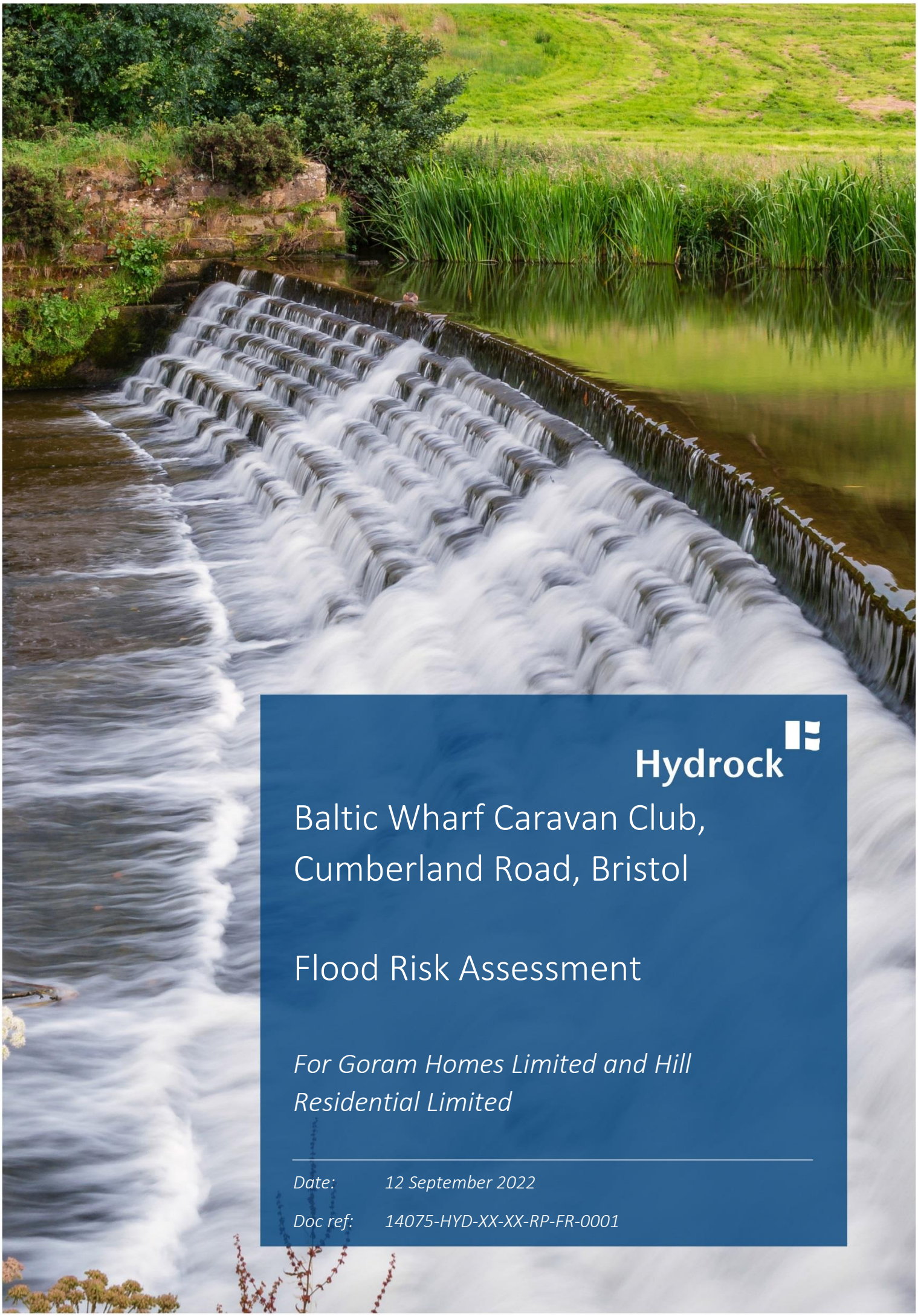

Hydrock

Baltic Wharf Caravan Club, Cumberland Road, Bristol

Flood Risk Assessment

For Goram Homes Limited and Hill Residential Limited

Date: *12 September 2022*

Doc ref: *14075-HYD-XX-XX-RP-FR-0001*

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P08	S2	26/10/2021	Updated Section 4.2.2
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1. INTRODUCTION

This report has been prepared by Hydrock Consultants Limited on behalf of Goram Homes Limited and Hill Residential Limited in support of a Full Planning Application to be submitted to Bristol City Council (BCC) for the proposed residential-led mixed-use redevelopment of the Baltic Wharf Caravan Club site on Cumberland Road in Bristol. This report has been updated following discussions with the Environment Agency via a pre-application approach and subsequent documents which have been made available in relation to the Bristol City Centre Flood Management Strategy.

This Flood Risk Assessment report has been prepared to address the requirements of the National Planning Policy Framework (NPPF), through:

- Assessing whether the site is likely to be affected by flooding.
- Assessing whether the proposed development is appropriate in the suggested location.
- Presenting any flood risk mitigation measures necessary to ensure that the proposed development and occupants will be safe, whilst ensuring flood risk is not increased elsewhere.

The report considers the requirements for undertaking a Flood Risk Assessment as detailed in the NPPF, and also acknowledges pre-application discussions held with BCC and the Environment Agency (EA).

2. SITE INFORMATION

2.1 Location and Setting

The 0.88ha site is currently occupied by the Baltic Wharf Caravan Club and comprises predominately areas of hardstanding, along with an internal access road, soft-landscaping, and several small buildings in the south of the site used as a reception/office and to provide visitor welfare facilities.

The site is located on Spike Island, approximately 1.7km to the south-west of Bristol City Centre, and is bounded by Bristol's Floating Harbour to the north (separated from the site by a promenade walkway); a residential area to the east; Cumberland Road to the south beyond which lies the River Avon; a boat storage area/building to the south-west of the site; and, The Cottage Inn (public house) to the north-west of the site.

The site has address: Cumberland Road, Bristol, BS1 6XG; and, grid reference: ST 57360 72172.

A site location plan is included at Figure 1.

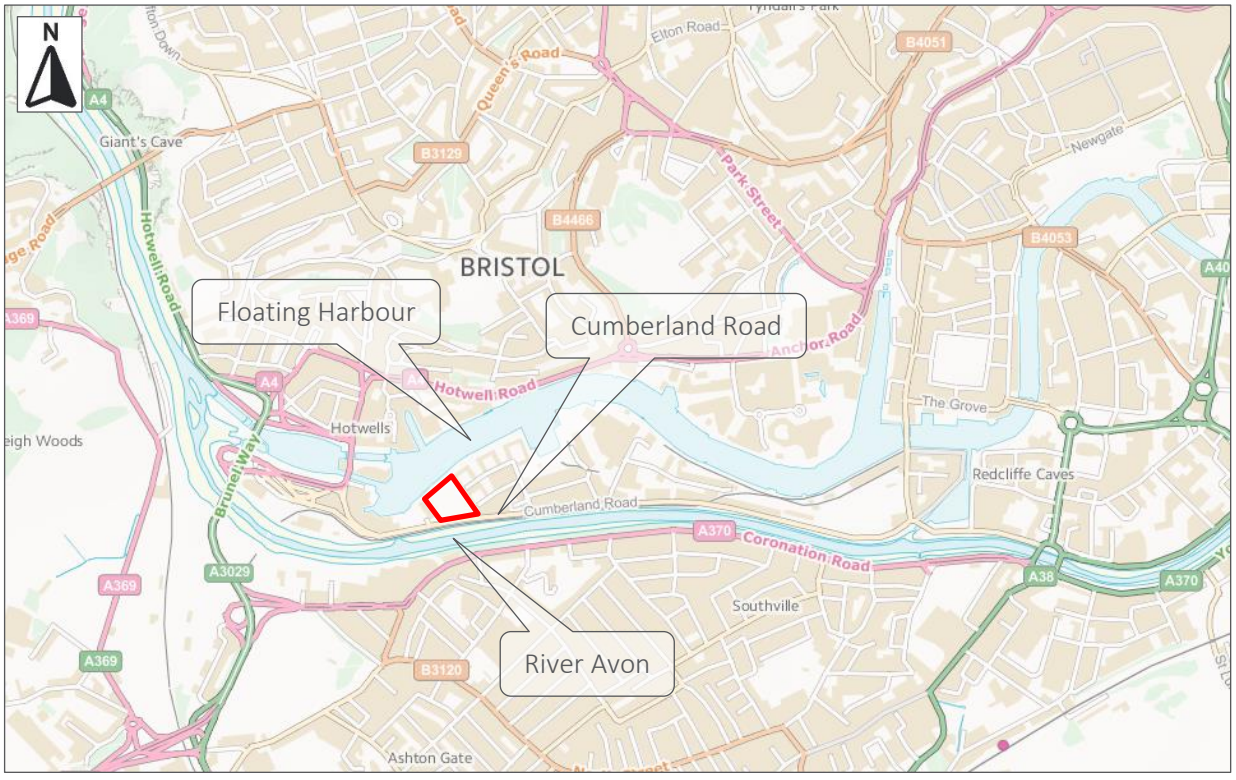


Figure 1: Site Location Plan

2.2 Topography

Existing highway levels on Cumberland Road adjacent to the site range from 9.25m AOD to 9.38m AOD. Ground levels across the site fall from 9.48 AOD on the southern site boundary to 8.07m AOD in the north of the site adjacent to the Floating Harbour.

A Topographical Survey of the site and immediate surrounding area is included at Appendix A.

2.3 Proposed Development

The Full Planning Application submitted proposes the residential-led mixed-use redevelopment of the site, comprising:

- Commercial, car parking and ancillary (i.e. general storage, cycle storage, plant rooms and refuse) uses at lower ground floor level. External access to this level will be provided via ramps down from 'normal ground level' in the south of the site (i.e. the approximate level of the adjacent Cumberland Road).
- Residential, commercial and ancillary (i.e. plant room) uses at upper ground floor level, along with external landscaped areas.
- Residential uses at first, second, third, fourth and fifth floor levels.

A total of 166 residential apartments are proposed, along with a total commercial floorspace of 576m^2.

Vehicular access is proposed to be retained off Cumberland Road on the southern site boundary, with residential access proposed off Cumberland Road and the promenade walkway on the northern site boundary.

Proposed scheme drawings are included with the Planning Application submission.

3. ASSESSMENT OF FLOOD RISK

3.1 Flood Zone Mapping

The latest EA Flood Map for Planning (Figure 2) shows the entirety of the site to be within Flood Zone 3 (land having a 1 in 100 or greater annual probability of fluvial flooding; or, 1 in 200 or greater annual probability of tidal flooding), with small areas to the south west and south east of site designated as Flood Zone 2 (land having between a 1 in 100 and 1 in 1,000 annual probability of fluvial flooding; or, 1 in 200 and 1 in 1,000 annual probability of tidal flooding)

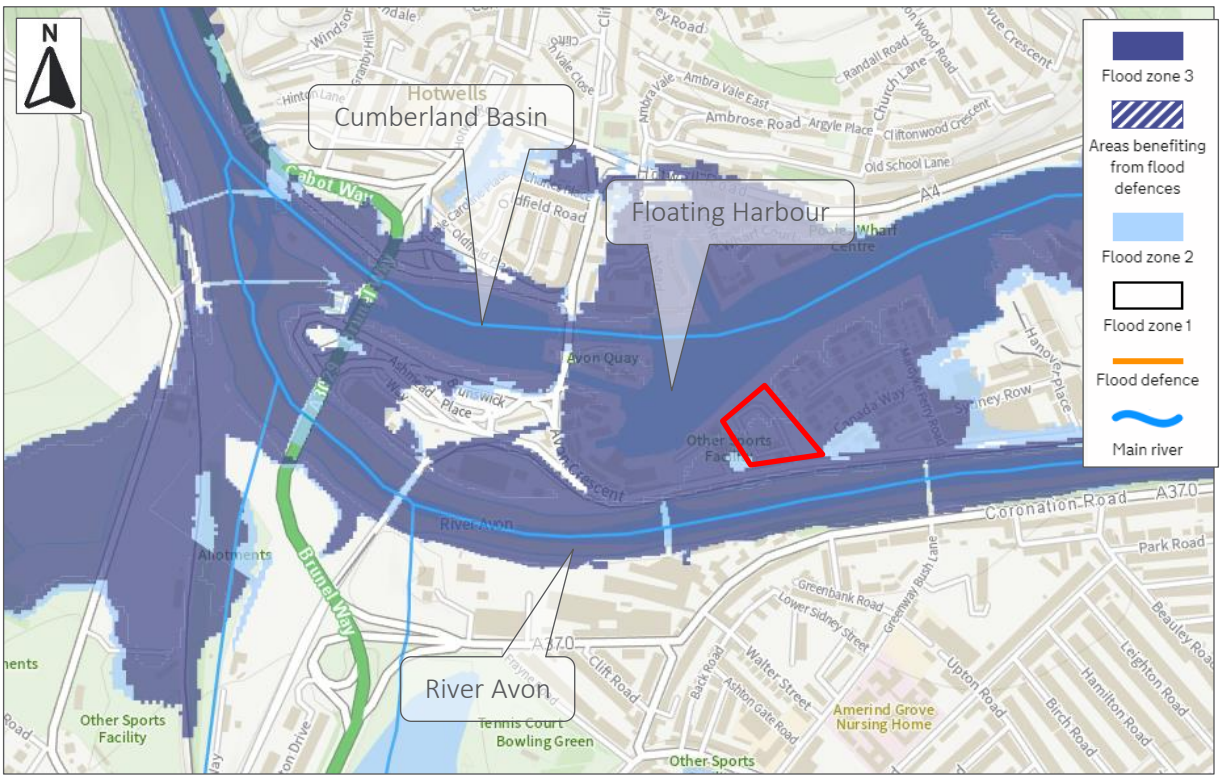


Figure 2: EA Flood Map for Planning

3.2 Tidal & Fluvial Flooding

The tidal River Avon flows westwards immediately beyond Cumberland Road to the south of the site. To the immediate north and north-west of the site lies the Floating Harbour and Cumberland Basin respectively, the water levels within which are artificially maintained by the control of inflows and outflows.

Information provided by the EA (included at Appendix B) shows the area to be afforded some protection by existing flood defences, principally comprising ‘masonry walls’ and ‘walled channels’. The crest level of such structures varies, but generally the lowest crest level of the flood defences within the immediate vicinity of the site is 8.57m AOD.

BCC has provided flood risk modelling from their latest Central Area Flood Risk Assessment (CAFRA) model, known as 'Model-20', which includes climate change allowances based on the latest 'UKCP18' climate change projections. it is understood that an updated model 'Model-22' is available however, it is understood from conversations with the EA that the later models (post Model-20), which include the

latest EA Climate Change allowances have not yet been approved and signed off and therefore 'Model-20' remains the most up-to-date model available.

Given that the River Avon/Floating Harbour/Cumberland Basin are influenced by tidal and fluvial flows, though tidally dominated, the combined 1 in 200 year tidal (2120) and 1 in 2 year fluvial Annual Exceedance Probability (AEP) flood risk scenario has been adopted as the 'design' flood risk event for the purposes of this assessment.

The 'design' flood risk event adopted for the purposes of this assessment considers flood risk at the present-day (2020), in 60 years (2080), and in 100 years (2120). The consideration of flood risk in 2080 and 2120 is in accordance with BCC's Strategic Flood Risk Assessment (SFRA) which requires the assessment of flood risk over a 60 year time-span for new commercial development and 100 years for new residential development, i.e. the calculated flood levels include an allowance for the predicted sea level rise over the next 60 years and 100 years respectively. In addition, a 70% increase in fluvial flood flows has been considered, in accordance with the EA's latest climate change guidance, for the modelled '2080' and '2120' flood risk scenarios. It should be noted that both the defended and undefended future scenarios are using the Tidal 1 in 200 year 'Upper End' Climate Change allowance and is therefore considered a conservative approach and a worst-case scenario.

The modelled flood levels are based on both a 'defended' scenario (i.e. accounting for the influence of flood defence structures within the catchment) and an 'undefended' scenario (i.e. assuming that no flood defence structures are in place within the catchment).

The calculated flood levels for such flood events are summarised in Table 3, with the resulting modelled floodplains in the 'defended' scenario illustrated in Figure 4.

Modelled Flood Risk Scenario	Modelled Flood Event	Maximum Flood Level within Site (m AOD)	Maximum Flood Depth within Site (m AOD)*
'Defended 2020'	1 in 200 Year (2020) Tidal / 1 in 2 Year Fluvial	9.22	1.15
'Defended 2080'	1 in 200 Year (2080) Tidal / 1 in 2 Year (+70%) Fluvial	9.73	1.66
'Defended 2120'	1 in 200 Year (2120) Tidal / 1 in 2 Year (+70%) Fluvial	10.46	2.39
'Defended 2100 H++'	1 in 200 Year (2100) Tidal / 1 in 2 Year (+70%) Fluvial	10.93	2.86
'Undefended 2030'	1 in 200 Year (2030) Tidal / 1 in 2 year (+70%) Fluvial	9.24	1.23
'Undefended 2080'	1 in 200 Year (2080) Tidal / 1 in 2 Year (+70%) Fluvial	9.85	1.78
'Undefended 2120'	1 in 200 Year (2120) Tidal / 1 in 2 Year (+70%) Fluvial	10.43	2.36

Table 3: 'Model-20' Flood Levels
** Based on an existing lowest identified ground level within the site of 8.07m AOD.*

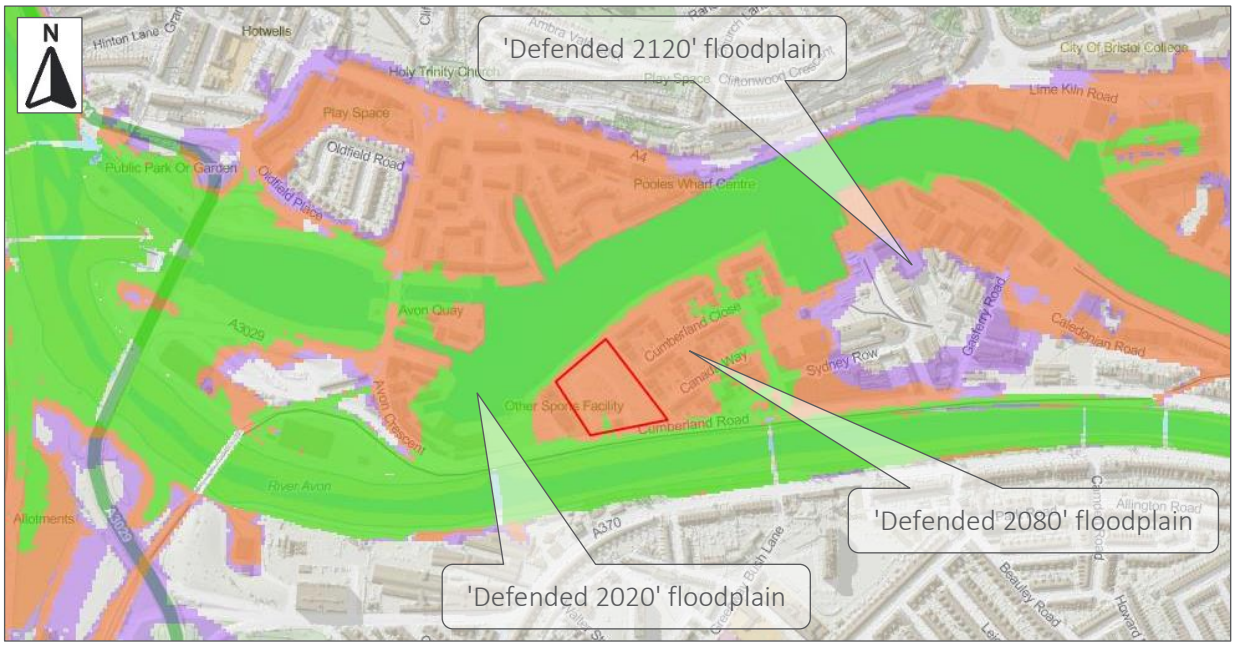


Figure 4: 'Model-20' 'Defended' Flood Risk Scenario Floodplain Mapping

The results of the 'Model-20' flood risk modelling indicates that only a small area in the south of the site is at risk of flooding in the 'defended 2020' (present-day) flood risk scenario. In the future, however, as a result of climate change the entirety of the site is shown to be at risk of flooding in the '2080' and '2120' flood risk events, in both the 'defended' and 'undefended' modelled scenarios. Maximum velocities for the design event on site are predicted to be approximately 2.4m/s.

As requested by the EA, a sensitivity event has been modelled using the EA's H++ sea level rise allowance, a level of 1.9m for the total sea level rise to 2100. Just as the '2080' and '2120' have completely inundated the site, so too does the H++ event to an extreme flood level and velocities of 10.93m AOD and 9.1m/s.

Further analysis of the 'Model-20' flood risk modelling indicates that due the tidally dominated nature of such flooding, flood levels will rise and fall with the tidal cycle and, whilst the initial cycles of the 'defended 2120' cause relatively short-lived on-site flooding (approx. 3hr45mins), the peak of the flood event is predicted to last for approximately 10hr15mins. Cumberland Road is predicted to have flooding for a maximum of 4hr but only deemed 'impassable' for around 3hr at the peak of the flood event with the hazard rating along the road considered to be Very Low Hazard (in accordance with the DEFRA FD2320 guidance note) after this time.

From conversation it is understood the Flood Management Strategy for Central Bristol is to be submitted to Committee before the end of 2022. This document outlines a strategy for managing the fluvial and tidal risks to the centre of Bristol and is believed to include measures for ongoing improvements/upgrading of the flood defences to ensure a consistent and standard level of protection through the Central Area with a target date for completion of 2030.

In addition to provided engineering defences/improvements it is also understood that one of the earlier phases of implementation will include a review of access and egress routes through the city with a view of managing any such risks.

Whilst it is accepted that this document has yet to be approved it is understood the Bristol City Council are keen to progress with the proposals. On this basis, and to support this application, an additional scenario has been prepared.

Therefore, Hydrock have run a 2030 tidally dominated 1 in 200-year event using the 2020 1 in 200-year tidal boundary and applying a 10-year uplift based on the EA Climate Change predictions for Sea Level Rise and the South West river basin districts 'Upper End' allowance for yearly uplift. The results of this model indicate the majority of the site to be impacted by flooding however small areas in the south east and along the southern boundary of the site are indicated to remain dry with a maximum flood level and depth of 9.24mAOD and 1.23m.

During the 2030 event, flooding is first predicted to come out of bank to the west of the site, from Bristol Harbour with flooding then experienced on site approximately 30 minutes later. Flooding is predicted to remain on site for approximately 2hrs 30mins across the peak tidal cycle. From when flooding is first indicated to overtop Bristol Harbour, it is approximately 1hr before flooding is predicted to impact Cumberland Road to the south east of the site and is predicted to remain on Cumberland Road for approximately 30mins across the peak tidal cycle. During the peak, flood depths on Cumberland Road are predicted to be less than 300mm and would be considered as shallow and critically shows Cumberland Road to be classified as 'Very Low Hazard' in accordance with FD2320 guidance for new development.

Based on the above, the site is therefore concluded to be at risk of flooding from the combined fluvial and tidal flood risk posed to the area from the River Avon/Floating Harbour/Cumberland Basin.

3.3 Surface Water Flooding

The EA's Flood Risk from Surface Water mapping (Figure 5) shows the site, adjacent Cumberland Road and the immediate surrounding areas (ignoring the Floating Harbour) to be at 'very low' risk of surface water flooding.

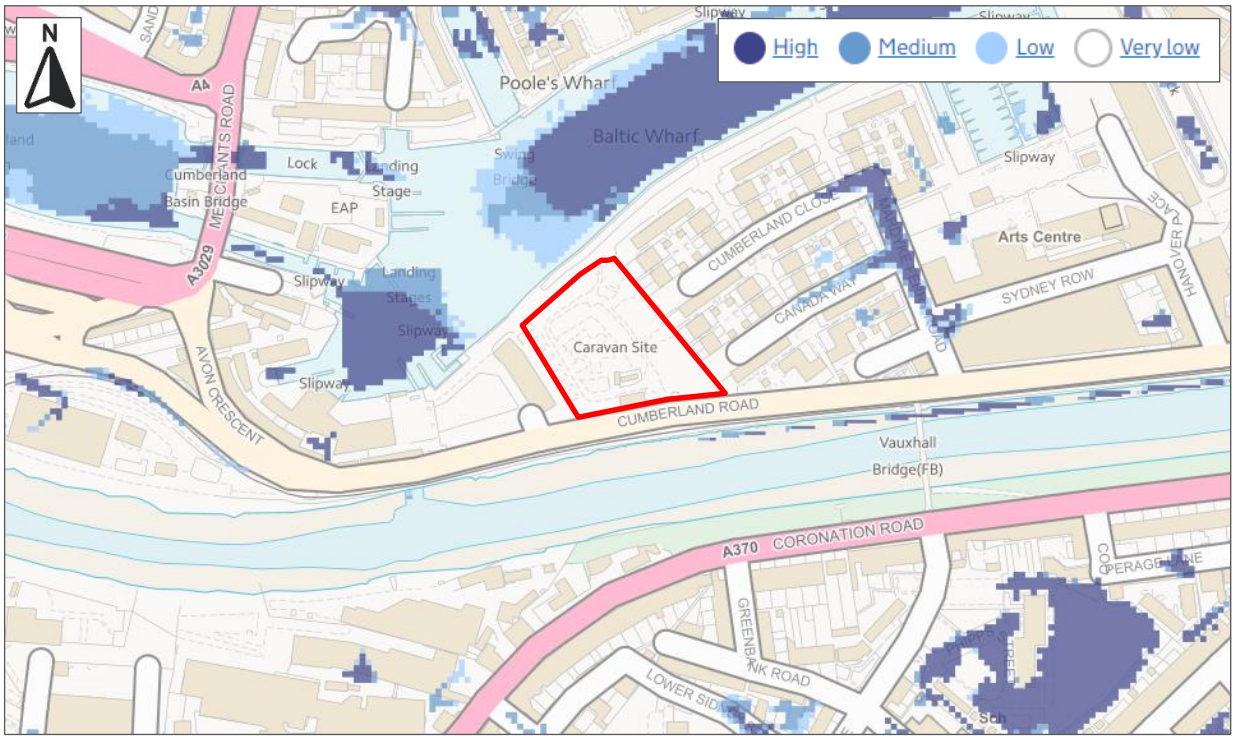


Figure 5: EA Flood Risk from Surface Water Mapping

Furthermore, it is noted that:

- The generally level nature of the surrounding area, and absence of any significant gradients means that any surface water run-off generated within the area is unlikely to be concentrated and directed towards the site but is more likely to be dispersed over a relatively wide area resulting in minimal flood water depths.
- The site and surrounding area are currently served by surface water drainage systems which will act to intercept and manage the majority of any surface water run-off and thereby reduce the likelihood of overland surface water flows being directed onto the site and/or surface water 'ponding' within the site.

On the basis of the above, the site is therefore concluded to be at low risk of surface water flooding.

3.4 Groundwater Flooding

British Geological Survey mapping shows the site to be underlain by superficial Tidal Flat Deposits comprising Clay and Silt, which overlie the Redcliffe Sandstone Member.

The presence of the adjacent River Avon/Floating Harbour/Cumberland Basin could be conducive to a variable groundwater table level within the underlying Sandstone bedrock, with the groundwater table influenced by water levels within the watercourse/waterbodies. The presence of the overlying superficial low-permeability Tidal Flat Deposits is, however, likely to act as an aquitard, restricting the upward movement of groundwater and thereby reducing the risk of groundwater emergence within the site.

It is also noted that the SFRA states that *"There are no reports of groundwater flooding in the Environment Agency database and therefore this is considered unlikely to be a significant source of flooding in Bristol".*

Accordingly, the site is concluded to be at low risk of groundwater flooding.

3.5 Sewer Flooding

The developed nature of the site and surrounding area means that an extensive sewer system is anticipated to be present within the vicinity of the site. However, the generally level nature of the surrounding area and absence of any significant gradients means that if the existing surrounding sewer system were to fail or surcharge within the vicinity of the site, any surcharged sewer overland flows generated are unlikely to be concentrated and directed towards the site but are more likely to be dispersed over a relatively wide area resulting in minimal flood water depths.

It is also noted that the SFRA does not record any previous sewer flooding incidents within the immediate vicinity of the site (mapping extract included at Appendix B).

On the basis of the above, the site is therefore concluded to be at low risk of sewer flooding.

3.6 Infrastructure Failure Flooding

The EA's Flood Risk from Reservoir mapping (Figure 6) shows the site to be within an area that could be affected in the extremely unlikely event of an upstream catastrophic reservoir dam failure.

The indicated risk is shown to emanate from the Barrow Reservoirs (located around 4.9km to the south-west of the site) and Chew Valley Lake (located approximately 10.6km to the south of the site) with overland flows shown to preferentially follow the course of Colliter's Brook and the River Chew respectively, and subsequently enter the River Avon.

It is however noted that:

- The risk of such a scenario occurring is extremely unlikely due to the ongoing inspection and maintenance of such assets by Bristol Water.
- Given the distance of the site from the Reservoirs, any flows reaching the site will likely have a relatively low velocity and be of limited depth (having been abated and dispersed within the upstream catchment).

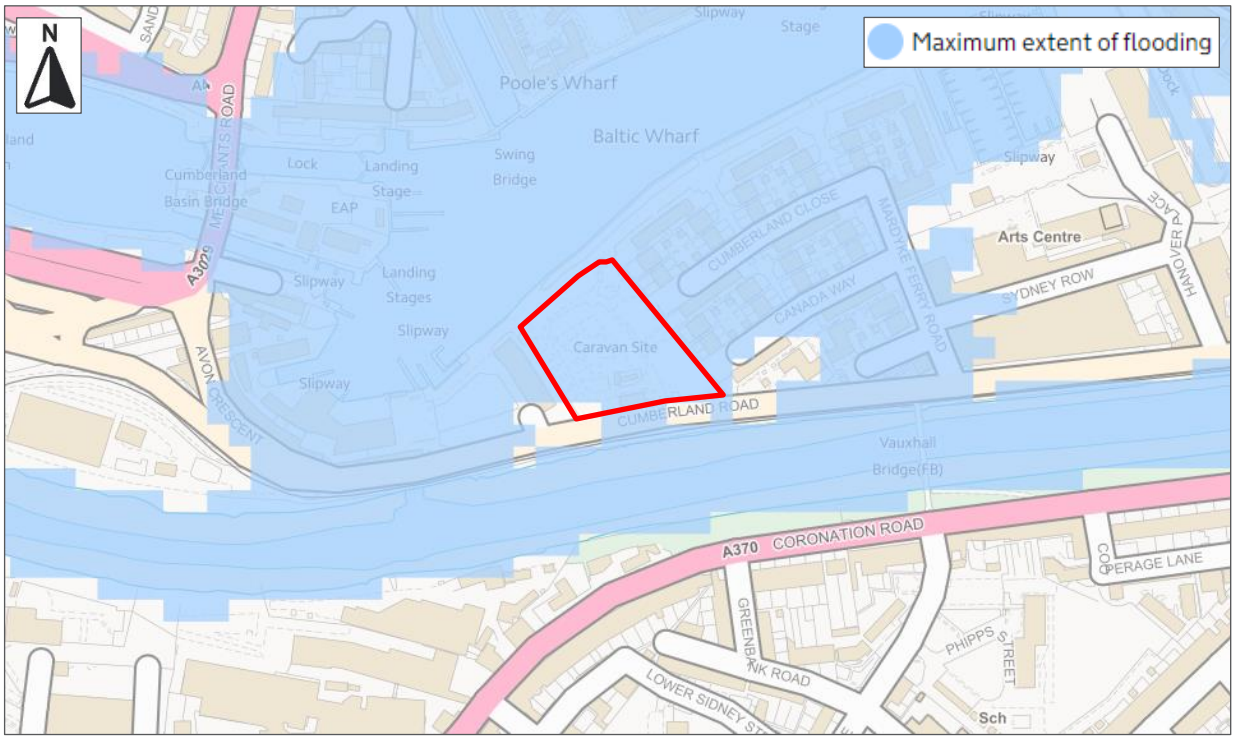


Figure 6: EA Flood Risk from Reservoir Mapping

No other potential sources of infrastructure failure flooding, such as other reservoirs or canals, have been identified within the immediate vicinity or uphill of the site, and accordingly the site is concluded to be at low risk of infrastructure failure flooding.

4. NPPF REQUIREMENTS

4.1 Sequential and Exception Tests

On the basis that the site is shown to be within Flood Zones 2 and 3, and that the proposed scheme entails 'more vulnerable' (i.e. residential) and 'less vulnerable' (i.e. commercial) development (as defined within the Flood Risk and Coastal Change Planning Practice Guidance (NPPG)), then in accordance with the NPPF and NPPG, the Planning Application submitted for the site is required to be demonstrated to pass the Sequential and Exception Tests, as specified within the NPPF.

Paragraph 158 of the NPPF states that *"The aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding"*.

The Exception Test is defined within Paragraph 160 of the NPPF as needing to demonstrate that: *"(a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and, (b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall"*.

To this end, a separate assessment (included with the Planning Application submission) has been undertaken which concludes that the proposed development passes the Sequential Test and part 'a' of the Exception Test, and accordingly that document should be consulted with respect the Sequential and Exception Tests.

Recommended measures intended to address part 'b' of the Exception Test are outlined in section 4.2.

4.2 Mitigation Measures

On the basis of the combined fluvial and tidal flood risk posed to the area from the River Avon/Floating Harbour/Cumberland Basin, the following mitigation measures are recommended to be incorporated into the design, construction and operation of the proposed development.

All mitigation measures outlines are considered as being widely acceptable and follow a generally adopted national approach for this type of development in areas of flood risk. The approaches outlined below have also been successfully recommended for a number of developments within Central Bristol over the last 18months -2 years. Such applications where these have received both Environment Agency and Bristol City Council approval are Bedminster Green (4 separate applications), Bristol General Hospital, Wapping Wharf (all phases). As such, the below are considered appropriate and following precedents set.

4.2.1 Resistance and Resilience Measures

In accordance with the SFRA, proposed flood resistance and resilience measures have been recommended on the basis of providing protection from the following flood events/levels:

- Commercial development: a minimum of 0.3m above the 'undefended 2080' flood risk scenario flood level of 9.85m AOD, i.e. 10.15m AOD (adopted on the basis that the equivalent modelled flood level in the defended scenario is lower, and therefore so as to adopt a 'conservative' approach).

- Residential development: a minimum of 0.3m above the 'defended 2120' flood risk scenario flood level of 10.46m AOD, i.e. 10.76m AOD (adopted on the basis that the equivalent modelled flood level in the undefended scenario is lower, and therefore so as to adopt a 'conservative' approach).

4.2.1.1 Lower Ground Floor Level

The proposed finished floor level of the lower ground floor level is 8.000m AOD. It is acknowledged that this level is below the 'undefended 2080' and 'defended 2120' flood risk scenario flood levels of 9.85m AOD and 10.46m AOD respectively, and accordingly the lower ground floor level will be at risk of flooding in such flood events.

On this basis, the following mitigation measures are recommended to be incorporated into the design and construction of the lower ground floor level:

- A 'sequential approach' to building use will be adopted, through the locating of 'less vulnerable' uses (as defined in Table 2 of the NPPG) at the lower ground floor level, and avoidance of 'more vulnerable' uses, such as residential. Such proposed 'less vulnerable' uses include commercial, car parking and ancillary (i.e. general storage, cycle storage, plant rooms and refuse).
- The majority of the lower ground floor level (i.e. commercial spaces, car parking area, general storage, cycle storage and refuse areas) is to be designed and constructed so as to be flood resilient, i.e. allow water entry, but be designed and constructed so as to limit any damage from flood water and be able to return to 'normal-use' as quickly as possible following flooding. Such recommended measures include:
  - » Use of solid floor construction and finishes.
  - » External and internal walls constructed of materials with low water penetration, good drying ability, and good retention of pre-flood integrity.
  - » Use of durable fixtures and fittings.
  - » Sensitive services (i.e. electrics) brought in and continued at as high a level as possible.
  - » Deployment of temporary flood barriers at external accesses to the proposed commercial space fronting the Floating Harbour, up to a level of 0.600m above finished floor level. In accordance with guidance set out in 'BS 5500 Flood Resistant and Resilient Construction, Improving the Flood Performance of New Buildings - Flood Resilient Construction', attempting to retain flood depths greater than 0.600m depth is considered to pose potential structural integrity issues, and consequently it is recommended that flood barriers are deployed to a maximum height of 0.600m in order to reduce the risk of flooding in lower magnitude flood events, but allowing overtopping in larger flood events so as to minimise the risk of structural damage.
  - » Installation of a sump-and-pump system in order to permit any flood water entering the lower ground floor level, and unable to flow back into the Floating Harbour under gravity, to be discharged to the Floating Harbour.
- Those areas at lower ground floor level considered more sensitive to flooding (i.e. plant rooms and lobbies providing stair and lift access to upper floors) are to be designed and constructed so as to be flood resistant, i.e. prevent water entry. Such recommended measures include:
  - » 'Tanking' of external and internal walls, and sealing of any voids etc.
  - » Use of permanent flood doors on plant room and lobby entrances.

4.2.1.2 Upper Ground Floor Level

The proposed finished floor level for all residential uses at upper ground floor level is 10.970m AOD. Such a level is 0.510m above the 'defended 2120' flood risk scenario flood level of 10.46m AOD, from which new residential development is required to be protected, and therefore in excess of the minimum 0.300m 'freeboard' above the 'design' flood level as required by the SFRA. Accordingly, no further flood risk mitigation measures are considered necessary for the proposed residential uses at upper ground floor level. It is noted that this level is also 50mm above the extreme maximum flood level found on site when using the EA's H++ sea level rise allowance scenario.

It is also noted that the proposed ground levels for the external landscaped areas in the central and western portions of the site are to be set at 10.970m AOD, 0.510m above the 'defended 2120' flood risk scenario flood level of 10.46m AOD, thereby also providing external areas safe from the 'design' flood events identified.

The proposed finished floor level for all commercial uses at upper ground floor level is 10.295m AOD and 10.755m AOD. Such levels are 0.445m and 0.905m above the 'undefended 2080' flood risk scenario flood level of 9.85m AOD, from which new commercial development is required to be protected, and therefore in excess of the minimum 0.300m 'freeboard' above the 'design' flood level as required by the SFRA. Accordingly, no further flood risk mitigation measures are considered necessary for the proposed commercial uses at upper ground floor level.

It is however noted that several areas at upper ground floor level have proposed finished floor levels lower than the 'design' flood levels, as a result of constraints imposed by existing/proposed external ground levels, specifically:

- Block D - residential entrance lobby: 9.870m AOD.
- Block E - residential entrance lobby: 10.150m AOD.
- Block E - substation: 9.200m AOD.
- Block F - refuse storage area: 10.000m AOD.

Accordingly, the following mitigation measures are recommended to be incorporated into the design and construction of such areas at the upper ground floor level:

- The residential entrance lobbies in blocks D and E are recommended to be designed and constructed so as to be flood resistant and resilient, i.e. prevent water entry, but be designed and constructed so as to limit any damage if the areas were to inadvertently flood and be able to return to 'normal-use' as quickly as possible following flooding. Such recommended measures include:
  - » Use of solid floor construction and finishes.
  - » External and internal walls constructed of materials with low water penetration, good drying ability, and good retention of pre-flood integrity.
  - » Use of durable fixtures and fittings.
  - » Sensitive services (i.e. electrics) brought in and continued at as high a level as possible, and ideally above 10.760m AOD (based on a minimum 0.300m 'freeboard' above the 'defended 2120' flood risk scenario flood level of 10.46m AOD).
  - » Deployment of temporary flood barriers at external accesses to the proposed residential entrance lobbies, up to a level of 0.600m above finished floor level. In accordance with guidance set out in 'BS 5500 Flood Resistant and Resilient Construction, Improving the Flood

Performance of New Buildings - Flood Resilient Construction', attempting to retain flood depths greater than 0.600m depth is considered to pose potential structural integrity issues, and consequently it is recommended that flood barriers are deployed to a maximum height of 0.600m. It is also noted that based on the proposed finished floor levels of the specific residential entrance lobbies of 9.870m AOD and 10.150m AOD respectively, the deployment of temporary flood barriers to a height of 0.600m would afford such areas protection to in excess of the 'defended 2120' flood risk scenario flood level of 10.46m AOD.

- Noting the vulnerability of the substation in block E to flood water, it is recommended that this area be designed and constructed so as to be flood resistant, i.e. prevent water entry. Such recommended measures include:
  - 'Tanking' of external and internal walls, and sealing of any voids etc.
  - Use of a permanent flood door at the substation entrance.
- The refuse storage area in block F is considered to be relatively 'insensitive' to flooding, and therefore it is recommended that this area be designed and constructed so as to be flood resilient, i.e. allow water entry, but be designed and constructed so as to limit any damage from flood water and be able to return to 'normal-use' as quickly as possible following flooding. Such recommended measures include:
  - Use of solid floor construction and finishes.
  - External and internal walls constructed of materials with low water penetration, good drying ability, and good retention of pre-flood integrity.
  - Use of durable fixtures and fittings.
  - Sensitive services (i.e. electrics) brought in and continued at as high a level as possible, and ideally above 10.760m AOD (based on a minimum 0.300m 'freeboard' above the 'defended 2120' flood risk scenario flood level of 10.46m AOD).

4.2.1.3 First, Second, Third, Fourth and Fifth Floor Levels

Proposed finished floor levels for the first, second, third, fourth and fifth residential use floor levels are as follows:

- First floor level: 14.045m AOD.
- Second floor level: 17.120m AOD.
- Third floor level: 20.195m AOD.
- Fourth floor level: 23.270m AOD.
- Fifth floor level: 26.345m AOD.

All such levels are significantly above the 'defended 2120' flood risk scenario flood level of 10.46m AOD, from which new residential development is required to be protected, and accordingly no further flood risk mitigation measures are considered necessary for the first, second, third, fourth and fifth residential use floor levels.

4.2.2 Warning and Evacuation Measures

Paragraph 038 of the NPPG states that *"The developer must provide evidence to show that the proposed development would be safe"*, which includes, amongst other requirements, the need for *"access and egress"*.

The criteria for access and egress being deemed 'safe' is outlined in Paragraph 039 of the NPPG, which states that *"Access routes should allow occupants to safely access and exit their dwellings in design flood conditions. Vehicular access to allow the emergency services to safely reach the development during design flood conditions will also normally be required"*, and *"Wherever possible, safe access routes should be provided that are located above design flood levels and avoiding flow paths. Where this is not possible, limited depths of flooding may be acceptable, provided that the proposed access is designed with appropriate signage etc to make it safe"*.

Accordingly, and owing to the identified levels of risk posed through flooding, it is proposed that a Flood Warning Management Plan be prepared to detail how a Flood Warning is disseminated within the site, and how site occupants should respond to a warning of impending flooding. This is proposed to be secured via a pre-occupation planning condition as part of any future Planning Consent.

It should also be noted that Bristol City Council are currently preparing a City-Wide Flood Strategy document. Whilst an anticipated date for the issuing of this document is unknown (but believed to be 2030) it is understood that this will be prior to the first occupation of the proposed development and will include city wide details of flood evacuation routes. As such, it is felt that securing the Flood Warning elements via a pre-occupation condition will enable such a document to be inline with this Bristol City Council document and be based on as up-to-date information as possible and, therefore, as accurate as possible for first occupation.

As a general point, the purpose of the Flood Warning Management Plan will be to ensure the safety of occupants, in line with the principal objective of the NPPG, comprising either the evacuation of the site prior to inundation of either the site and/or surrounding highways, or remaining within the site as a place of 'safe refuge', and will include the following measures, as a minimum:

- Site occupants to register with the EA's Flood Warning service.
- Upon receipt of Flood Warning, nominated ‘Flood Wardens’ to:
  - Oversee immediate evacuation of the site, ideally via preferential route eastwards along Cumberland Road (this route represents the most direct route out of the 'floodplain', and is indicated to be ‘flood free’ upon first receipt of a Flood Warning, during which time evacuation will likely occur).
  - Vehicles to be removed from car park.
  - Prepare site for potential flooding as outlined in the Flood Warning Management Plan, i.e. deployment of any temporary flood barriers, and ensuring permanent flood doors are secure.
  - Those remaining on-site, to remain at upper ground floor level and above, on the basis that such areas have been designed to be safe, and therefore offer 'safe refuge' in the 'design flood event'.

The factors in support of such an approach include:

- The nature of tidal flooding meaning that sufficient warning time will be available to allow occupants to respond to the potential risk of flooding in a timely manner, i.e. evacuation of the site will be possible prior to any potential inundation of the area or to a place of safe refuge on site.
- The raising of the occupied portions of the proposed development above ‘design’ flood levels will ensure that any occupants not evacuating will be safe within the site (i.e. will have ‘safe refuge’), both within the proposed buildings and the elevated external area in the central and western portions of the site.

- An existing residential area is located immediately to the east of the site, and therefore the proposed development of this site does not represent the introduction of a different use within the area, such that any necessary response by emergency services etc within the area during a flood event would already occur, regardless of whether the proposed development was to be approved. It is also noted that the 'safe refuge' provided at the site reduces the likelihood of the emergency services needing to attend the site during a flood event.
- Similar approaches have been adopted and approved for other recent proposed residential developments within the Bristol City Council area. The proposed residential-led mixed-use development at Redcliffe Quarter (planning ref. 16/02964/F) in particular has similar flood risk issues as the Baltic Wharf Caravan Club site, principally that:
  - The Flood Risk Assessment prepared in support of the Redcliffe Quarter proposed development identified that the site and immediate surrounding area are at risk of flooding, principally from the Floating Harbour.
  - The proposed development itself was designed to be safe in the 'design flood event', via the raising of finished floor levels, and use of demountable site-specific flood barriers.

A number of measures have however been recommended to address this issue (as above), along with a number of other mitigatory factors which are deemed material planning considerations, so as to ensure that the safety of the proposed development and occupants will not be compromised during a 'design flood event' for the entirety of the proposed development's lifetime.

4.2.3 Floodplain Storage

In order to assess any potential off-site impacts as a result of the proposed development (i.e. such as through the loss of potential floodplain storage and resultant increase in flood levels within the surrounding area), the 'Model-20' model has been re-run for the post-development scenario. This entailed re-running the model but with the site topography altered such that flood waters were unable to flow across the proposed building footprint, thereby replicating the scenario in the post-development situation in which the raising of the proposed development will restrict the ability of any flood waters to flow across the site.

This modelling approach was 'conservative' in nature, as it modelled the proposed development footprint as a 'solid block', whereas in reality the proposed lower ground floor level will allow any flood waters to flow beneath the proposed building, and thereby further reduce the impact of the proposed development on flood risk in the surrounding area.

The modelling was run for the combined 1 in 1 year tidal (2120) and 1 in 100 year (+35%) fluvial AEP flood risk scenario, based on the acknowledgement that the EA consider the issue of floodplain storage/compensation in relation to fluvial flooding as opposed to tidal flooding, as any loss of tidal floodplain storage is considered negligible given the tidal waterbody volume when considered as a whole. All other modelling parameters were unaltered from the 'baseline' modelling simulation.

The adoption of climate change allowances of 2120 in relation to tidal flooding, and 35% in relation to fluvial flooding is done on the basis of the requirement to consider flood risk in relation to new residential development over a time-span of 100 years to 2120; and, in accordance with the EA's latest climate change guidance which stipulates that *"In most cases use the higher central* [35%] *allowance to calculate floodplain storage compensation"*. The guidance goes on to state that the upper end (70%) allowance should be adopted in scenarios where the *"catchment is particularly sensitive to small changes in volume, which could cause significant increases in flood depth or hazard"* and/or the

"affected area contains essential infrastructure or vulnerable uses, such as primary schools, caravans, bungalows or basement dwellings".

As already noted however, the flood risk in the area is tidally dominated and therefore the catchment is not considered sensitive to small changes in floodplain volume, on the basis that any alteration in tidal floodplain storage is deemed negligible given the tidal waterbody volume when considered as a whole. Furthermore, the 'flood cell' within which the site is located (i.e. the western portion of Spike Island) has not been identified to contain uses classified as 'essential infrastructure' or 'vulnerable' (noting that this proposed scheme replaces an existing caravan site). On this basis, it is considered that the adoption of climate change allowances of 2120 in relation to tidal flooding and 35% in relation to fluvial flooding is appropriate for the assessment of the potential impact on floodplain storage as a result of the proposed development.

Two model simulations were run, for the 'defended' and 'undefended' scenarios, the results of which are illustrated in Figures 7 and 8 respectively.

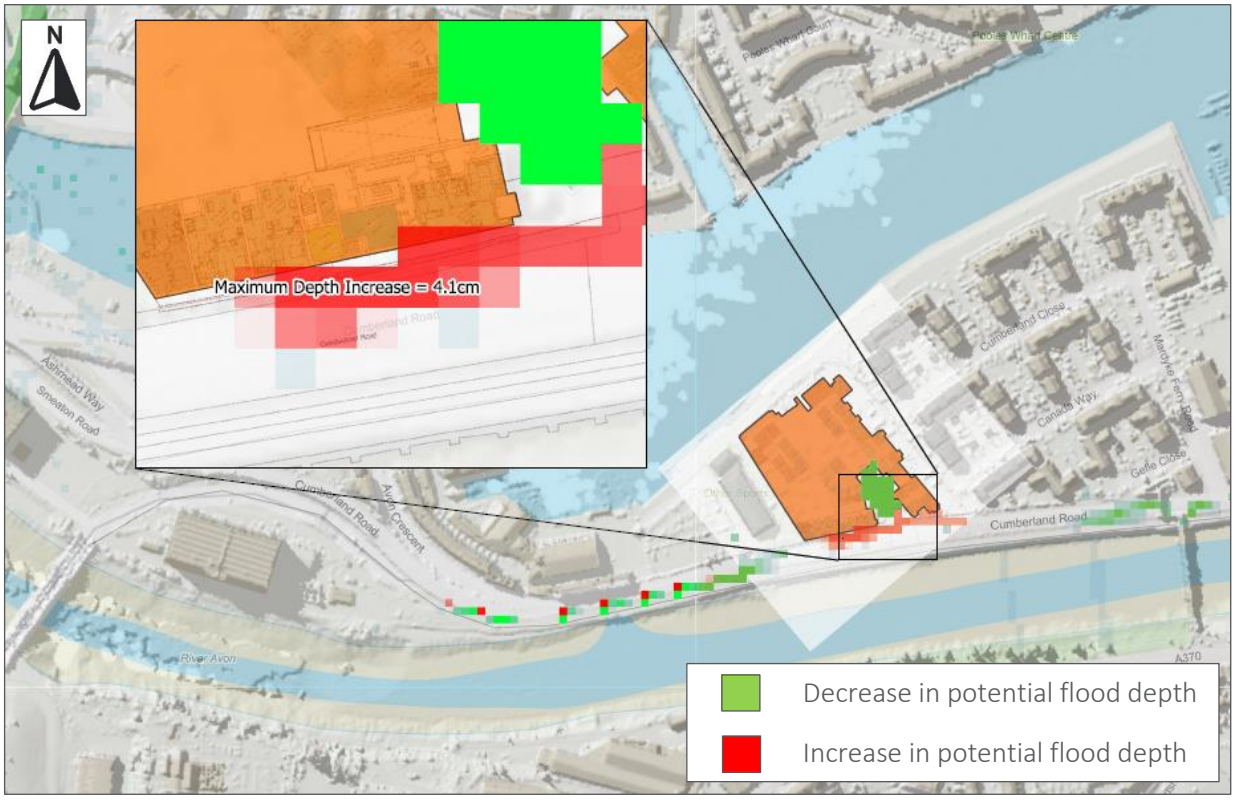


Figure 7: Floodplain Storage Modelling - 'Defended' Flood Risk Scenario

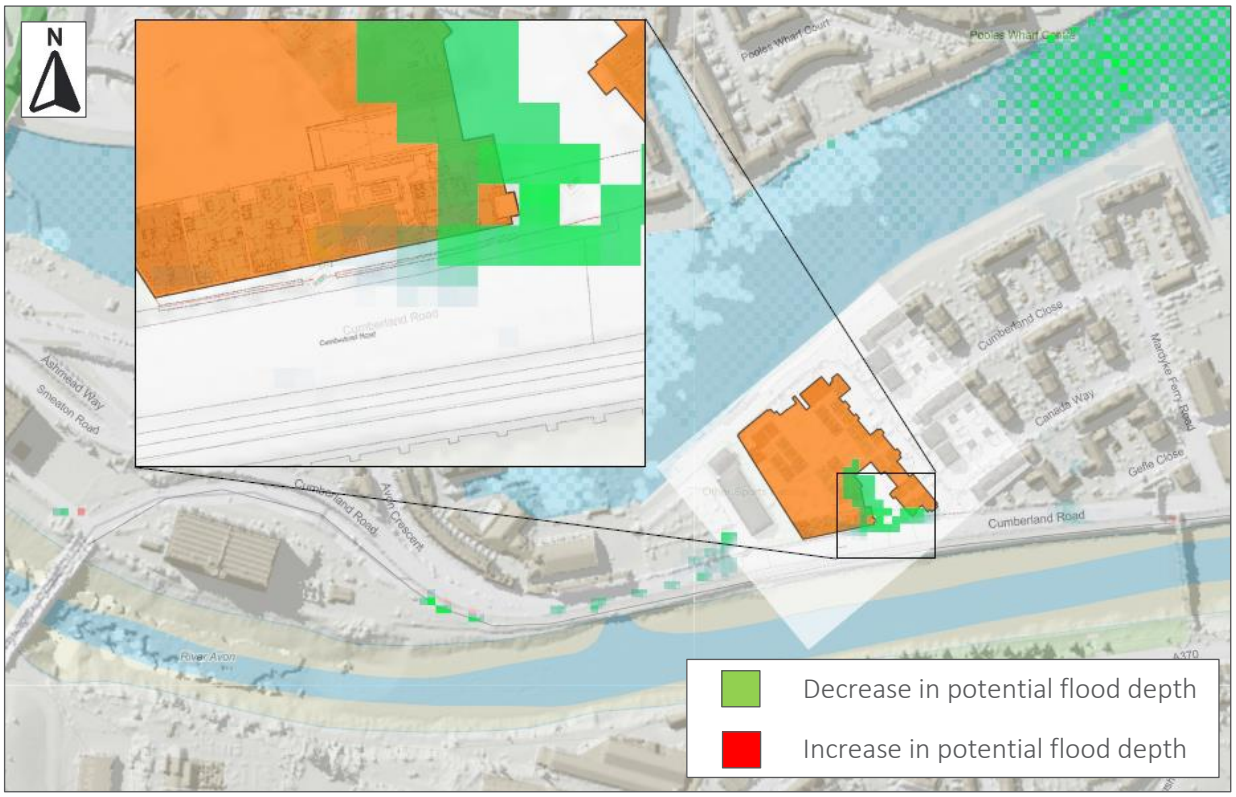


Figure 8: Floodplain Storage Modelling - 'Undefended' Flood Risk Scenario

The results show that in the 'defended' flood risk scenario the proposed development results in only a very localised demonstrable increase in flood risk, isolated to a stretch of Cumberland Road immediately adjacent to the site, where a maximum flood depth increase of 4cm has been identified. This area is however already indicated to be at risk of flooding and the 4cm increase in potential flood depth is therefore not considered to pose any further demonstrable adverse impacts.

In the 'undefended' flood risk scenario, the impact of the proposed development is shown to have no adverse impact on flood risk within the 'flood cell' within which the site is located (i.e. the western portion of Spike Island), with a decrease in potential flood levels identified within the southern portion of the site. The modelling did indicate changes to potential flood depths in several isolated areas of the model extent. Such areas are however in excess of 0.5km from the site and are outside the 'flood cell' within which the site is located, and therefore are considered a modelling abnormality as opposed to representative of realistic changes in potential flood levels. Regardless, it is also noted that the 'undefended' scenario represents a 'residual' risk event which is unlikely to be realised, given the regular inspection and maintenance undertaken by the EA of the surrounding flood defence assets.

Those areas where a <1cm flood level difference has been identified have not been considered further on the basis that level differences of <1cm are within standard flood risk 'modelling tolerances' and therefore are not considered significant, which is a standard approach accepted by the EA.

Based on the results of the modelling which demonstrate a negligible impact on flood risk in the combined 1 in 1 year tidal (in 2120) and 1 in 100 year (+ 35%) fluvial AEP in both the 'defended' and 'undefended' flood risk scenarios, the consideration of lower magnitude flood events is not considered necessary, on the basis that the lower depths of flooding and reduced flood water volume present within the area in lower magnitude flood events will by its nature mean that the impact of the proposed development on floodplain storage capacity is further reduced.

Accordingly, on the basis of the above, the proposed development is not considered to pose any demonstrable adverse impact on floodplain storage within the catchment, and accordingly no further floodplain compensation measures are considered necessary.

4.2.4 Surface Water Drainage

It is understood that a Surface Water Drainage Strategy for the proposed development has been prepared separately and is included with the Planning Application submission, and accordingly that document should be consulted with respect the existing and proposed means of surface water drainage at the site.

5. CONCLUSIONS

The entirety of the site is shown to be within Flood Zone 3, with small areas to the south east and south west of the site indicated to be Floodone 2.

A detailed assessment of flood risk based on BCC's most recent 'Model-20' has identified that the combined fluvial and tidal flood risk posed to the area from the River Avon/Floating Harbour/Cumberland Basin represents the dominant and 'worst-case' flood risk scenario for the site, with the entirety of the site assessed to be at risk of flooding in the 'design' combined 1 in 200 year tidal and 1 in 2 year fluvial AEP flood risk scenario (including climate change allowances to 2080 and 2120 in relation to tidal flooding, and 35% in relation to fluvial flooding), in both the 'defended' and 'undefended' modelled scenarios.

The site is concluded to be at low risk of flooding from all other potential sources.

A separate assessment (included with the Planning Application submission) has been undertaken which concludes that the proposed development passes the Sequential Test and part 'a' of the Exception Test.

A number of mitigation measures are recommended to be incorporated into the design, construction and operation of the proposed development so as to meet the requirements of part 'b' of the Exception Test. Such recommended measures include:

- A 'sequential approach' to building use, through the locating of only 'less vulnerable' uses at the lower ground floor level and restriction of any 'more vulnerable' uses, such as residential.
- The flood resilient design and construction of lower vulnerability uses (i.e. commercial spaces, car parking area, general storage, cycle storage and refuse area) at lower ground floor level, so as to allow water entry, but limit any damage from flood water and be able to return to 'normal-use' as quickly as possible following flooding. Recommended measures include, amongst others: the deployment of temporary flood barriers at external accesses to the proposed commercial space fronting the Floating Harbour, up to a level of 0.600m above finished floor level; and, the installation of a sump-and-pump system in order to permit any flood water entering the lower ground floor level, and unable to flow back into the Floating Harbour under gravity, to be discharged to the Floating Harbour.
- The flood resistant design and construction of those areas at lower ground floor level considered more sensitive to flooding (i.e. plant rooms and lobbies providing stair and lift access to upper floors) so as to prevent water entry. Such recommended measures include: 'tanking' of external and internal walls, and sealing of any voids etc; and, the use of permanent flood doors at plant room and lobby entrances.
- The setting of proposed finished floor levels for all residential uses at upper ground floor level (and the external landscaped areas in the central and western portions of the site) at 10.970m AOD. Such a level is 0.510m above the 'defended 2120' flood risk scenario flood level of 10.46m AOD, from which new residential development is required to be protected, and therefore in excess of the minimum 0.300m 'freeboard' above the 'design' flood level as required by the SFRA.
- The setting of proposed finished floor levels for all commercial uses at upper ground floor level at 10.295m AOD and 10.755m AOD. Such levels are 0.445m and 0.905m above the 'undefended 2080' flood risk scenario flood level of 9.85m AOD, from which new commercial development is required to be protected, and therefore in excess of the minimum 0.300m 'freeboard' above the 'design' flood level as required by the SFRA.

- The flood resistant and/or resilient design and construction of several isolated areas at upper ground floor level that have proposed finished floor levels lower than the 'design' flood levels, as a result of constraints imposed by existing/proposed external ground levels. Recommended measures include, amongst others: the deployment of temporary flood barriers at external accesses to the proposed residential entrance lobbies, up to a level of 0.600m above finished floor level (which will afford such areas protection to in excess of the 'defended 2120' flood risk scenario flood level of 10.46m AOD); and, the 'tanking' of external and internal walls and sealing of any voids etc, and the use of a permanent flood door, in relation to the substation in block E.
- The preparation of a Flood Warning Management Plan, post-planning, to detail how a Flood Warning is disseminated within the site, and how site occupants should respond to a warning of impending flooding. Such a document would be following completion of the Bristol City Council Flood Strategy to ensure all recommendations for Baltic Wharf are in line with wider approaches. As such, it is recommended that the site Flood Warning Management Plan to be secured via a pre-occupation condition.

Site-specific flood risk modelling has demonstrated that the proposed development is not considered to pose any demonstrable adverse impact on floodplain storage within the catchment, and accordingly no further floodplain compensation measures are considered necessary.

It is understood that a Surface Water Drainage Strategy for the proposed development has been prepared separately and is included with the Planning Application submission, and accordingly that document should be consulted with respect the existing and proposed means of surface water drainage at the site.

This report therefore demonstrates that, in respect of flood risk, the proposed residential-led mixed-use development at the site:

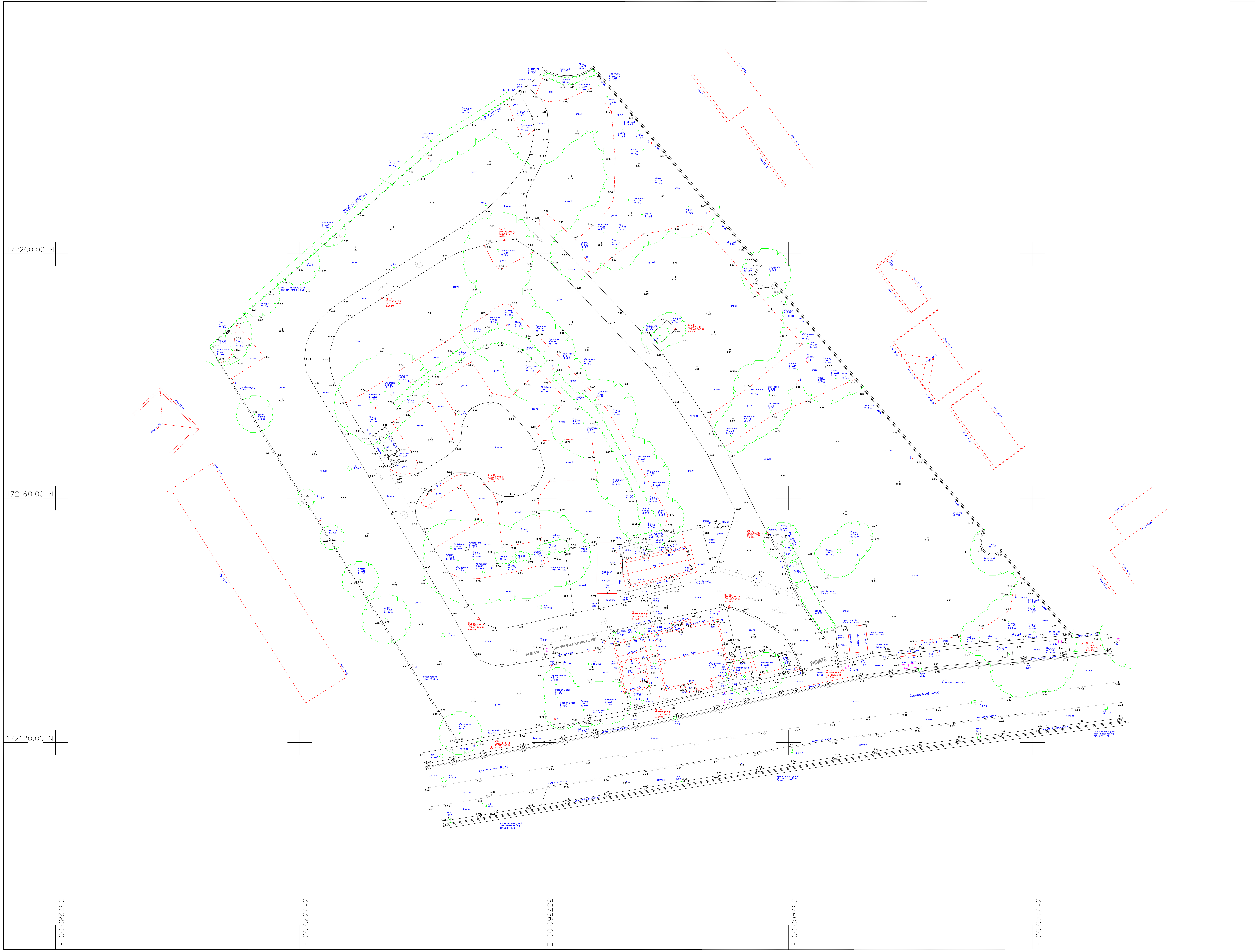
- Is suitable in the location proposed.
- Will be adequately flood resistant and resilient.
- Remains safe for occupants in the 'design' flood risk event for the lifetime of the proposed development.
- Will not increase flood risk elsewhere through the loss of floodplain storage.

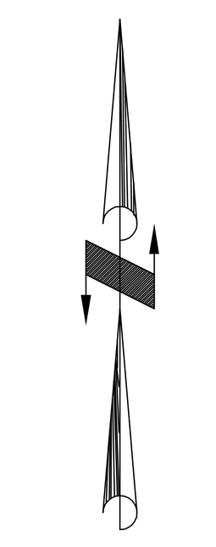
On the basis of the above, the Planning Application submitted for the site is concluded to meet the flood risk objectives of the NPPF and NPPG.

Hydrock Consultants Limited

Appendix A - Site

Reference	Title
509/11008/1	Topographical Survey





STANDARD REFERENCES

ABBREVIATIONS

bb	belisha beacon	ko	kerb outlet
bl	bollard	lp	lamp post
brw	brick ret. wall	mh	manhole
bs	bus stop	mk	marker post
bt	telecoms cover	np	nameplate (road)
bw	brick wall	obf	open boarded fence
catv	cable TV cover	p	post
cbf	closeboarded fence	pb	post box
cbrw	conc block ret. wall	ret.	retaining wall
cbw	conc cbw	re	rodding eye
cl	cover level	rg	road gully
clf	chainlink fence	rs	road sign
conc	concrete	rwp	rainwater pipe
cp	concrete post	sp	signpost
cws	combined sewer	srw	stone ret. wall
dk	drop kerb	sv	stop valve
ep	electricity pole	svp	soil vent pipe
ESS	Elec. Sub–Station	sw	stone wall
fb	flower bed	s/w	stay wire
fh	fire hydrant	sws	storm water sewer
fl	floor level	tcb	telephone callbox
fws	foul water sewer	tl	traffic light
g	gully	tp	telegraph pole
gsv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	w'lap	woodlap fence
irf	iron railing fence	wm	water meter
jb	junction box	wp	wood post

Notes

1. This survey has been computed and drawn "true to scale" and relates to the OSTN15 GPS National Grid at a single point.
2. All levels are in metres and relate to the mean of the nearest five Ordnance Survey active GPS stations (OSGM15).
3. This survey was measured for a scale of 1:200, any subsequent enlargements should be verified on site.

Revisions

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Surveyed	C Langslow	Date	July 2019
Drawn	C Langslow	Checked	July 2019

Drawing Title: Topographical Survey
Baltic Wharf Caravan Park
Cumberland Road
Hotwells, Bristol

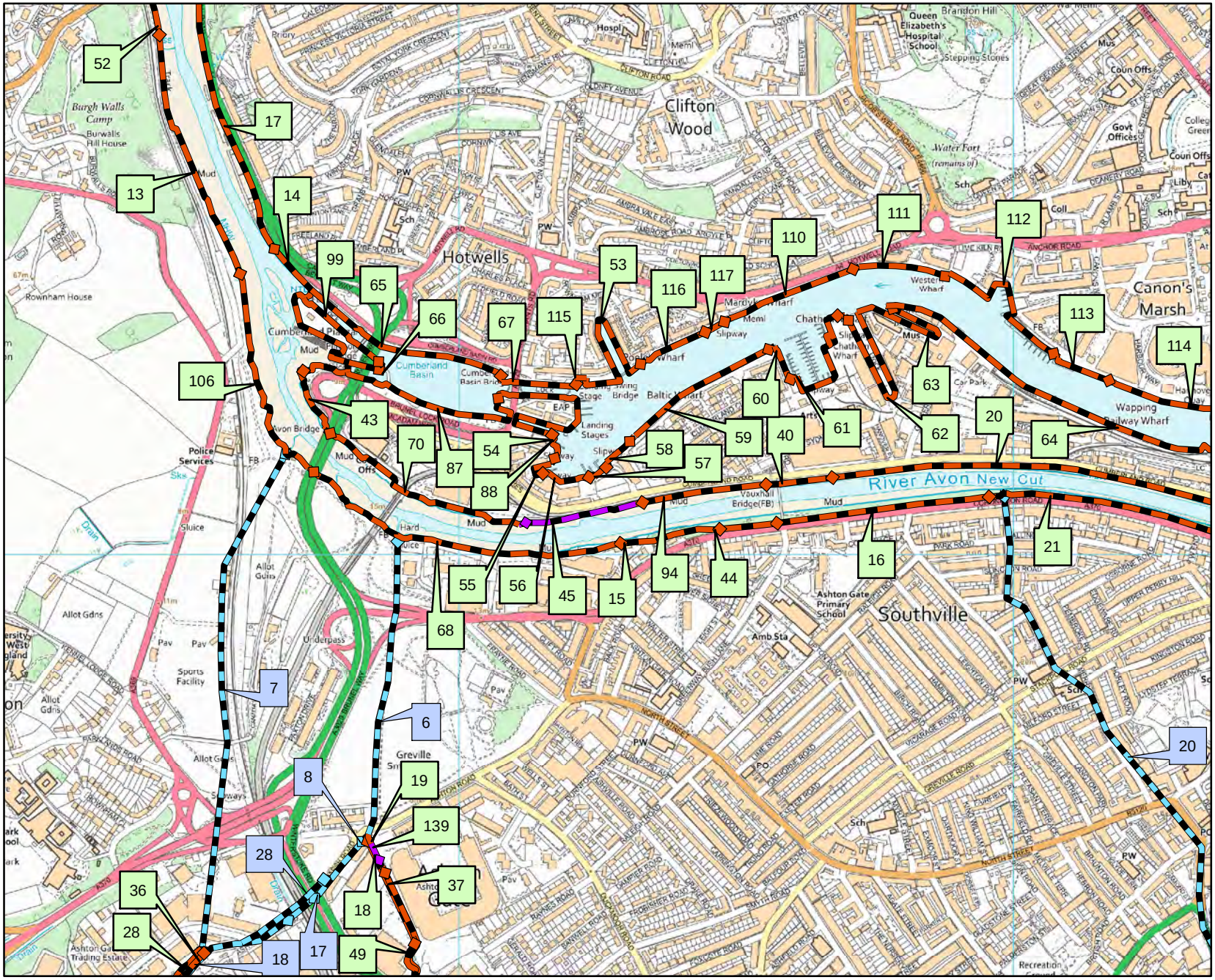
Client: AECOM Ltd
Portwall Place
Portwall Lane
Bristol, BS1 6NB

Drawing No.	Rev	Scale A0 @
509/11008/1		1:200

Appendix B - Flood Risk

Reference	Title
162968_01-WX	Current Flood Defences
162968_02-WX	AIMS Information [2 pages]
WB/BCSF/	3C - Historical Flooding

Current Flood Defences (ref. 162968_01-WX)



Environment Agency

Scale: 1:10,000

N W E S

Legend

Defences

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes

Channels

- open_channel
- simple_culvert

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.

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

Product 4 - AIMS Information **162968_02-WX**

Map Ref	Asset ID	Asset Type	Asset Description	Approx length (m)	Right or left bank	Actual fluvial downstream crest level (mAOD)	Actual fluvial downstream crest level accuracy	Actual fluvial upstream crest level (mAOD)	Actual fluvial upstream crest level accuracy	Actual fluvial coastal crest level (mAOD)	Actual fluvial coastal crest level accuracy	NGR	Most recent inspection	Overall condition
13	1947	high_ground	MASONRY WALL	463.70	left	8.80	+/->75cm	9.18	+/->75cm	DNR	DNR	ST5654172644	29/08/2019	3
14	1948	high_ground	MASONRY WALL	467.68	right	7.53	+/->75cm	7.83	+/->75cm	DNR	DNR	ST5678672363	29/08/2019	3
15	1949	high_ground	MASONRY WALL	181.93	left	8.45	+/->75cm	7.96	+/->75cm	DNR	DNR	ST5735172025	25/09/2019	3
16	2060	high_ground	MASONRY WALL	385.65	left	8.03	+/->75cm	8.27	+/->75cm	DNR	DNR	ST5782972092	25/09/2019	4
17	2184	high_ground	COMPLEX WALL (MASONRY/CONCRETE)	1030.16	right	11.58	+/->75cm	7.96	+/->75cm	DNR	DNR	ST5652773050	29/08/2019	3
18	2186	high_ground	Masonry Wall	203.55	left	8.25	+/->75cm	8.42	+/->75cm	DNR	DNR	ST5687471402	17/05/2018	3
19	2237	high_ground	Natural Bank	18.56	right	8.25	+/->75cm	8.42	+/->75cm	DNR	DNR	ST5683571491	17/05/2018	3
20	2061	high_ground	MASONRY WALL	1092.50	right	8.62	+/->75cm	8.42	+/->75cm	DNR	DNR	ST5853672063	25/09/2019	4
21	2062	high_ground	REGRADED ROCK BANK	500.92	left	14.09	+/->75cm	15.01	+/->75cm	DNR	DNR	ST5803372110	25/09/2019	3
28	5046	high_ground	Sheet Piling	92.75	left	9.47	+/->75cm	9.47	+/->75cm	DNR	DNR	ST5651271262	16/02/2018	2
36	5119	high_ground	Sheet Piling	100.29	right	9.47	+/->75cm	9.65	+/->75cm	DNR	DNR	ST5651171247	16/02/2018	2
37	40503	high_ground	Natural Bank	267.83	right	8.42	+/->75cm	8.54	+/->75cm	DNR	DNR	ST5691071265	17/05/2018	2
40	40550	high_ground	MASONRY WALL	120.25	right	8.63	+/->75cm	8.62	+/->75cm	DNR	DNR	ST5757872127	25/09/2019	3
43	41400	high_ground	REGRADED BANK	143.31	right	7.83	+/->75cm	9.01	+/->75cm	DNR	DNR	ST5672272301	29/08/2019	3
44	41401	high_ground	GABION WALL (COMPLEX)	104.02	left	7.96	+/->75cm	8.03	+/->75cm	DNR	DNR	ST5753872052	25/09/2019	3
45	41402	wall	MASONRY WALL	216.12	right	8.57	+/->75cm	8.57	+/->75cm	DNR	DNR	ST5722272072	25/09/2019	2
49	40750	high_ground	Natural Bank	125.49	left	8.42	+/->75cm	8.54	+/->75cm	DNR	DNR	ST5690571266	17/05/2018	3
52	57599	high_ground	NATURAL BANK	184.40	left	9.16	+/->75cm	8.80	+/->75cm	DNR	DNR	ST5641073086	29/08/2019	3
53	73645	high_ground	Walled channel	353.87	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5728572322	14/08/2019	2
54	73687	high_ground	Walled channel	52.85	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5717872190	14/08/2019	3
55	73688	high_ground	Patent Slipway and walled channel	69.65	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5715672148	14/08/2019	3
56	73689	high_ground	Walled channel	91.35	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5722572140	14/08/2019	3
57	73709	high_ground	Walled channel	39.56	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5726972162	14/08/2019	2
58	73710	high_ground	Walled channel	68.50	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5729972195	14/08/2019	2
59	73711	high_ground	Walled channel	301.18	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5742272300	14/08/2019	2
60	73712	high_ground	Harbour wall and slipway	83.38	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5757472368	14/08/2019	2
61	73713	high_ground	Sheet piling walled channel	283.83	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5766672396	14/08/2019	3
62	73714	high_ground	Drydock	350.57	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5777272283	14/08/2019	2
63	73910	high_ground	Walled channel and Drydock	271.53	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5786572398	14/08/2019	2
64	73911	high_ground	Walled channel	969.83	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5827472197	14/08/2019	2
65	73912	high_ground	Walled channel	402.15	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5697872357	14/08/2019	3
66	73913	high_ground	Walled channel	67.96	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5686072333	14/08/2019	3
67	73914	high_ground	Walled channel	151.22	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5711772309	14/08/2019	2
68	77159	high_ground	REGRADED BANK	608.12	left	6.91	+/->75cm	8.45	+/->75cm	DNR	DNR	ST5690672029	25/09/2019	3
70	77160	high_ground	REGRADED BANK	414.12	right	9.01	+/->75cm	8.57	+/->75cm	DNR	DNR	ST5689472117	25/09/2019	3
87	129473	high_ground	Walled channel	383.29	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5696472262	14/08/2019	3
88	129474	high_ground	Walled channel	397.35	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5720972282	14/08/2019	3
94	119950	high_ground	MASONRY WALL	225.14	right	8.57	+/->75cm	8.63	+/->75cm	DNR	DNR	ST5743072113	25/09/2019	3
99	129472	high_ground	Walled channel	194.34	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5680172393	14/08/2019	2
106	131638	high_ground	REGRADED BANK	418.35	left	9.18	+/->75cm	7.34	+/->75cm	DNR	DNR	ST5665472237	29/08/2019	3
110	134807	high_ground	Walled channel	251.08	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5754772454	14/08/2019	3
111	134808	high_ground	Walled channel	169.17	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5781672518	14/08/2019	3
112	134969	high_ground	Walled channel/bund	325.69	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5798972487	14/08/2019	2

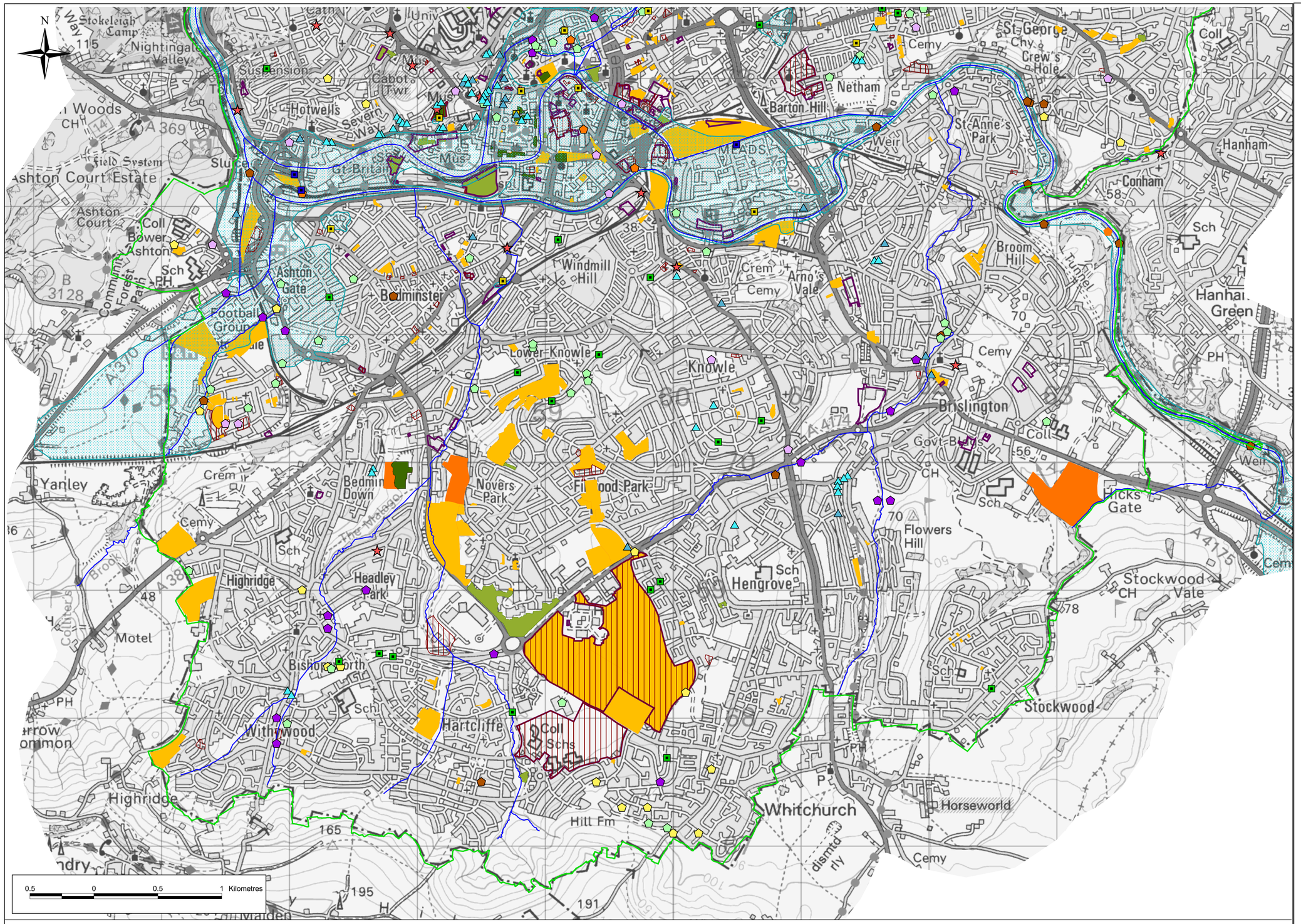
Map Ref	Asset ID	Asset Type	Asset Description	Approx length (m)	Right or left bank	Actual fluvial downstream crest level (mAOD)	Actual fluvial downstream crest level accuracy	Actual fluvial upstream crest level (mAOD)	Actual fluvial upstream crest level accuracy	Actual fluvial coastal crest level (mAOD)	Actual fluvial coastal crest level accuracy	NGR	Most recent inspection	Overall condition
113	134970	high_ground	Walled channel	118.24	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5808072349	14/08/2019	3
114	134971	high_ground	Walled channel	322.70	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5836572264	14/08/2019	3
115	134972	high_ground	Sheet pile wall	19.78	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5722972319	14/08/2019	3
116	144601	high_ground	Walled channel	132.21	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5735472362	14/08/2019	3
117	144602	high_ground	Harbour wall	39.29	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5748972426	14/08/2019	3
139	479258	wall	Masonry wall constructed by Bristol City Football Club - 20m in length	45.93	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5686171437	14/02/2017	3

Map Ref	Asset ID	Asset Type	Asset Description	Approx length (m)	Right or left bank	Actual fluvial downstream crest level (mAOD)	Actual fluvial downstream crest level accuracy	Actual fluvial upstream crest level (mAOD)	Actual fluvial upstream crest level accuracy	Actual fluvial coastal crest level (mAOD)	Actual fluvial coastal crest level accuracy	NGR	Most recent inspection	Overall condition
6	40749	simple_culvert	Culvert	547.80		DNR	DNR	DNR	DNR	DNR	DNR	ST5687971861	17/05/2018	3
7	57219	simple_culvert	Ashton Vale Relief Culvert	943.78		DNR	DNR	DNR	DNR	DNR	DNR	ST5668872183	22/11/2018	2
8	64721	simple_culvert	Culvert	135.56		DNR	DNR	DNR	DNR	DNR	DNR	ST5678871440	18/05/2017	3
17	141636	simple_culvert	Ashton Vale Culvert	61.63		DNR	DNR	DNR	DNR	DNR	DNR	ST5674871388	18/05/2017	4
18	141828	simple_culvert	Ashton Vale Culvert	230.83		DNR	DNR	DNR	DNR	DNR	DNR	ST5655371291	18/05/2017	3
20	153734	simple_culvert	Culvert	1247.65		DNR	DNR	DNR	DNR	DNR	DNR	ST5823971595	17/05/2018	3
28	369548	simple_culvert	1600mm polyethylene pipe culvert	199.93		DNR	DNR	DNR	DNR	DNR	DNR	ST5671371372	18/05/2017	3

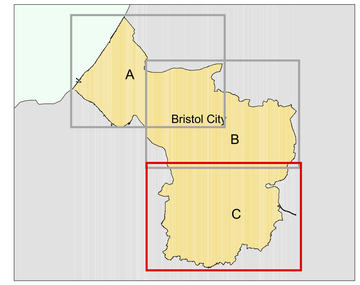
Notes

* Overall Condition has been taken from the most recent inspection
* Inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset
* Condition 1 = very good, Condtion 2 = good, Condition 3 = fair, Condition 4 = poor, Condition 5 = very poor

DNR = data not recorded



Location Plan:



Legend:

- Bristol City Boundary
- Main River
- Historical Flood Event
- Fire and Rescue Incidents
  Data Source: Avon Fire and Rescue Service
- Flood Incident
  Data Source: South Gloucestershire District Council
- Flooding Incidents
  Data Source: Highways Agency

Flood Incident

- Bristol City Flood Report
- Environment Agency Flood Report
- Environment Agency Historical Flood database

Location of foul sewerage flooding
Data Source: DG5 register, Wessex Water

- 2 in 10 years
- 1 in 10 years
- 1 in 20 years

Flood Reconnaissance Information System: Flood Incidents
Data Source: Environment Agency

- Property

Incidents:

- Fluvial
- Sewer
- Surface water
- Tidal
- Unknown

Sites for Evaluation (planning information)

Core Strategy

- Employment
- Residential

Planning Permissions

- Residential
- Non-residential

Local Plan

- Employment
- Residential

Project: **BRISTOL CITY COUNCIL STRATEGIC FLOOD RISK ASSESSMENT**

Title: **3C - HISTORICAL FLOODING**

Drawn By	: Karen Ulloa	Revision	Drawing Scale	: 1:15,000	Drawing No. : WB/BCSF/
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