to the north and south.

6.2.4 Surface water

During the 1% AEP (1 in 100-year) surface water climate change event, there is flood free access and escape via the unnamed road along Rushenden Road to the north. However, there is flooding predicted travelling from the south along Rushenden Road with flood depths between 0.30m and 0.60m which is likely to inhibit access and escape.

6.3 Dry islands

A dry island is a parcel of land that is elevated above surrounding areas at risk of flooding and is not at risk of flooding itself.

The site is not located on a dry island.

7 Requirements for drainage control and impact mitigation

7.1 Broadscale assessment of possible SuDS

- 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 and therefore permeability could be highly variable. As a result, permeability should be confirmed through infiltration testing. Off-site discharge may be required to discharge surface water runoff from the site. This would need to be in accordance with the SuDS hierarchy and national and local guidance.
- 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's topography is relatively flat which will allow availability for gravity-fed infiltration features like basins.
- The site is not located within a historic landfill site.

7.2 Opportunities for wider sustainability benefits and integrated flood risk management

- Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (Local Planning Authority, Lead Local Flood Authority, and the EA) at an early stage to understand possible constraints.
- Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.
- Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered.
- Consideration should be made to the existing condition of receiving waterbodies for water quality. 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.
- 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 potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access.
- Surface water discharge rates should not exceed the existing greenfield runoff rates for the site for the 50% AEP (1 in-2 year) and 1% AEP (1 in-100) year storm events. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. 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.
- If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the Lead Local Flood Authority alongside confirmation with the asset owner of the available capacity.
- The site is within the North Kent Marshes Water Level Management Board (WLMB) district who may have additional requirements regarding discharge rates (directly or indirectly) into their district. The WLMB should be consulted during the detailed design of the site to establish the Board's requirements, approval to discharge into WLMB watercourses (directly or indirectly) and ordinary watercourse consents.
- The Environment Agency has confirmed that any flood risk activities carried out within 16 metres of the main river, or tidal defence would require a Flood Risk Activity Permit. The site currently provides access to the Queenborough barrier and an unrestricted access to the Queenborough barrier will need to be maintained.

8 NPPF and planning implications

8.1 Exception Test requirements

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

Annex F of the NPPF classifies residential development as "More vulnerable".

The Exception Test is required for this site because it is More vulnerable and located within Flood Zone 3a. More vulnerable development is not permitted within Flood Zone 3b.

8.2 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 or 3 or see flood map for planning
- within Flood Zone 3b
- within 'Flood Zones plus Climate Change', showing it is at increased risk of flooding from rivers or sea in future - see flood map for planning
- within Flood Zone 1 and the flood map for planning shows it is at risk of flooding from surface water, now or in future

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

Consultation with the Local Authority, Lead Local Flood Authority, Southern Water, North Kent Marshes WLMB and the Environment Agency should be undertaken at an early stage.

Any 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 Swale Borough Council Local Plan Policies.

The development should be designed with mitigation measures in place where required as outlined in Section 8.3

8.3 Guidance for site design and making development safe

- A sequential approach should be applied within the site, locating development in the areas of lowest flood risk where possible. While tidal flood risk affects a significant proportion of the site, the layout should also take account of current and future fluvial and surface water flood risk. Development should be steered outside areas within Flood Zone 3b.
- Mitigation measures such as further land raising and/or the construction of private flood defences may be required for the development to be safe for its lifetime from tidal flooding. Where ground raising or flood defences are proposed as part of a development surface water flow paths should be avoided to prevent detriment elsewhere. If flow paths cannot be avoided then site-specific hydraulic

modelling will be needed to demonstrate that there is no impact on flood risk elsewhere.

- It is understood that land raising has been carried out at the site since the latest North Kent Coast model was prepared. The Flood Risk Assessment should incorporate the revised ground levels to ensure that the assessment accurately represents current site conditions.
- The residual risk at the site should be assessed and include breach modelling for the 2125 0.5% AEP (1 in 200-year) tidal event and the risk of a culvert collapse or blockage.
- Assuming the site can be made safe from tidal flooding
    - Where development cannot avoid areas at risk of flooding, then flood resilience and resistance measures e.g. raising of floor levels, including property flood resistance and resilience measures should be implemented, where appropriate. These measures should be assessed to make sure that flooding is not increased either on or off the site.
    - The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff volumes from the development are not increased by development. 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 retained as open space and SuDS or water compatible/essential infrastructure uses only.
    - A Flood Response Plan will be required in consultation with Swale Borough Council. Arrangements for safe access and escape will need to be provided for the 1% AEP surface water 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 mitigation measures, to ensure the development and occupants are safe. It may involve consideration of evacuation before the event or safe refuge on site.
    - 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.
    - The Environment Agency has confirmed that any flood risk activities carried out within 16 metres of the main river, or tidal defence would require a Flood Risk Activity Permit. The site currently provides access to the Queenborough barrier and unrestricted access to the Queenborough barrier will need to be maintained.

9 Conclusions

A small portion of the southwestern corner is within Flood Zone 3b. Flood Zone 3a covers a large area of the site and the south and northeast are within Flood Zone 2.

The site benefits from engineered high ground which runs along the western, northern and eastern boundaries and walls and the Queenborough tidal gate/barrier.

According to the North Kent Coast model, the southwestern corner is predicted to flood in the defended 3.3% (1 in 30-year), 0.5% (1 in 200-year) and 0.1% AEP (1 in 1000-year) events. However, in the defended 0.5% AEP (1 in 200-year) 2125 Upper End event, the entire site is predicted to flood.

The LiDAR included in the model was flown in 2018 and does not include recent land raising. A comparison of the flood levels predicted during the defended 0.5% AEP (1 in 200-year) 2125 Upper End event and the ground levels provided by Homes England still shows tidal flooding at the site, but the flood depths and hazard shown in the North Kent Coast model are likely to be over predicted as ground levels are now higher.

In terms of surface water flood risk, during the 3.3% (1 in 30-year) and 1% AEP (1 in 100-year) events, ponding is predicted in the south and east of the site. There is also flooding predicted along the unnamed road which leads into the site in the southeastern area of the site. In the 0.1% AEP *(*1 in 1000-year*)* event, there is further ponding predicted in the south and east, as well as patches of flooding in the northwest adjacent to Queenborough Creek. Surface water flooding in the 1% AEP (1 in 100-year) plus climate change event is predicted to increase slightly compared to the 1% AEP (1 in 100-year) event, particularly in the south, east and northwest.

According to the Environment Agency's Historic Flood Map, nearly the whole site flooded in 1978 due to overtopping of the sea defences and Kent County Council's records indicate that the site is within two areas that have had 6 and 10 historic flood incidents respectively.

There have been 4 sewer flood incidents in the ME11 5 postcode area since 2015 according to Southern Water's SIRF dataset.

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

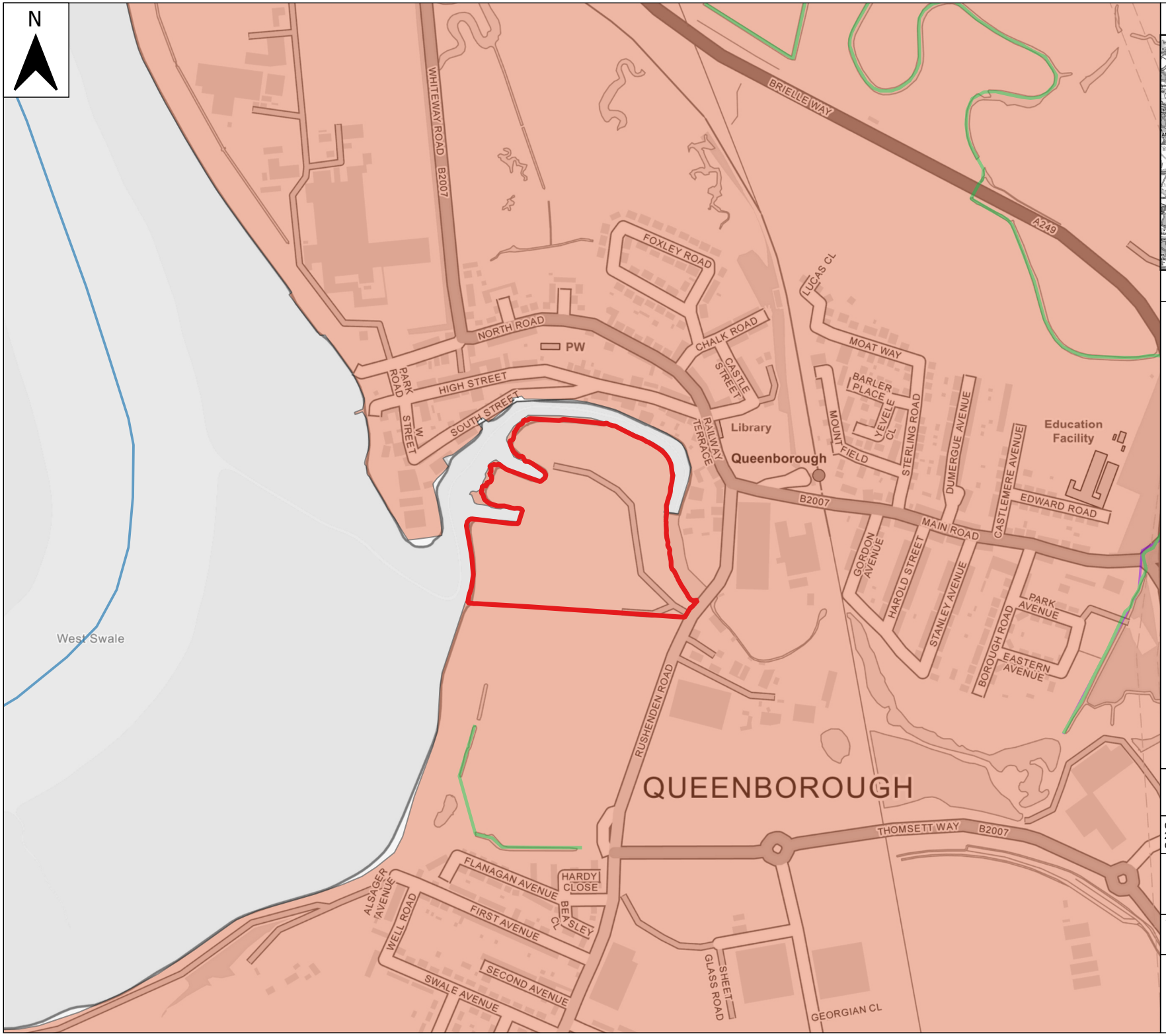
- A site-specific Flood Risk Assessment will be required which demonstrates that development can be safely accommodated on the site for its lifetime. A sequential approach should be applied within the site, locating development in the areas of lowest flood risk where possible. Development should be steered outside of the areas within Flood Zone 3b. Where this is not possible, it may mean further land raising and/or the construction of private flood defences are required. Where ground raising or flood defences are proposed as part of a development surface water flow paths should be avoided to prevent detriment elsewhere. If flow paths cannot be avoided, then site-specific hydraulic modelling will be needed to demonstrate that there is no impact on flood risk elsewhere.

- The residual risk should be assessed and include breach modelling for the 2125 0.5% AEP (1 in 200-year) event and assess the risk of culvert blockage.
- Development should be steered outside the areas of surface water and tidal risk on site. Where development cannot avoid areas at risk of flooding, then flood resilience and resistance measures e.g. raising of floor levels, including property flood resistance and resilience measures should be implemented, where appropriate. These measures should be assessed to make sure that flooding is not increased either on or off the site.
- SuDS (filtration techniques, conveyance features such as swales or discharging to nearby sewers) should be incorporated throughout the site to manage runoff, provide climate change resilience and deliver wider water quality, biodiversity and amenity benefits.
- A Flood Response Plan will be required in consultation with Swale Borough Council. Arrangements for safe access and escape will need to be provided for the 1% AEP surface water and 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 mitigation measures, to ensure the development and occupants are safe. It may involve consideration of evacuation before the event or safe refuge on site.

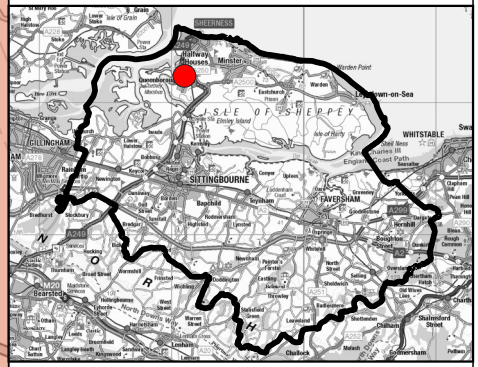
A Sources of information

- National Planning Policy Framework (NPPF) https://www.gov.uk/guidance/national-planning-policy-framework
- Planning Practice Guidance (PPG), Flood Risk and Coastal Change https://www.gov.uk/guidance/flood-risk-and-coastal-change
- Swale Borough Local Plan https://services.swale.gov.uk/media/files/localplan/adoptedlocalplanfinalwebversion.pdf
- Swale Borough Council Sequential and Exception Tests for Planning Applications https://swale.gov.uk/planning-and-regeneration/local-plans/local-plan-review-evidence/flood-risk#h2
- Swale Borough Council Level 1 SFRA
- https://swale.gov.uk/planning-and-regeneration/local-plans/local-plan-review-evidence/flood-risk#h2
- Kent County Council Local Flood Risk Management Strategy https://www.kent.gov.uk/__data/assets/pdf_file/0016/205621/Local-Flood-Risk-Management-Strategy-2024-2034.pdf
- Flood risk assessments: applying for planning permission https://www.gov.uk/guidance/flood-risk-assessments-applying-for-planning-permission
- Kent County Council's Drainage and Planning Policy Statement https://www.kent.gov.uk/about-the-council/strategies-and-policies/service-specific-policies/economic-regeneration-and-planning-policies/planning-policies/flooding-drainage-and-water-management-policies-and-guidance
- Defra's National standards for sustainable drainage systems (SuDS) https://www.gov.uk/government/publications/national-standards-for-sustainable-drainage-systems/national-standards-for-sustainable-drainage-systems-suds
- Flood Map for Planning - Flood Zones dataset https://environment.data.gov.uk/dataset/04532375-a198-476e-985e-0579a0a11b47
- Flood Map for Planning - Flood Zones plus Climate Change https://environment.data.gov.uk/dataset/59065c43-257e-4867-8798-fd2366156a6b
- British Geological Survey (BGS) Geology Viewer https://geologyviewer.bgs.ac.uk/
- Flood Warning sign up https://www.gov.uk/sign-up-for-flood-warnings

B Flood Risk Mapping



Location Plan



Legend

- Swale Borough Outline
- Site boundary

Watercourses

- Statutory Main Rivers
- Ordinary watercourses
- North Kent Marshes Water Level Management Board Watercourses
- North Kent Marshes Water Level Management Board

0 200 400 m

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SWALE BOROUGH COUNCIL
LEVEL 2 SFRA:
WATERCOURSES - SHELAA-217

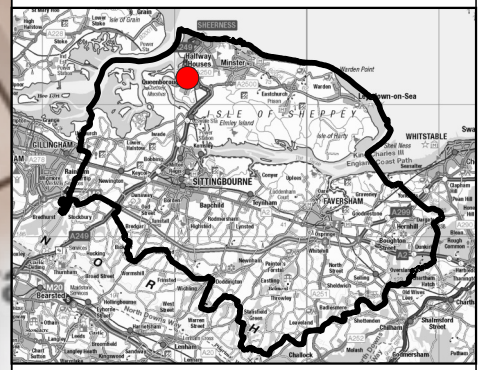
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Swale BOROUGH COUNCIL
Making Swale a better place



Location Plan



Legend

Swale Borough Outline

Site boundary

Topography

LIDAR 1m DTM (mAOD)

7.84

-1.19

Notes

The LIDAR Composite DTM (Digital Terrain Model) is a raster elevation model covering ~99% of England at 1m spatial resolution. The DTM (Digital Terrain Model) is produced from the last or only laser pulse returned to the sensor. We remove surface objects from the Digital Surface Model (DSM), using bespoke algorithms and manual editing of the data, to produce a terrain model of just the surface.

Produced by the Environment Agency in 2022, the DTM is derived from a combination of the EA's Time Stamped archive and National LIDAR Programme surveys, which have been merged and re-sampled to give the best possible coverage. Where repeat surveys have been undertaken the newest, best resolution data is used. Where data was resampled a bilinear interpolation was used before being merged.

The 2025 LIDAR Composite contains surveys undertaken between 6th June 2000 and 1st August 2025.

0 60 120 m

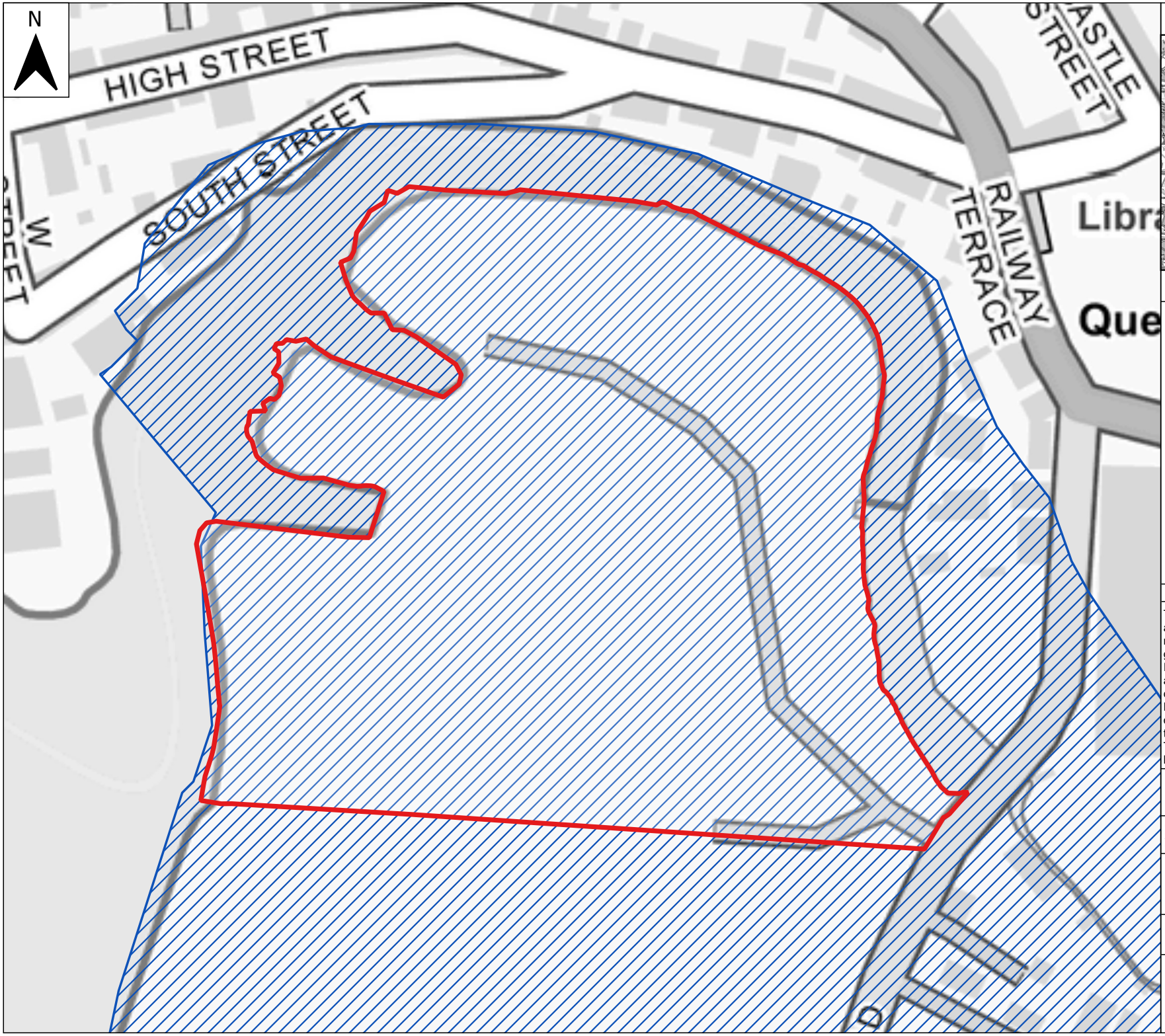
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LEVEL 2 SFRA:
TOPOGRAPHY - SHELAA-217

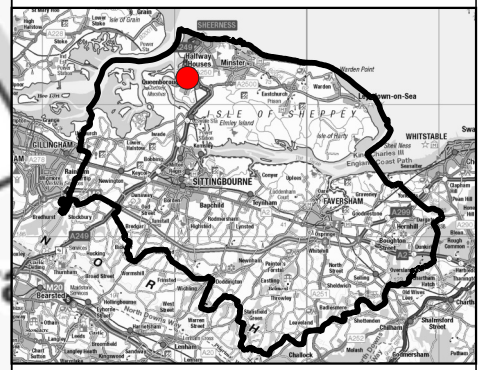
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

Environment Agency recorded flood outlines

- Main Rivers
- Sea

Notes

The Historic Flood Map shows the recorded flood outlines available from the Environment Agency. The dataset records historical flooding from rivers, the sea, groundwater and surface water.
It is possible that the pattern of flooding has changed and area would now flood or not flood under different circumstances.
Please note that not all historical records may be shown on this map, and that it is therefore advised you contact the Environment Agency for updated information.
The map does not include recorded incidents of flooding held by Kent County Council or Southern Water.

0 60 120 m

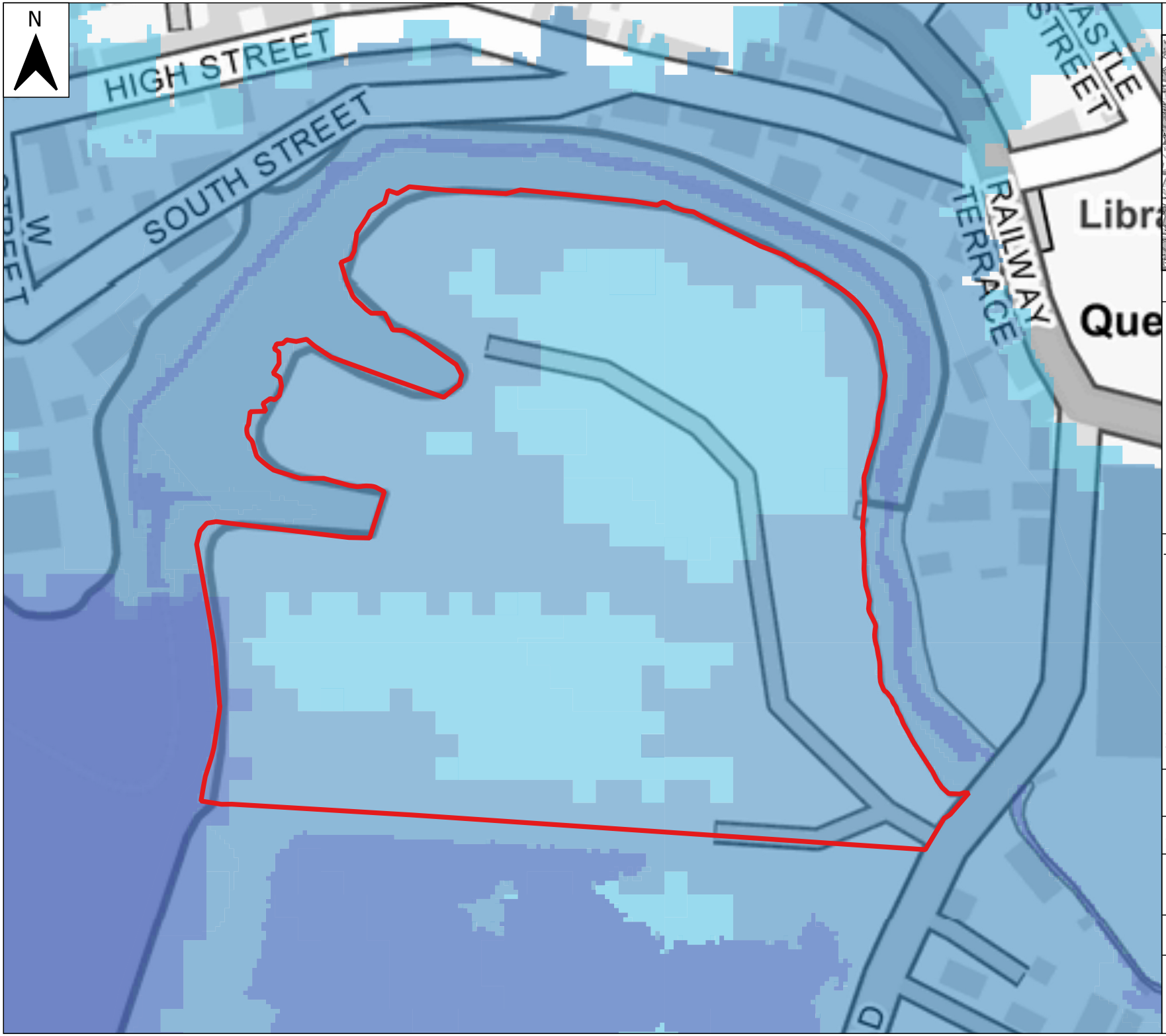
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LEVEL 2 SFRA:
HISTORIC FLOODING - SHELAA-217

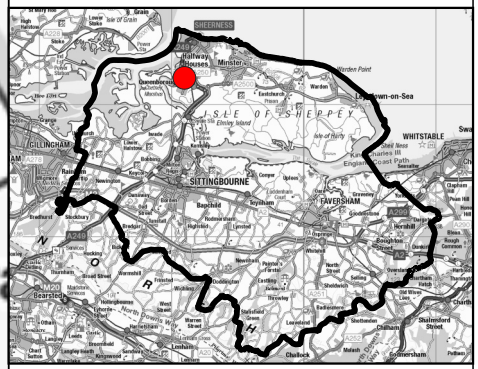
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

Flood Zone

- Flood Zone 2
- Flood Zone 3
- Flood Zone 3b
- Generalised modelling used for Flood Zone 3b

Notes

Flood Zone 1: Land assessed as having a less than 0.1% AEP of river or sea flooding.
Flood Zone 2: Land assessed as having a 0.1% - 1% AEP (1 in 1000-year and 1 in 100-year) of river flooding or a 0.1% - 0.5% AEP (1 in 1000-year and 1 in 200-year) of flooding from the sea.
Flood Zone 3a: Land assessed as having a greater than a 1% AEP (1 in 100-year) of river flooding or a greater than 0.5% AEP (1 in 200-year) of flooding from the sea.
Flood Zone 3b: Land where water has to flow or be stored in times of flood (functional floodplain). The SFRA identifies this Flood Zone as land which floods with an annual probability of 3.3% AEP (1 in 30-year) where detailed modelling exists. Where the 3.3% AEP (1 in 30-year) ouputs are not available, Flood Zone 3a is used as a surrogate as a precautionary approach. If a proposed development is in Flood Zone 3, further analysis should be undertaken in a detailed site specific FRA to define and confirm the extent of Flood Zone 3b.

0 60 120 m

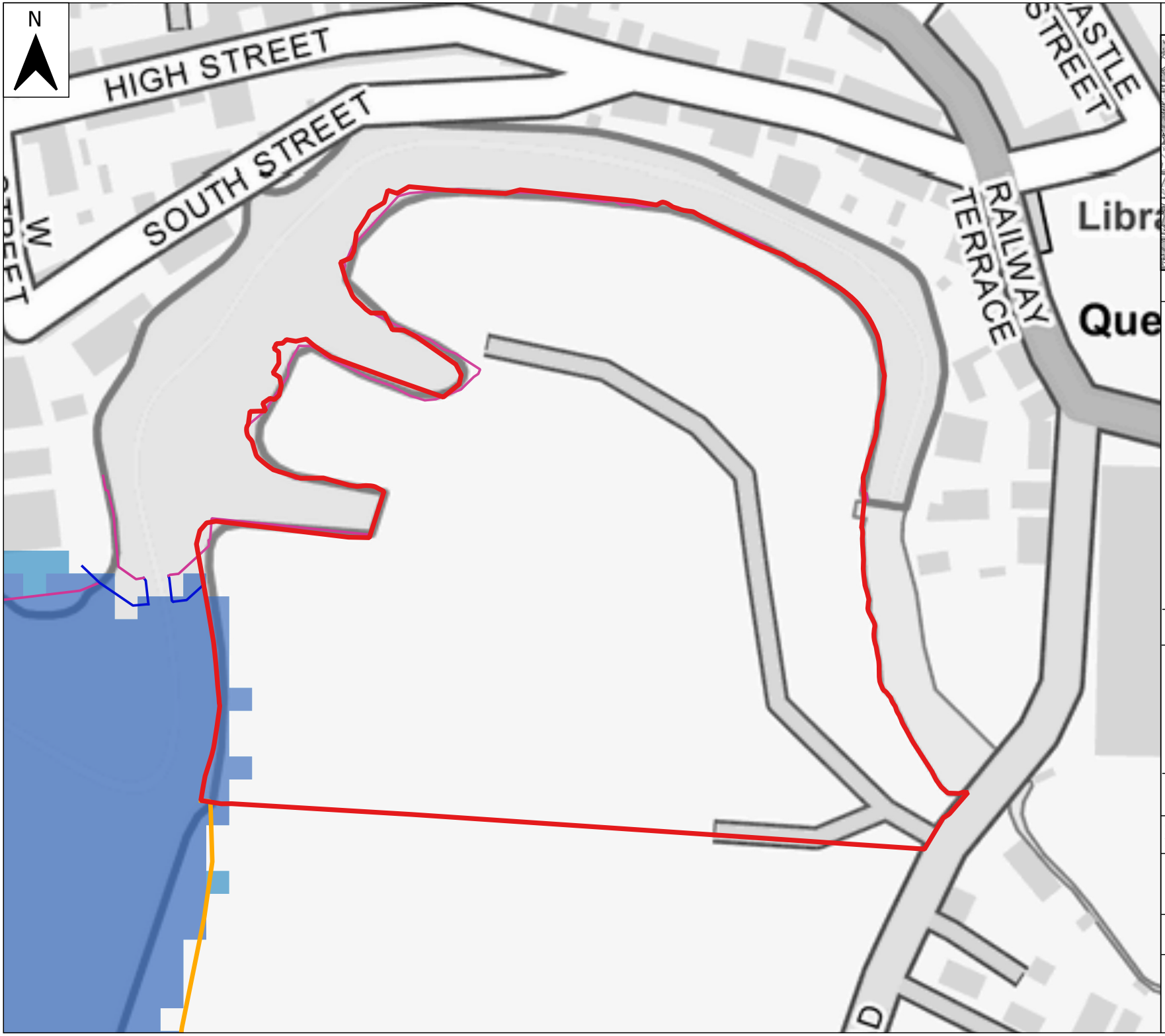
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LEVEL 2 SFRA:
PRESENT DAY FLOOD RISK FROM RIVERS AND SEA (FLOOD ZONES) - SHELAA-217

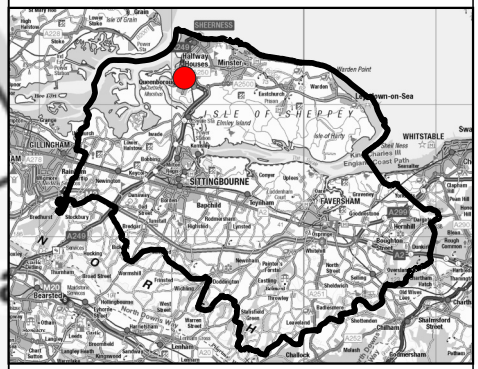
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Location Plan



Legend

- Swale Borough Outline
- Site Boundary
- 3.3% AEP (1 in 30-year)
- 0.5% AEP (1 in 200-year)
- 0.1% AEP (1 in 1000-year)

EA Flood Defence Types

- Embankment
- Engineered High Ground
- Wall

Notes

Present day extents for the North Kent Coast modelling study shows the tidal and coastal flood risk for the 3.3% AEP (1 in 30-year) defended flood event and 0.5% AEP (1 in 200-year) and 0.1% (1 in 1000-year) defended flood events.

0 60 120 m

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LEVEL 2 SFRA:
NORTH KENT COAST MODEL - DEFENDED PRESENT DAY TIDAL EXTENT - SHELAA-217

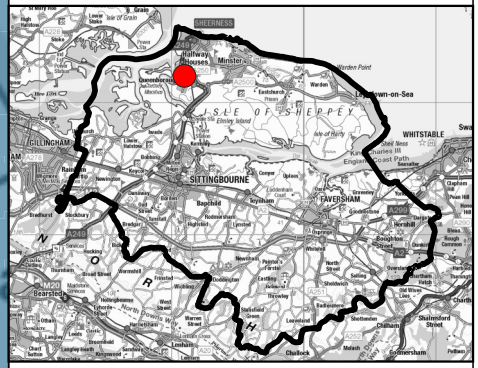
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Location Plan



Legend

- Swale Borough Outline
- Site Boundary
- 1% AEP (1 in 100-year) and 0.1% AEP (1 in 1000-year) undefended extents under the 2125 year climate change scenario

Notes

The Flood Zone plus Climate Change mapping was produced by combining the Flood Zone 2 and Flood Zone 3 extents with the relevant climate change allowances to illustrate the potential future flood risk to the area. This represents an undefended scenario, meaning that existing flood defences are not considered in the modelling. For further information on this flood extent dataset, please refer to the guidance available on;

https://flood-map-for-planning.service.gov.uk/how-to-use-

0 60 120 m

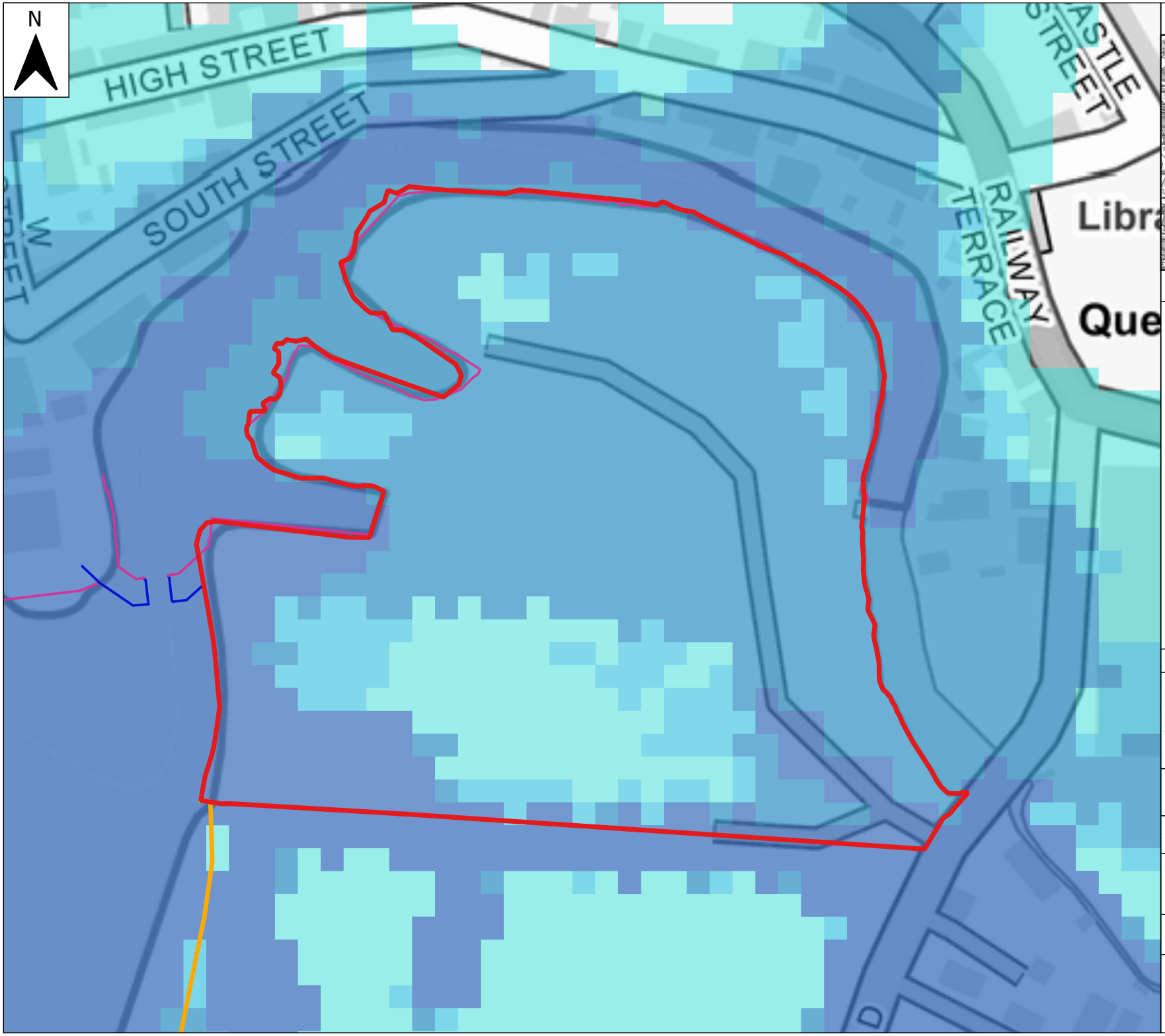
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LEVEL 2 SFRA:
FUTURE FLOOD RISK FROM RIVERS AND SEA - FLOOD MAP FOR PLANNING- SHELAA-217

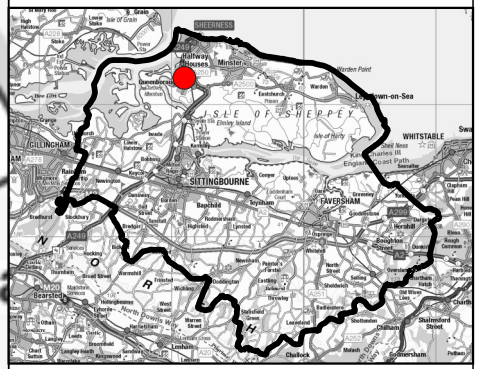
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Location Plan



Legend

- Swale Borough Outline
- Site boundary
- 0.5% AEP (1 in 200-year) 2100 defended (higher central)
- 0.5% AEP (1 in 200-year) 2100 defended (upper end)
- 0.5% AEP (1 in 200-year) 2125 defended (higher central)
- 0.5% AEP (1 in 200-year) 2125 defended (upper end)

EA Flood Defences Types

- Embankment
- Engineered High Ground
- Wall

Notes

Climate change extents for the 0.5% AEP (1 in 200-year) events with the Higher Central and Upper End estimates (2100 and 2125) are shown. The difference in flood extents are relatively small.

0 60 120 m

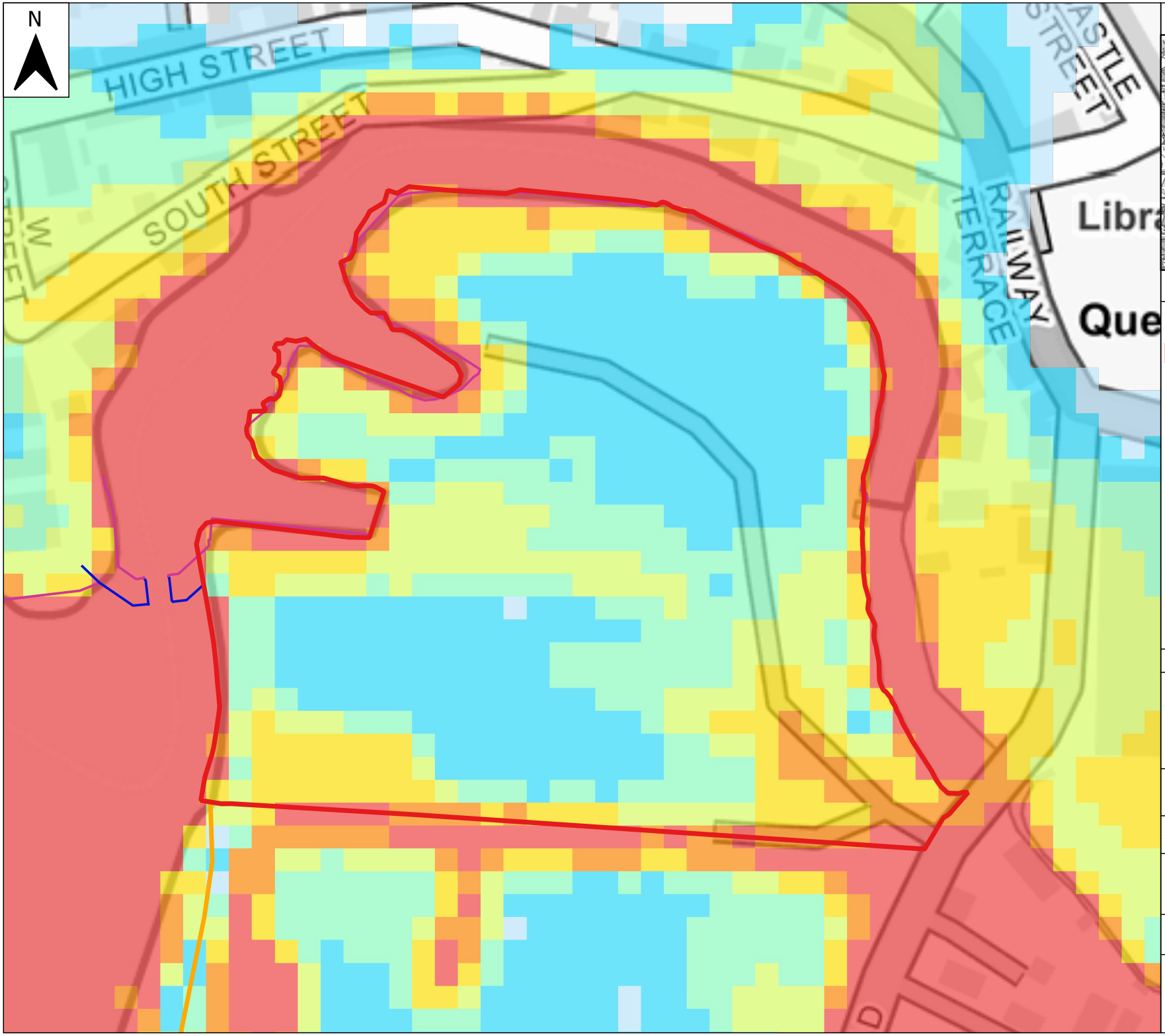
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LEVEL 2 SFRA:
FUTURE FLOOD RISK FROM THE SEA - NORTH KENT COAST MODEL - SHELAA-217

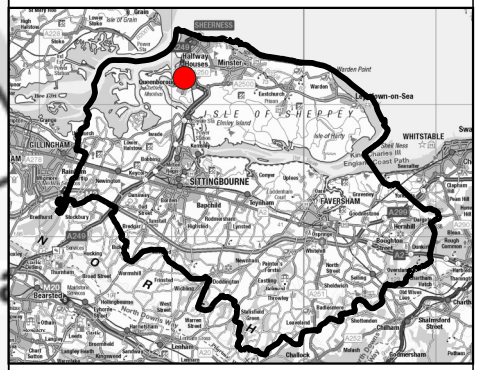
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

North Kent Coast Model - Defended
0.5% AEP (1 in 200-year) 2125 UE depth (m)

- 0.00 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- 2.00 - 2.50
- > 2.50

EA Flood Defences Types

- Embankment
- Engineered High Ground
- Wall

Notes

Climate change depths for the 0.5% AEP (1 in 200-year) event with the Upper End estimate (2125) is shown.

0 60 120 m

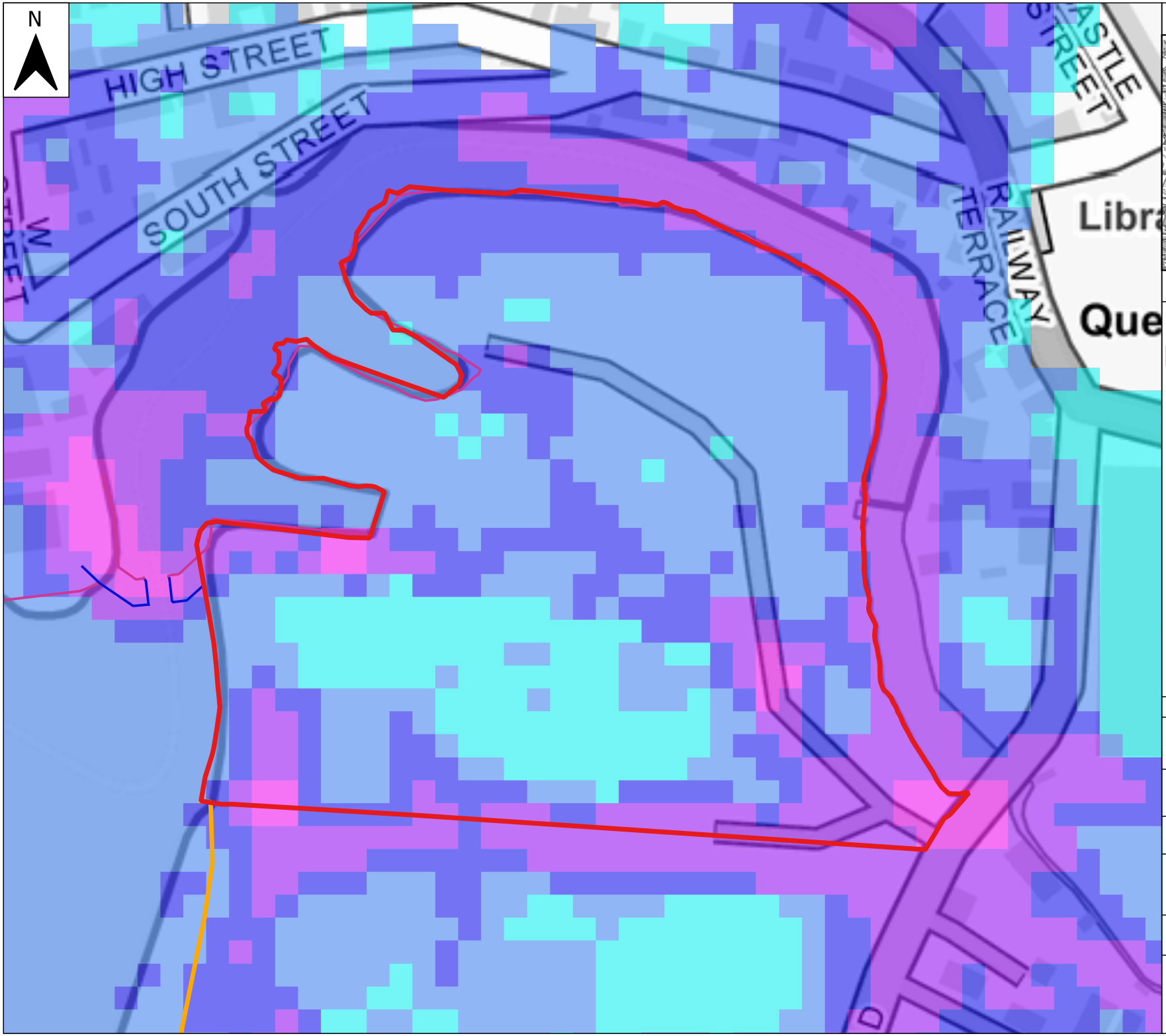
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SWALE BOROUGH COUNCIL
LEVEL 2 SFRA:
FUTURE FLOOD RISK FROM THE SEA - NORTH KENT COAST MODEL DEPTH - SHELAA-217

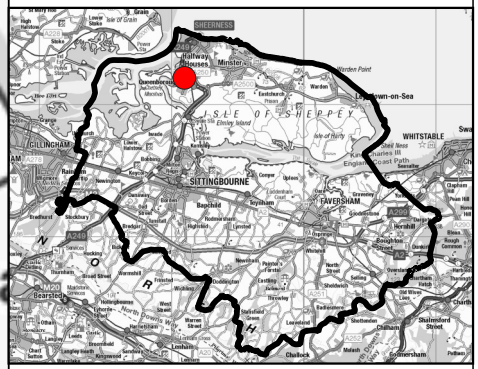
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

North Kent Coast Model - Defended 0.5% AEP (1 in 200-year) 2125 UE Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

EA Flood Defences Types

- Embankment
- Engineered High Ground
- Wall

Notes

Climate change velocity for the 0.5% AEP (1 in 200-year) event with the Upper End estimate (2125) is shown.

0 60 120 m

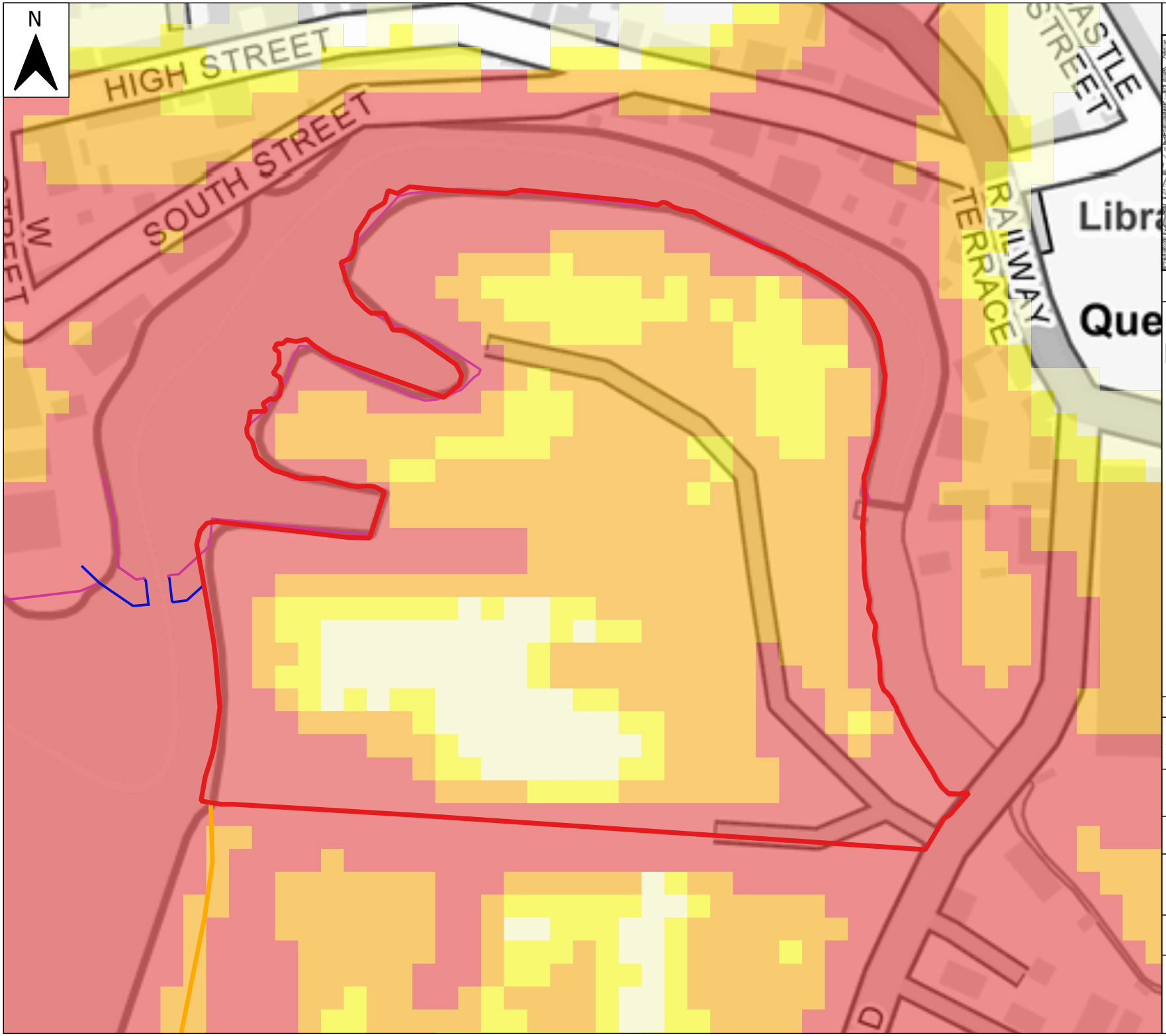
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SWALE BOROUGH COUNCIL
LEVEL 2 SFRA:
FUTURE FLOOD RISK FROM THE SEA - NORTH KENT COAST MODEL VELOCITY - SHELAA-217

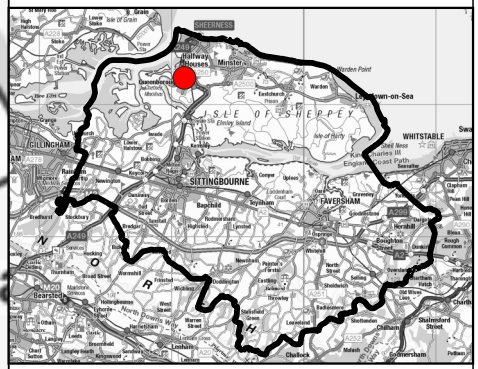
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

North Kent Coast Model - Defended 0.5% AEP (1 in 200-year) 2125 UE hazard classification

- No hazard
- Very low hazard - Caution
- Danger for some
- Danger for most
- Danger for all

EA Flood Defences Types

- Embankment
- Engineered High Ground
- Wall

Notes

Climate change hazard for the 0.5% AEP (1 in 200-year) event with the Upper End estimate (2125) is shown.

0 60 120 m

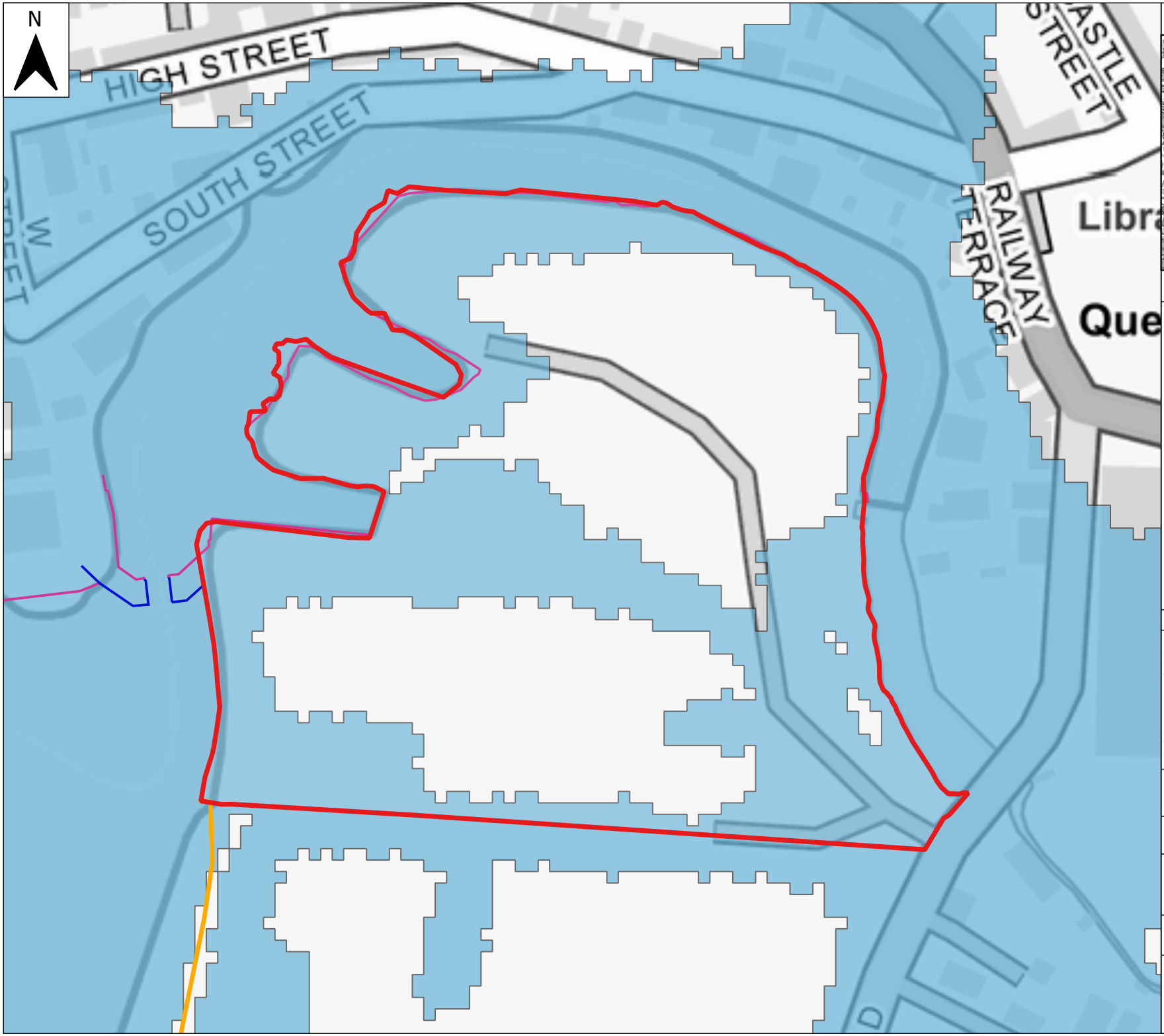
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LEVEL 2 SFRA:
FUTURE FLOOD RISK FROM THE SEA - NORTH KENT COAST MODEL HAZARD - SHELAA-217

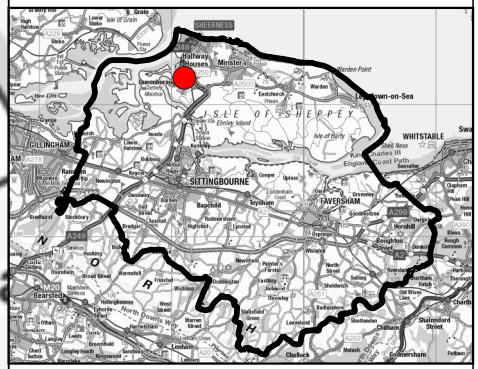
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Location Plan



Legend

- Swale Borough Outline
- Site boundary
- North Kent Coast Model - 0.5% AEP (1 in 200-year) 2075 UE Breach Extent

EA Flood Defences Types

- Embankment
- Engineered High Ground
- Wall

Notes

Breach modelling is a hydraulic approach used to simulate the failure or overtopping of a flood defence, such as a flood wall or embankment, during a given flood event. It assesses how such a failure would influence flood extents and the potential impacts on surrounding areas.
In the North Kent Coast Model, breach modelling was carried out at several locations. The results presented here relate to all of the breaches, which represent simulated failures of surrounding defences during the climate change 0.5% AEP (1 in 200-year) event with the Upper End estimate (2075), illustrating the predicted extent of flooding under these conditions.

0 60 120 m

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LEVEL 2 SFRA:
FUTURE BREACH RISK FROM THE SEA - NORTH KENT COAST MODEL EXTENT - SHELAA-217

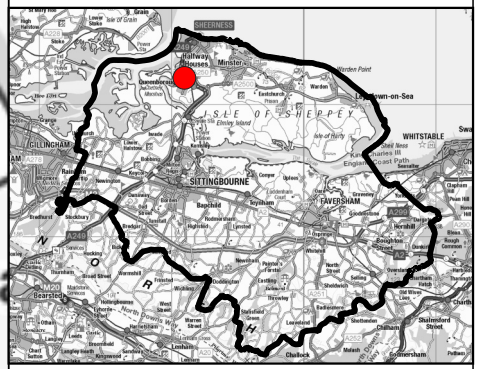
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

North Kent Coast Model - 0.5% AEP (1 in 200-year) 2075 UE Breach Depth (m)

- 0.00 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- 2.00 - 2.50
- > 2.50

EA Flood Defences Types

- Embankment
- Engineered High Ground
- Wall

Notes

Breach modelling is a hydraulic approach used to simulate the failure or overtopping of a flood defence, such as a flood wall or embankment, during a given flood event. It assesses how such a failure would influence flood extents and the potential impacts on surrounding areas.
In the North Kent Coast Model, breach modelling was carried out at several locations. The results presented here relate to the maximum depth of all the breaches, which represent simulated failures of surrounding defences during the climate change 0.5% AEP (1 in 200-year) event with the Upper End estimate (2075), illustrating the predicted depth of flooding under these conditions.

0 60 120 m

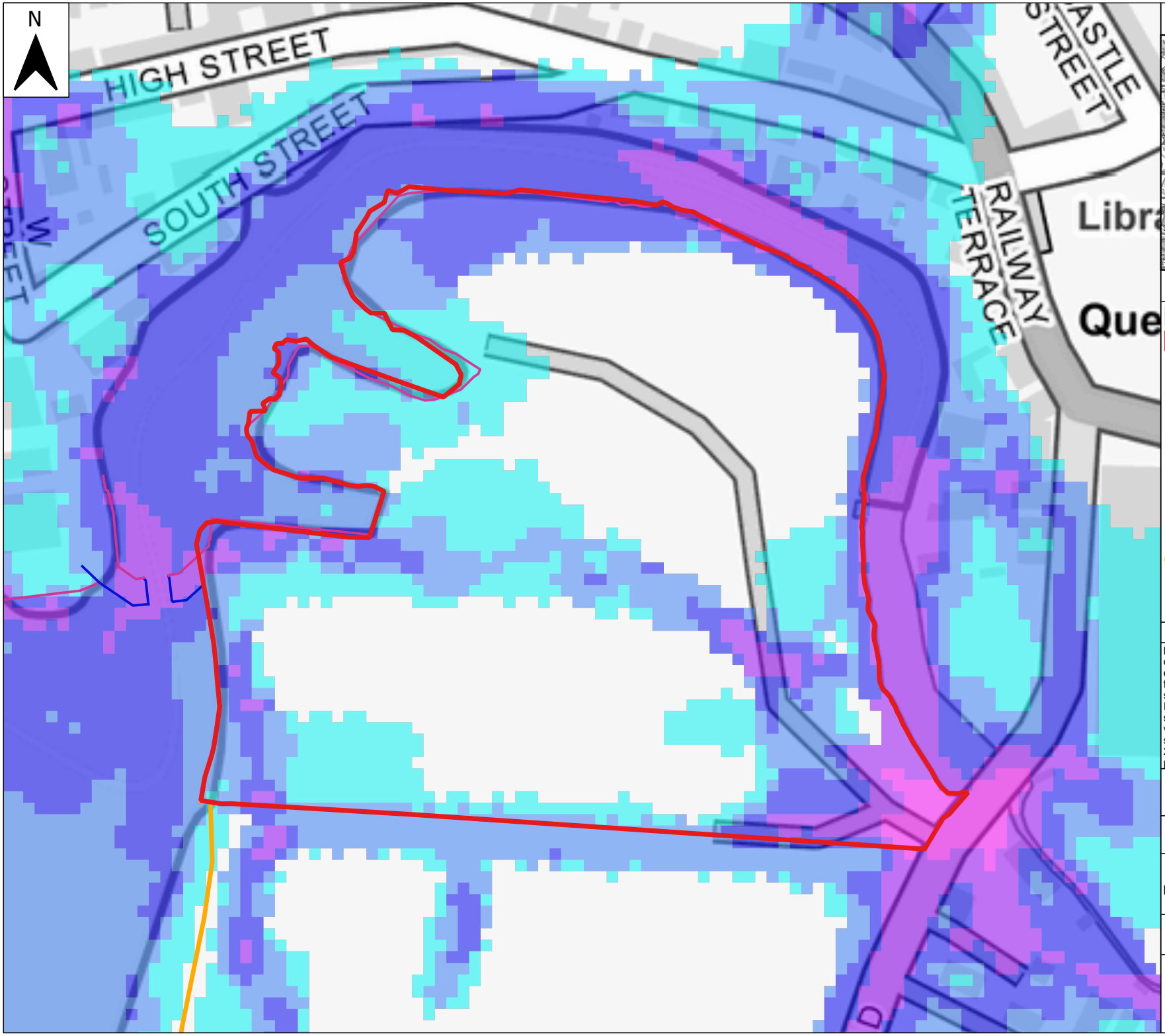
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LEVEL 2 SFRA:
FUTURE BREACH RISK FROM THE SEA - NORTH KENT COAST MODEL DEPTH - SHELAA-217

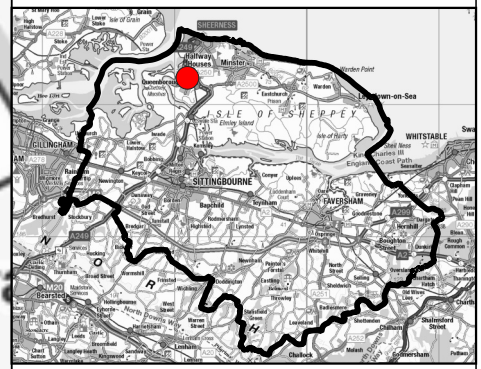
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Location Plan



Legend

Swale Borough Outline

Site boundary

North Kent Coast Model - 0.5% AEP (1 in 200-year) 2075 UE Breach Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

EA Flood Defences Types

- Embankment
- Engineered High Ground
- Wall

Notes

Breach modelling is a hydraulic approach used to simulate the failure or overtopping of a flood defence, such as a flood wall or embankment, during a given flood event. It assesses how such a failure would influence flood extents and the potential impacts on surrounding areas.

In the North Kent Coast Model, breach modelling was carried out at several locations. The results presented here relate to the maximum velocity of all the breaches, which represent simulated failures of surrounding defences during the climate change 0.5% AEP (1 in 200-year) event with the Upper End estimate (2075), illustrating the predicted velocity of flooding under these conditions.

0 60 120 m

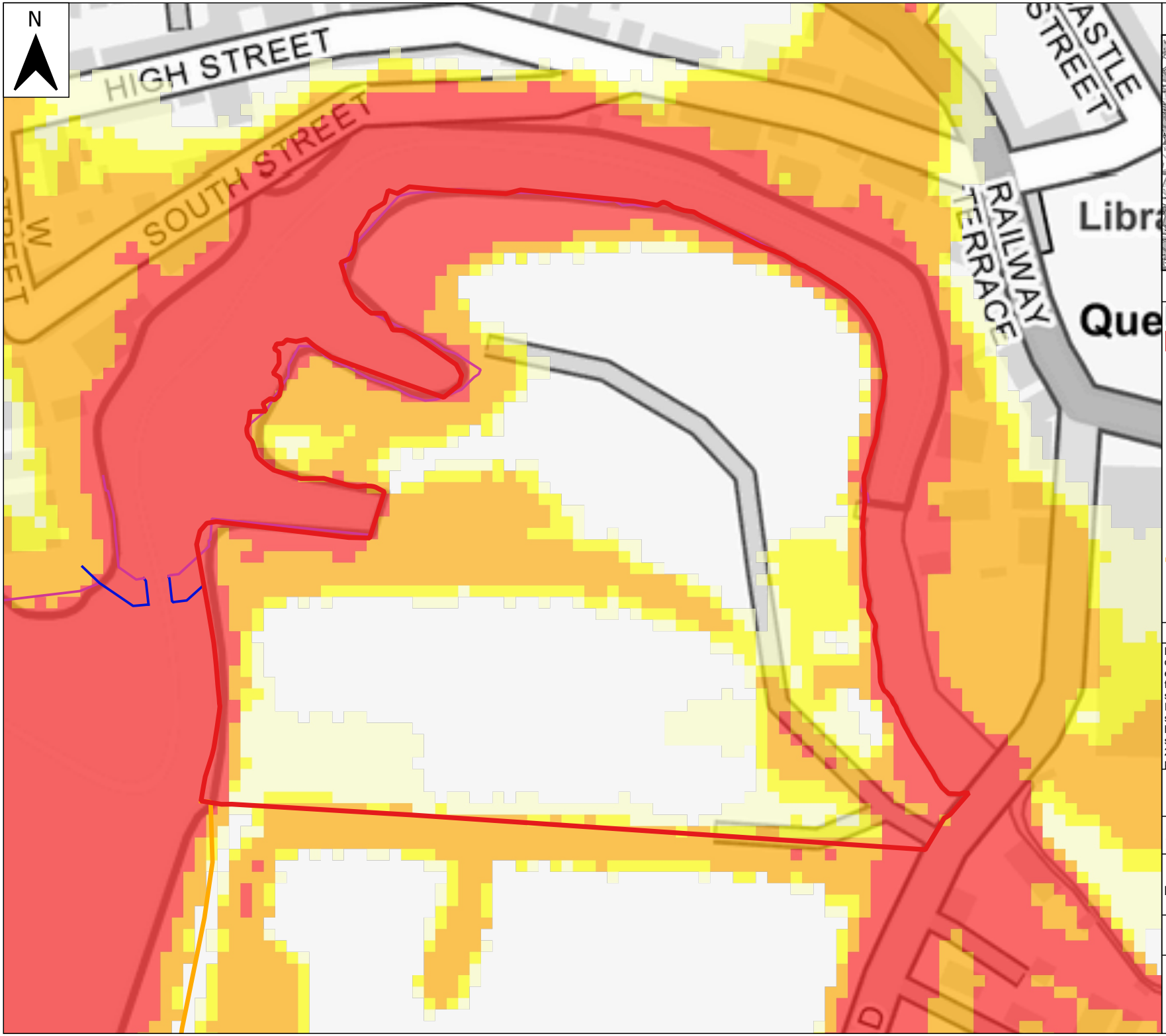
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FUTURE BREACH RISK FROM THE SEA - NORTH KENT COAST MODEL VELOCITY - SHELAA-217

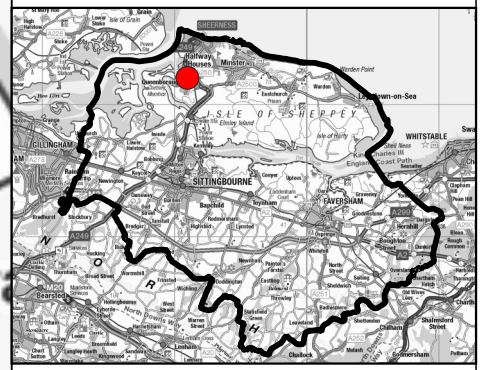
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

North Kent Coast Model - 0.5% AEP (1 in 200-year) 2075 UE Breach Hazard Classification

- No hazard
- Very low hazard - Caution
- Danger for some
- Danger for most
- Danger for all

EA Flood Defences Types

- Embankment
- Engineered High Ground
- Wall

Notes

Breach modelling is a hydraulic approach used to simulate the failure or overtopping of a flood defence, such as a flood wall or embankment, during a given flood event. It assesses how such a failure would influence flood extents and the potential impacts on surrounding areas.
In the North Kent Coast Model, breach modelling was carried out at several locations. The results presented here relate to the maximum hazard of all the breaches, which represent simulated failures of surrounding defences during the climate change 0.5% AEP (1 in 200-year) event with the Upper End estimate (2075), illustrating the predicted hazard of flooding under these conditions.

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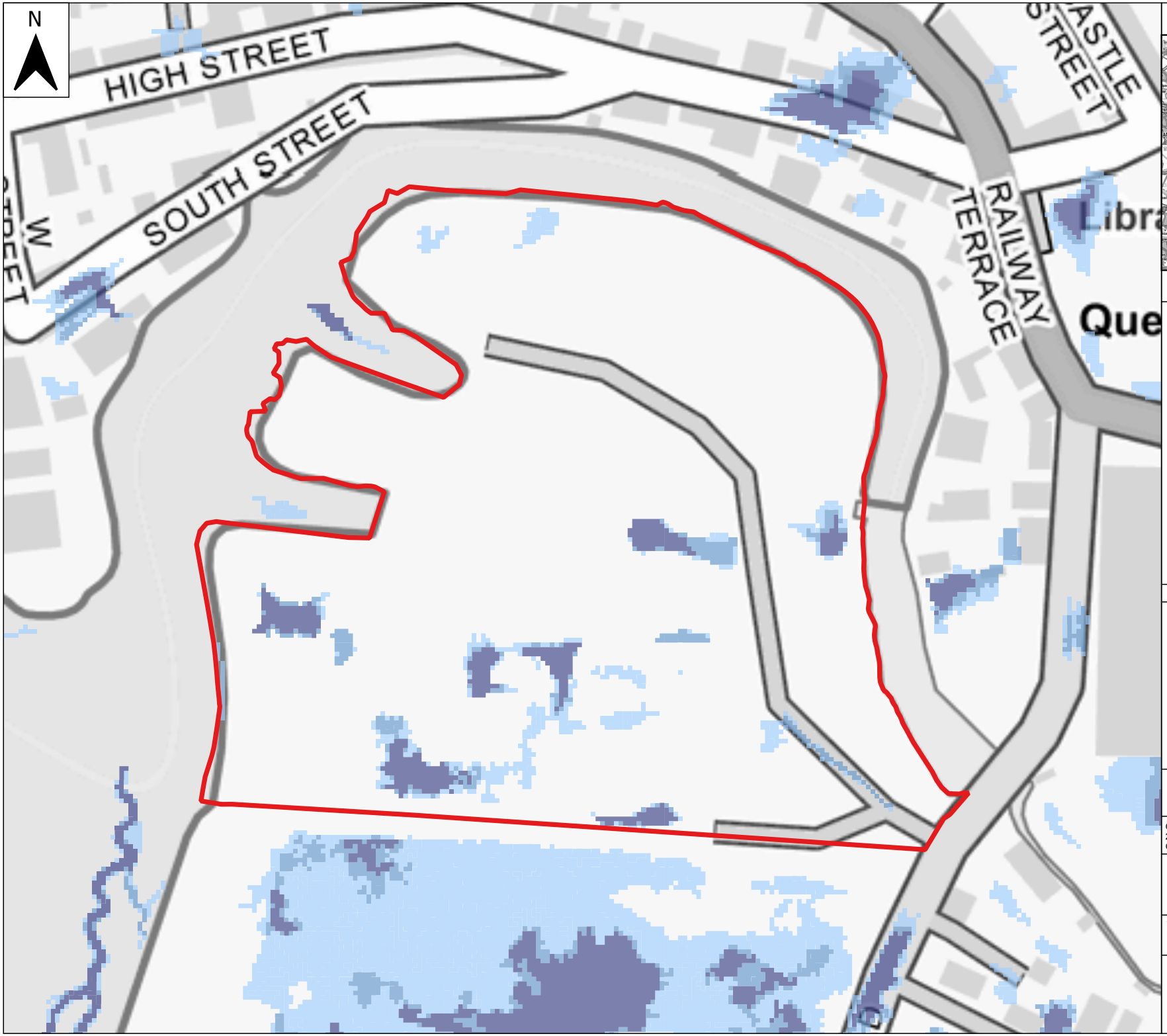
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FUTURE BREACH RISK FROM THE SEA - NORTH KENT COAST MODEL HAZARD - SHELAA-217

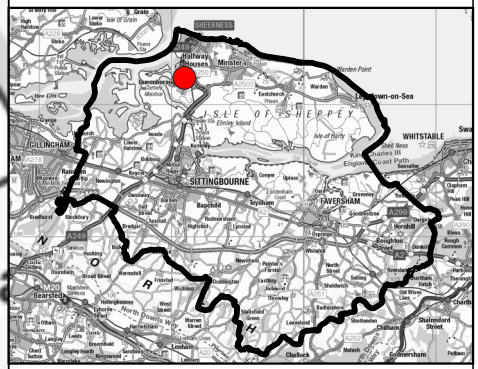
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

FMfP - Surface Water Spatial Planning Extents

- 3.3% AEP (1 in 30-year)
- 1% AEP (1 in 100-year)
- 0.1% AEP (1 in 1000-year)

Notes

The Flood Map for Planning Service includes several layers of information. This includes Surface Water Spatial Planning Extents. These datasets show the extent of land at risk of flooding from surface water to a defined annual exceedance probability (AEP) or chance of flooding each year.
These datasets are designed to only give an indication of flood risk to an area of land and are not suitable for showing whether an individual property is at risk of flooding.

0 60 120 m

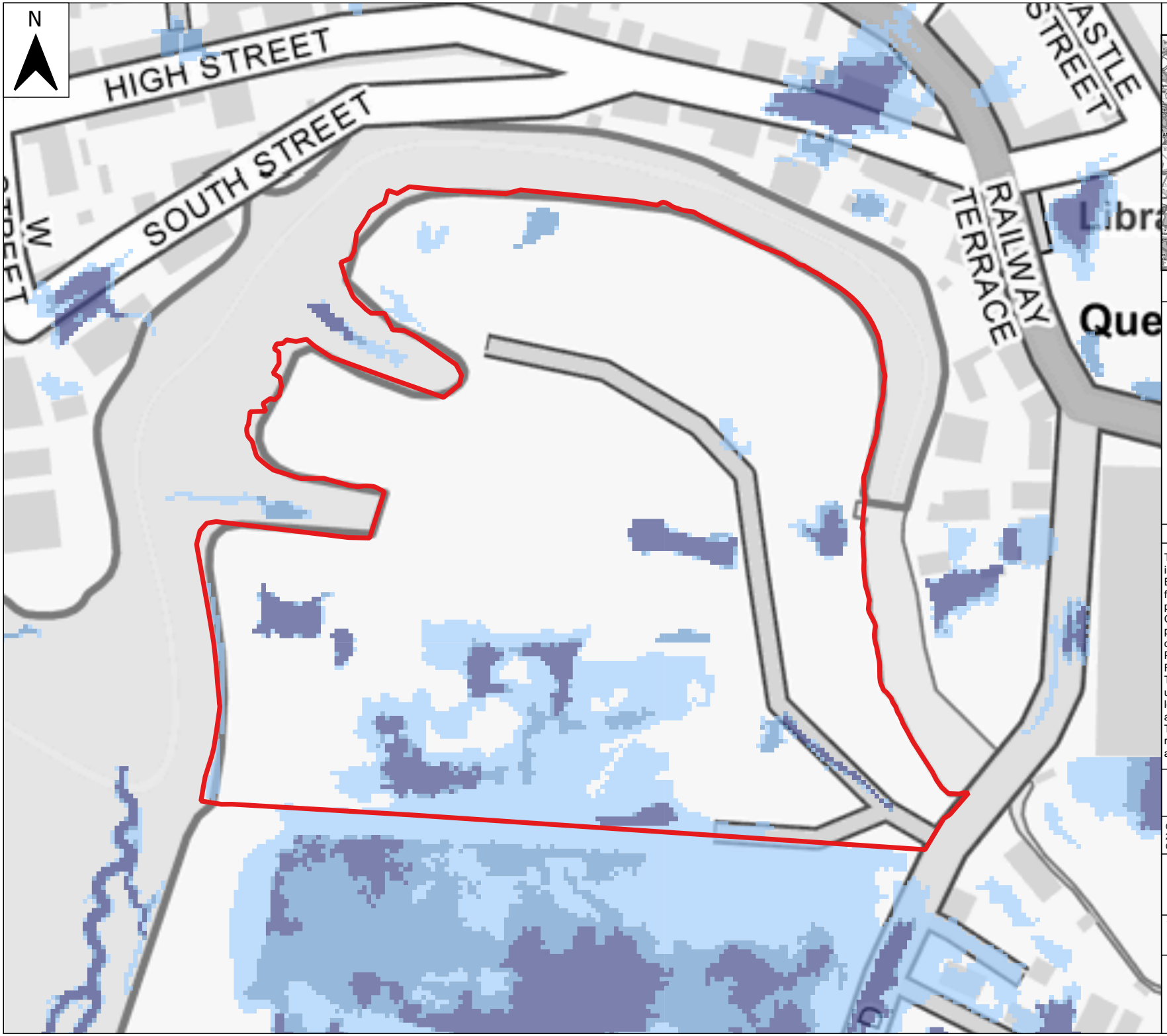
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LEVEL 2 SFRA:
SURFACE WATER FLOODING - SHELAA-217

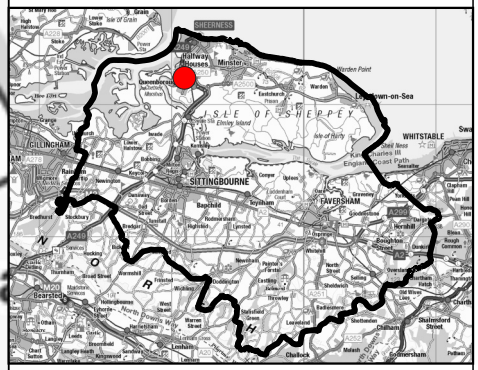
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

FMfP - Surface Water Spatial Planning Extents plus climate change

- 3.3% AEP (1 in 30-year) plus CC
- 1% AEP (1 in 100-year) plus CC
- 0.1% AEP (1 in 1000-year) plus CC

Notes

The Flood Map for Planning Service includes several layers of information. This includes Surface Water Spatial Planning Extents. These datasets show the extent of land at risk of flooding from surface water to a defined annual exceedance probability (AEP) or chance of flooding each year.
Climate change scenarios have been produced to indicate the predicted impacts of climate change on future flood risk. The climate change allowances are based on the latest UK Climate Projections (UKCP18) from the Met Office, using the Representative Concentration Pathway (RCP) 8.5.
The 'Upper End' for the 2070s epoch (2061-2125) has been used for the climate change scenarios. We have chosen long-term epochs appropriate to support long-term planning and development decisions.
These datasets are designed to only give an indication of flood risk to an area of land and are not suitable for showing whether an individual property is at risk of flooding.

0 60 120 m

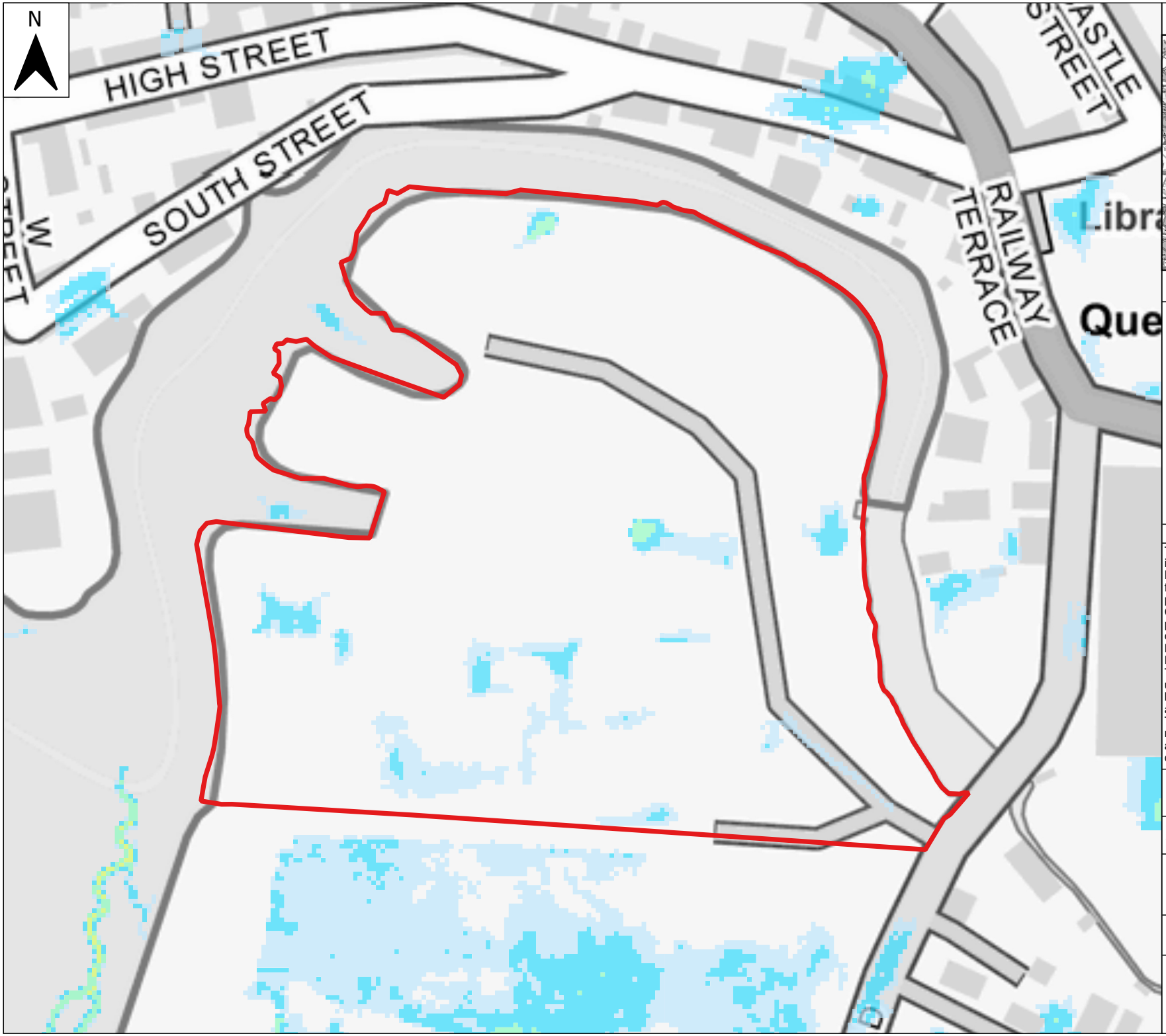
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SURFACE WATER FLOODING PLUS CLIMATE CHANGE - SHELAA-217

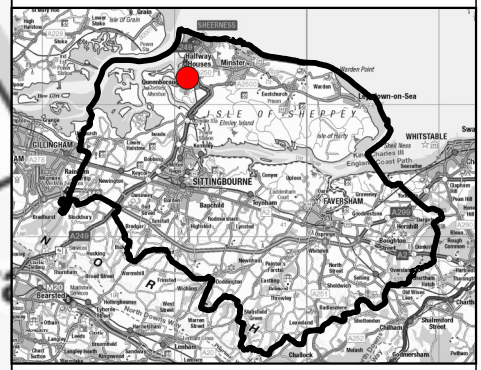
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

FMfP Surface Water Spatial Planning Depths
1% AEP (1 in 100-year) plus climate change

- <150mm
- 150-300mm
- 300-600mm
- 600-900mm
- 900-1200mm
- 1200-2300mm
- >2300mm

Notes

The Flood Map for Planning Service includes several layers of information. This includes Surface Water Spatial Planning Extents. These datasets show the extent of land at risk of flooding from surface water to a defined annual exceedance probability (AEP) or chance of flooding each year.
Climate change scenarios have been produced to indicate the predicted impacts of climate change on future flood risk. The climate change allowances are based on the latest UK Climate Projections (UKCP18) from the Met Office, using the Representative Concentration Pathway (RCP) 8.5.
The 'Upper End' for the 2070s epoch (2061-2125) has been used for the climate change scenarios. We have chosen long-term epochs appropriate to support long-term planning and development decisions.
These datasets are designed to only give an indication of flood risk to an area of land and are not suitable for showing whether an individual property is at risk of flooding. This is because we cannot know all the details about each property.

0 60 120 m

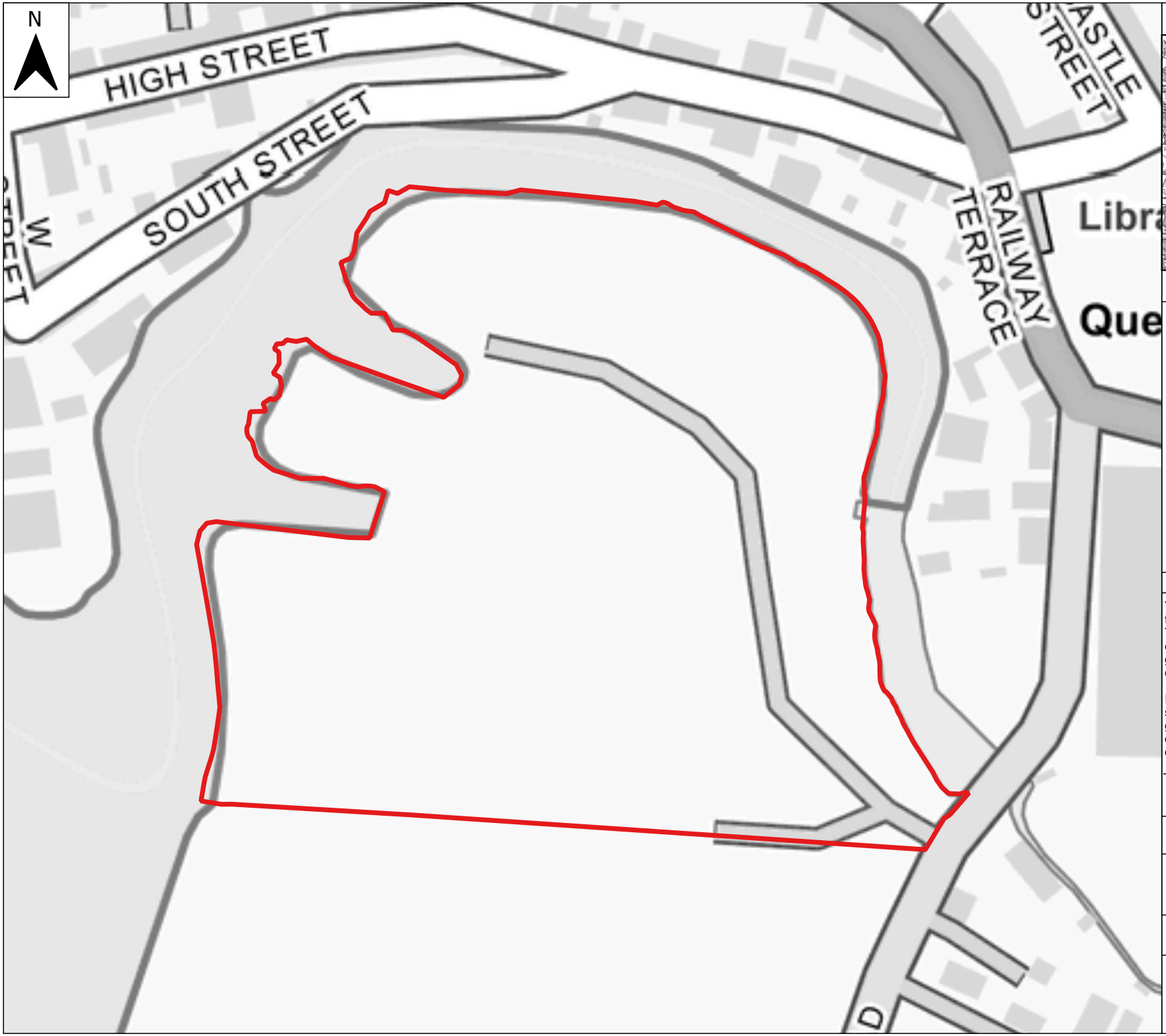
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SURFACE WATER FLOODING PLUS CLIMATE CHANGE DEPTHS - SHELAA-217

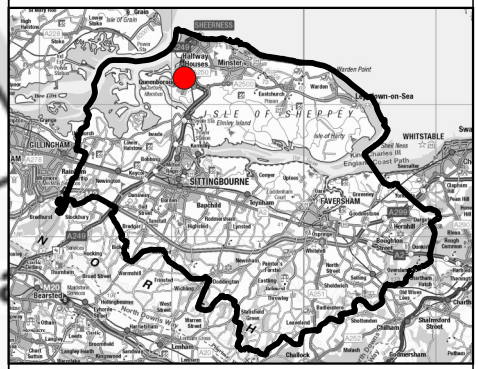
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Location Plan



Legend

Swale Borough Outline

Site boundary

JBA Groundwater Flood Map Depths

Groundwater levels are either at or very near (within 0.025m of) the ground surface.

Groundwater levels are between 0.025m and 0.5m below the ground surface.

Groundwater levels are between 0.5m and 5m below the ground surface.

Groundwater levels are at least 5m below the ground surface.

Low risk.

Notes

The modelled groundwater levels are not predictions of typical groundwater levels, rather they are flood levels. The 5m resolution JBA Groundwater Flood Map categorises the head difference (m) between the predicted groundwater levels and the surface level into five feature classes based on the 100-year flood model outputs.

It should be noted that the JBA Groundwater Flood Map is suitable for general broad-scale assessment of the groundwater flood hazard in an area, but is not explicitly designed for the assessment of flood hazard at the scale of a single property.

0 60 120 m

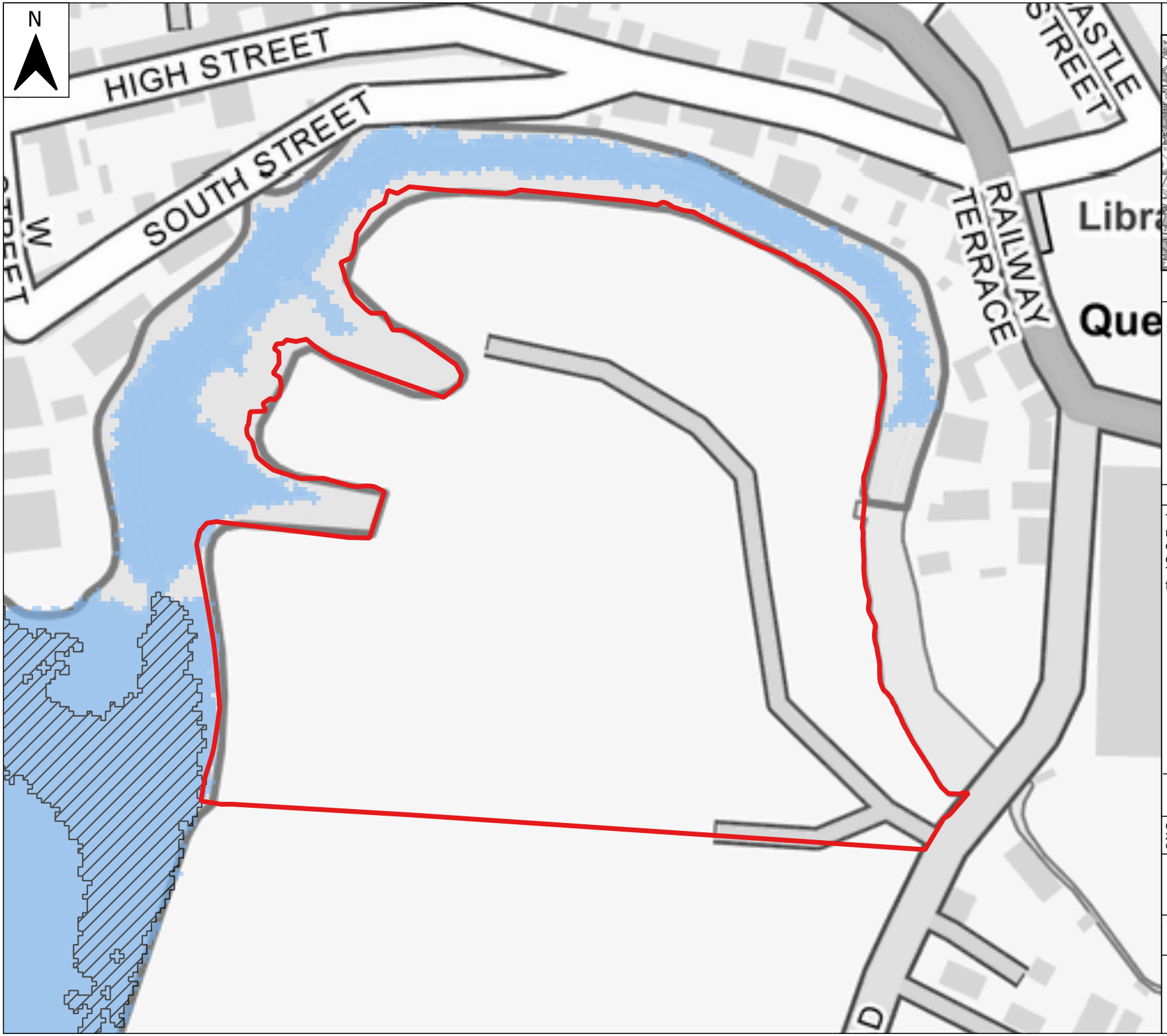
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JBA GROUNDWATER FLOOD MAP - SHELAA-217

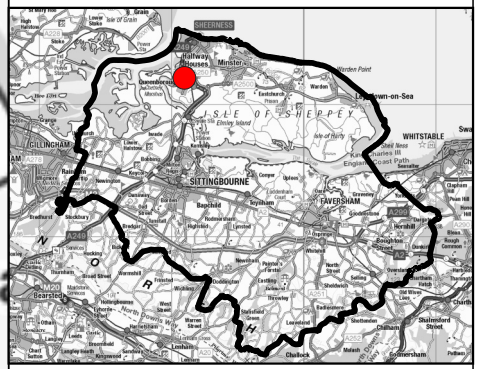
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

Environment Agency Reservoir Flood Extents

- Dry Day
- Wet Day

Notes

The risk of inundation due to reservoir breach or failure of reservoirs within the area has been mapped using the outlines available from the Risk of Flooding from Reservoir dataset, made available by the Environment Agency. The Environment Agency dataset includes areas of sea flooding.

0 60 120 m

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RISK OF FLOODING FROM RESERVOIRS - SHELAA-217

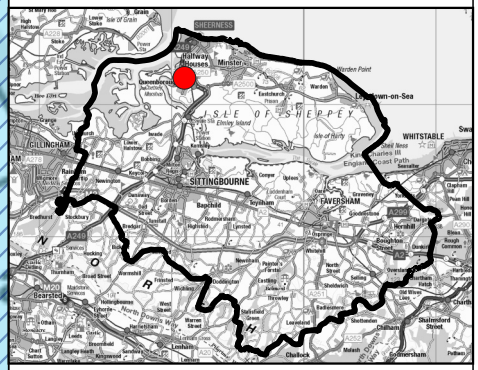
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Location Plan



Legend

- Swale Borough Outline
- Site boundary

Environment Agency Flood Warning and Alerts

- Flood Alert Area
- Flood Warning Area

Notes

Flood Alerts are used by the Environment Agency to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. Flood Alerts are issued earlier than a flood warning to give notice of the possibility of flooding but before the Environment Agency are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

0 60 120 m

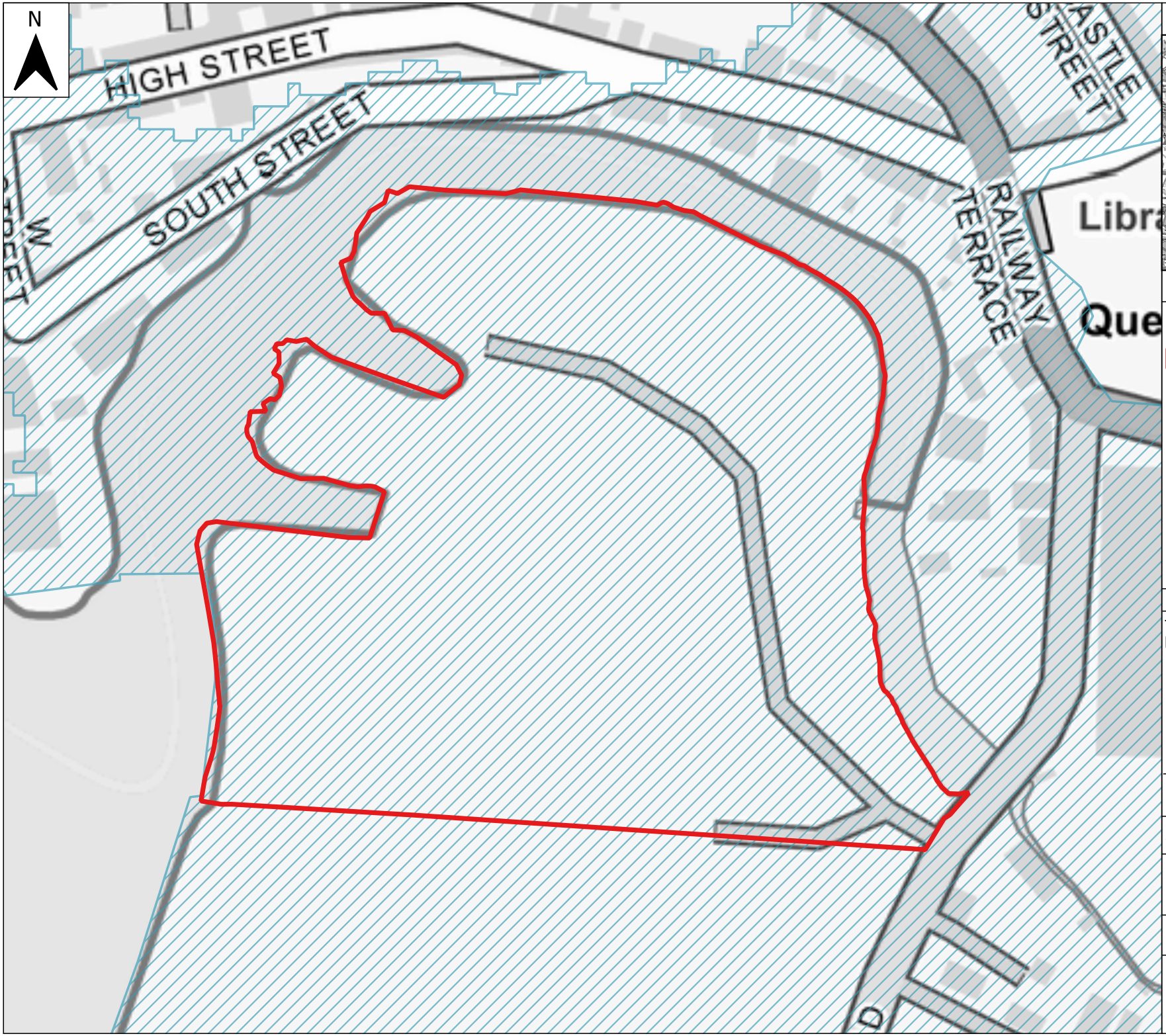
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ENVIRONMENT AGENCY FLOOD WARNINGS AND ALERTS - SHELAA-217

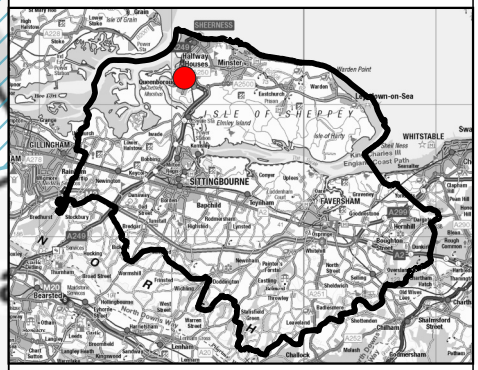
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Location Plan



Legend

- Swale Borough Outline
- Site boundary
- MEAS Benefit Area with a Hold the Line policy

Notes

The Medway Estuary and Swale Strategy Benefit Areas with a Hold the Line policy

0 60 120 m

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MEAS BENFIT AREA - SHELAA-217

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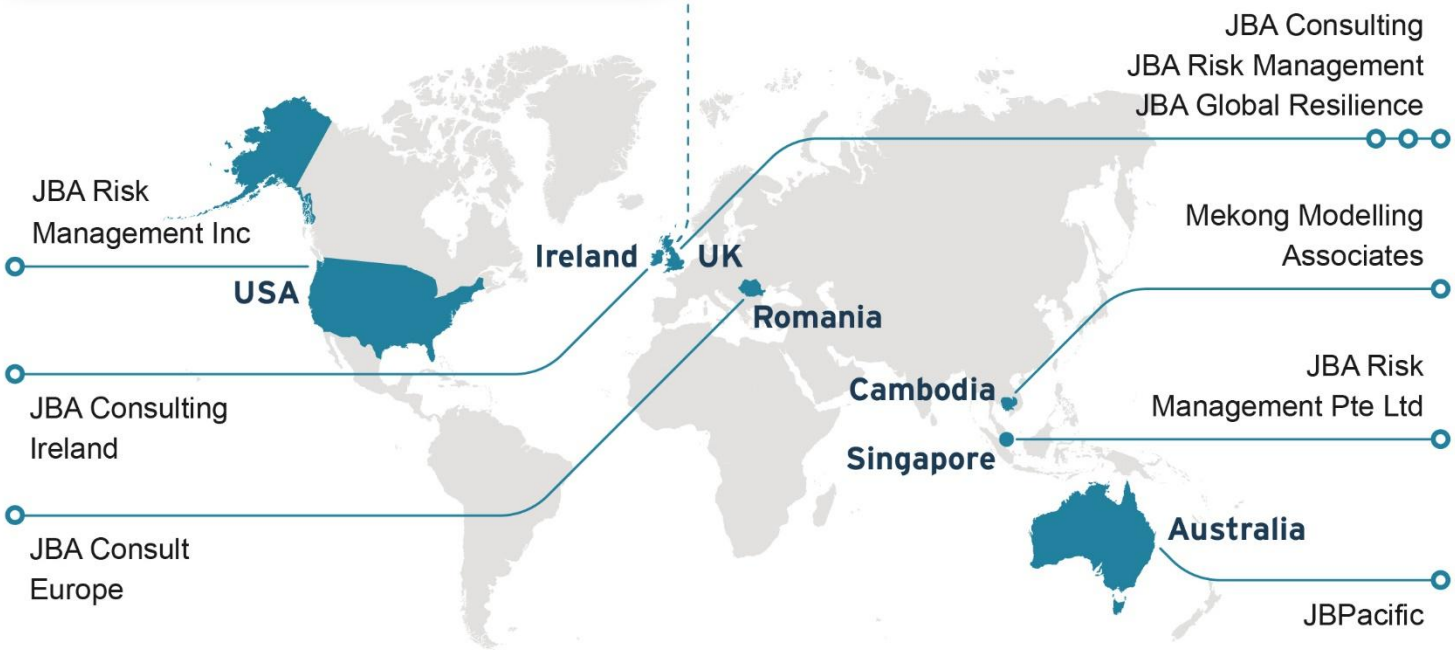
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