Town and Country Planning Act 1990

Town and Country Planning (Inquiries Procedure) (England) Rules 2000 (As Amended)

Appeal by Mead Realisations Ltd against the decision of North Somerset Council to refuse planning application 20/P/1579/OUT for a residential development of up to 75no. dwellings and associated infrastructure with access for approval, and appearance, scale, layout and landscaping reserved for subsequent approval on land at Lynchmead Farm, Ebdon Road, Wick St Lawrence, Weston-super-Mare

Planning Inspectorate reference: **APP/D0121/W/22/3313624**

North Somerset Council reference: **20/P/1579/OUT**

Proof of evidence of:

Simon Bunn

Flood Risk Manager, North Somerset Council

Statement of qualifications and experience

I am the council's Flood Risk Manager and the Flood Risk Team Leader. The Flood Risk team fulfils the function of the Lead Local Flood Authority, Coast Protection Authority and provides consultation responses to major planning applications as well as managing council owned coastal and inland flood risk infrastructure.

I am a highly experienced engineer who worked for 19 years as a consulting civil and structural engineer, designing, amongst other things, surface water and sustainable drainage schemes for retail clients, schools, and housing developments.

I then spent seven years at Cambridge City Council, advising on flood risk and flood risk management through the planning application process.

I was involved in the writing and implementation of the following best practice documents, guidance, and legislation:

- Cambridgeshire Flood and Water Supplementary Planning Document
- Cambridge Sustainable Drainage Design and Adoption Guide – local authority technical lead and joint author
- Planning for SuDS - making it happen Construction Industry Research and Information Association (CIRIA) C687 – CIRIA appointed peer reviewer
- The SuDS Manual CIRIA C753 – Project Steering Group member
- The Flood and Water Act 2010 – Member of Defra appointed task and finish group looking at the implementation of Schedule 3 – Sustainable Drainage

I am currently a member of the following groups:

- Severn Estuary Coastal Group
- South West Coastal Group
- Severn Estuary Partnership
- Association of Severn Estuary Relevant Authorities (chair)
- North Somerset Levels and Moors Partnership (chair)
- North Somerset Flood Risk Management Partnership (chair)
- Wessex Regional Flood and Coastal Committee (officer attendee)
- Devon and Severn Inshore Fisheries and Conservation Authority
- Bristol and Avon Catchment Partnership

The facts stated in this evidence are true to the best of my knowledge and belief, and the views I express represent my professional opinion.

1.0 Introduction

1.1 This proof of evidence addresses the wider flood risk issues impacting on the appeal site in respect of refusal reason number 2. I approach this task by, first, setting out the flood risk context of the site. I then describe the existing flood defences, explaining how the coast around North Somerset is managed to control flood risk. I then consider flood risk issues in the longer term, including those arising from climate change. I conclude with an assessment of why the risk of flooding at the appeal site makes its development inherently unsustainable.

2.0 Existing Flood Risk Context

2.1 <u>Flood map for planning</u>

The site is shown as being in flood zone 3 on the Environment Agency flood map for planning (see appendix SB1). Flood zone 3 has a 0.5% chance of flooding each year which is also expressed as a 1 in 200 year event. The map shows the extent of flooding without the presence of flood defences. It demonstrates that the site is at risk from coastal flooding even though it benefits from the presence of flood defences. Appendix SB1 shows the location of the site overlain on the flood extent map and the location of flood defences. Over time and due to sea level rise associated with climate change the risk to site is likely to change.

2.2 <u>Flood defences in planning policy</u>

The national Planning Practice Guidance (PPG) requires that “residual risk” needs to be addressed in development proposals and the associated flood risk assessment accompanying them. Residual risk comes in two main forms:

- residual risk from flood risk management infrastructure; and
- residual risk to a development once any site-specific flood mitigation measures are taken into account.

In the context of the proposed development, residual risk would be a breach of a raised flood defence or a flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence. The reality of this risk from a flood event overtopping flood defences was clearly evident during Storm Eunice in March 2022 which I address below

The PPG (paragraph 041) goes on to state:
"When considering residual risks over the lifetime of development, local planning authorities will need to make informed decisions about the likely presence of flood risk management infrastructure in future, taking advice from relevant risk management authorities. Where flood risk management infrastructure is likely to be improved to keep pace with climate change, the potential consequences of flooding resulting from breach or failure of that improved infrastructure is likely to be the main driver for mitigation.

Where infrastructure is unlikely to be improved, the potential consequences of flooding resulting from overtopping or the design standard being exceeded will also be an important consideration. It is important to consider the consequences of both overtopping and breach, as the nature of flooding will be different in each case. There may, therefore, be a need for different flood risk management measures."

If defences are not improved, residual risk may become actual risk as the level of risk increases due to sea level rise associated climate change.

In the context of the proposed development, the most recent and up to date modelling indicates that when an appropriate amount of sea level rise is used, the current defences would not protect the site from flooding for the design flood and there is uncertainty about whether the existing infrastructure will be improved to maintain protection against rising sea levels, which is discussed later in this evidence.

2.3 How the proposed site is defended

The site is protected by flood defences from risk presented in two locations along the coast, namely Sand Bay and Woodspring Bay.

2.3 Sand Bay

2.3.1 At Sand Bay, the defences combine raised beach levels, sand dunes, an embankment and a wall. The beach levels were raised after one of the highest recorded tidal levels in the last century were recorded on 13 December 1981 along the Somerset and Avon coastline. At Weston-super-Mare and Avonmouth, the predicted tides were 7.2m AOD. The actual tides recorded were 8.10m AOD at Weston-super-Mare and 8.83m AOD at Avonmouth, with a 1.7m surge. The tides combined with storm force westerly winds - gale force 8 to 10, up to 50 knots. Across Somerset and North Somerset, it is recorded that 12,500 acres (485 ha) of land were inundated with floodwater and 1,072 houses and commercial properties suffered flooding, with floodwater reaching the M5 motorway. Following the 1981 storm, over 600,000 tonnes of sand were dredged from the Severn Estuary and pumped onto the beach, raising it by approximately three metres at the sea wall. That is the form and level of the existing flood defence.

The current level of protection at Sand Bay is 1 in 100 according to figure 41 of the North Somerset Council Strategic Flood Risk Assessment 2020 (CD 8.13)

2.4 Woodspring Bay

2.4.1 At Woodspring Bay, the defences are grassed embankments and a tidal exclusion sluice that prevent extreme flood waters from flowing up the River Banwell. They were overtopped in the 1981 storm but did not affect the appeal site.

The current level of protection at Woodspring Bay is a combination of 1 in 200, 1 in 100, 1 in 50 and 1 in 25 according to figure 41 of the North Somerset Council Strategic Flood Risk Assessment 2020 (CD 8.13)

2.5 Defence condition

2.5.1 The Environment Agency manages and maintains the defences, and their asset data base describes their condition as ranging from ‘good’ to ‘fair’. The Environment Agency uses a standard method of visual inspection, known as “T98 inspections”, to determine and assign standard condition grades to defences. The condition grades are:

- 1 – Very good - Cosmetic defects that will have no effect on performance
- 2 – Good - Minor defects that will not reduce the overall performance of the asset
- 3 – Fair - Defects that could reduce performance of the asset
- 4 – Poor - Defects that would significantly reduce the performance of the asset. Further investigation needed
- 5 – Very Poor – Severe defects resulting in complete performance failure

2.5.2 There are currently no schemes within in the Environment Agency's medium term plan to upgrade the defences and according to the Environment Agency's Wessex Regional Flood and Coastal Committee Strategy for 2022-2027 and beyond, North Somerset is not a priority place for investment 2022-2027 and beyond (table 1) (CD 8.16). Compared to other places in the region currently North Somerset has a reasonable level of protection provided by the coastal flood defences, however due to climate change there will be a future need to invest in the defences if the standard of protection is to be maintained.

2.6 Site elevation and still water extreme levels

2.6.1 The Environment Agency has published a consistent set of extreme sea levels around the coast of England. This dataset is part of "Coastal Design/Extreme Sea Levels (2018)", an Environment Agency GIS dataset and supporting information providing design and extreme sea level and typical surge information around the coastline of the UK, including England, Wales, Scotland, Northern Ireland, Isle of Man and Jersey. The information is the most up to date information available and is used by modellers and consultants to represent present day conditions and does not account for future changes due to climate change, such as sea level rise. This is a specialist dataset which informs a wide range of coastal work and studies, including coastal flood modelling, scheme design, strategic planning and flood risk assessments.

In assessing planning applications, defences are assumed not to be present , as shown on the flood map for planning, this is to account for future uncertainty and for the following reasons:

- They may be overtopped in extreme events;

- They may fail and be breached in a storm;
- They may not be present for the lifetime of the development due to coastal erosion or a reduction in maintenance activities, or
- In the future they may be realigned in a different location and may no longer provide a level of protection to some areas;
- There is uncertainty that the defences will be upgraded due to the lack of available funding or environmental constraints.

Therefore, I have taken the data from the data set and compared it to the proposed ground floor level of the future dwellings. I then have made an assessment assuming no defences are present.

2.6.2 The site’s elevation ranges between 6.0 metres above ordnance datum (mAOD) and 6.7mAOD. The appellant’s proposal is to raise the ground level of properties to 300mm above the existing ground level. For table 1 below, a ground floor level of 7.0mAOD has been assumed. The table shows that the proposed ground floor level of the properties is below all extreme sea levels now and will be below mean high water springs (MHWS) with climate change. The height MHWS is the average throughout the year, of two successive high waters, during a 24-hour period in each month when the range of the tide is at its greatest (Spring tides). Monthly tides are defined as ‘Springs’ or ‘Spring tides’ when the tidal range is at its highest and ‘Neaps’ or ‘Neap tides’ when the tidal range is at its lowest.

Table 1 – Ground floor levels compared with extreme sea levels

(AEP means Annual Exceedance Probability)

	Average level (mAOD) from chainages 352 to 364	**Average depth (m) of flood water above ground floor now**	**Average depth (m) with sea level rise to 2125 (higher central) 1.21m**	**Average depth (m) with sea level rise to 2125 (upper end) 1.62m**
Highest Astronomical Tide	7.56	**0.56**	**1.77**	**2.18**
Mean High Water Springs (MHWS)	6.19	0	0.4	**0.81**
1 in 1 year (100% AEP) (happens every year)	7.55	**0.55**	**1.76**	**2.17**
1 in 10 year (10% AEP)	7.88	**0.88**	**2.09**	**2.50**
1 in 50 year (2% AEP)	8.15	**1.15**	**2.36**	**2.77**
1 in 100 year (1% AEP)	8.27	**1.27**	**2.48**	**2.89**
1 in 200 year (0.5% AEP)	8.40	**1.40**	**2.61**	**3.02**
1 in 1000 year (0.1% AEP)	8.72	**1.72**	**2.93**	**3.34**

2.6.3 Flood hazard ratings are a function of risk associated with flood depth and velocity and are calculated using the following equation:

Hazard Rating (HR) = Depth x (Velocity + 0.5) + (Debris Factor)

2.6.4 This equation is taken from the Department for the Environment, Food and Rural Affairs' (Defra's) "Supplementary Note on Flood Hazard Ratings and Thresholds for development and planning control purpose" issued in May 2008 (CD 8.17). This is the most up to date guidance on the assessment of hazard ratings.

2.6.5 This Supplementary Note also provides guidance on classifying Flood Hazard Ratings, as detailed below and I have adopted this for the table above, assuming a velocity of 0 m/s and a debris factor of 1 as the development will be an urban area.

HR < 0.75: Very low hazard.

0.75 < HR < 1.25: Danger for some, shown as yellow

1.25 < HR < 2.0: Danger for most, shown as orange

HR > 2.0: Danger for all shown as red

2.6.6 As can be seen from table 1 the risk to the proposed development site increases over time as sea levels rise. The elevation of the site is currently below the highest astronomical tide and in the future will be below mean high-water springs (the highest tides that happen each year). For a 1 in 200 year event (0.5% AEP) the site has 1.4m deep flooding now and potentially between 2.6m and 3m deep flooding in the future due to sea level rise associated with climate change. The data set does not consider the presence of defences that currently provide a level or protection to the site and therefore reference is made to the most recent hydraulic modelling available, which I do in the next section.

2.7 Flood Modelling

2.7.1 A more detailed hydrological assessment of the risk to the site was carried out by flood risk modellers JBA Consultants for the Environment Agency and this forms the basis of the Government's Flood Map for Planning. The "Woodspring Bay and Severn House Farm Flood Modelling and Mapping Report 2020" (CD 8.6) details the modelling and the output data that was derived and created in the form of the flood extents and flood depths for a range of different scenarios. This analysis is the most recent (2020) hydraulic modelling of the coast. I have taken the GIS data and created a table of the different modelled simulations and the resulting depth of flood water and hazard rating for the proposed site and this is presented below in table 2

2.7.2 Table 2 indicates that the depths vary across the site and are average depths minus 300mm to represent the quoted ground floor level of the proposed dwellings. UKCP09 is the United Kingdom Climate Projections 2009 dataset, that has now been superseded by the United Kingdom Climate Projections 2018 (UKCP18) dataset.

Table 2 – Woodspring Bay Model outputs

Event (%AEP)	Event (Return Period, years)	Average Defended water depth (m)	Average Defended hazard rating	Undefended water depth (m)	Undefended hazard rating
10	**10**	0	0	0.8	1.624
2	**50**	0	0	1.1	1.836
1	**100**	0	0	1.3	2.066
0.5	**200**	0	0	1.5	2.245
0.1	**1000**	0	0	2.0	2.8
0.5 + UKCP09 (2118)	**200 + UKCP09 (2118)**	0 (0.3 externally)	1.1 (externally)	2.7	3.538
0.5 + NPPF (2118) Design flood	**200 + NPPF (2118) Design flood**	1.1	2.47 (externally)	3.0	3.16

HR < 0.75: Very low hazard.

0.75 < HR < 1.25: Danger for some, shown as yellow

1.25 < HR < 2.0: Danger for most, shown as orange

HR > 2.0: Danger for all, shown as red

2.7.3 The Environment Agency publishes climate change allowances that the government states should be used by local planning authorities, developers and their agents in flood risk assessments. The climate change allowances used in the Environment Agency's Woodspring Bay model are inconsistent with current allowances published on the government's website. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#sea-level-allowances. The revised allowances are greater and therefore the risk may be greater. The modelling also only uses the 'Higher Central' allowance and not the 'Upper End' allowance. This was due to the timing of the modelling which started prior to the UKCP18 data becoming available.

2.7.4 The allowances are based on percentiles. A percentile describes the proportion of possible scenarios that fall below an allowance level.

The:

- higher central allowance is based on the 70th percentile
- upper end allowance is based on the 95th percentile

An allowance based on the 70th percentile is exceeded by 30% of the projections in the range. At the 95th percentile it is exceeded by 5% of the projections in the range.

The government’s website that provides the allowance states “For flood risk assessments and strategic flood risk assessments, assess both the higher central and upper end allowances.”

2.7.5 Table 3 is taken from table 5-1 of the Woodspring Bay and Severn House Farm Flood Modelling and Mapping Report 2020 (CD 8.6)

Table 3 - Climate change allowances used in the 2020 Woodspring Bay Model

Guidance	**Year**	**Sea level rise uplifts**	**Wind speed and wave height (%)**
UKCP09	2068	0.327 and 0.326	10%
	2118	0.756 and 0.754	10%
NPPF	2068	0.432	10%
	2118	1.121	10%

2.7.6 Table 4 shows sea level allowances by river basin district for each year in mm for each year (based on a 1981 to 2000 baseline) – the total sea level rise for each year is in brackets. The wind speed and wave height allowances are the anticipated percentage increase in wave wind speed and wave heights due to increased storminess due to climate change.

Table 4 current climate change allowance guidance as published on the government's website

Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Higher central	5.8 (203)	8.8 (264)	11.7 (351)	13.1 (393)	1.21
Upper end	7 (245)	11.4 (342)	16 (480)	18.4 (552)	1.62

2.7.8 From the tables above and depths of flood water that the new dwellings would experience, the current defences in a fair state of repair, provide a suitable level of protection now, however in the undefended scenario the flood depth is around 1.4m and when an allowance for climate change has been applied, flood depths are over 3m for the undefended design flood (PPG Para 002) of 0.5% AEP (1 in 200 year event). With climate change in the defended scenario the flood water is over 1m deep for the design flood event . I note that the appellant's assessment of tidal flood risk in the flood risk assessment does not include an assessment of the impacts of climate change. The undefended condition is the residual risk that needs to be managed in the development proposals, due to the level of uncertainty outlined in paragraph 2.6.1 of my evidence and paragraph 42 of the PPG. I also note that the appellant's Flood Risk Assessment (CD 1.13) appears to have been undertaken based on superseded information prior to the release of the most up to date hydraulic model, which is the Woodspring Bay Model (2020).

2.7.9 Flood defences are at risk of breach and there is no certainty they will be present and in a reasonable condition for the lifetime of the development. The UK has a history of storms that have been breached defences, such as the 1703 storm that resulted in extensive and prolonged flooding of the Somerset Levels; the 1953 east coast storm surge that flooded 1,600km and the sea walls were breached in 1,200 places; in 1981 defences were breached all along the coast and in January 2021 defences were breached in Dorset. Accepted practice, as outlined in the PPG, is to provide mitigation for the residual risk. The defences are currently graded by the Environment Agency as being 'fair' in places, which indicates that there are defects that could reduce the performance of the asset. The appellant's Flood Risk Assessment (CD 1.13) states that a safe refuge will be provided at a height of 8.81m AOD, which is 2.11-2.81m above existing ground levels. The appellants state that 300mm has been added as an allowance for climate change. As can be seen above, this does not equate with current sea level rise predictions. The implication of this is that climate change has not been fully considered and that the safe refuge will need to be higher.

2.7.10 A safe refuge is provided where a dry evacuation route is not possible. Due to the depth of flooding present on the site a dry evacuation route would not be possible. From my assessment of the flood risk to the site, based on more up to date information than was used in the applicant's flood risk assessment, the height of the safe refuge would need to be higher than 3.3m above existing ground levels. The refuge would need to be large enough for all of the potential residents of the dwelling and have basic facilities such fresh water, medicines and be comfortable for overnight stays if needed. External access would also be required for a resident to be evacuated in the event of a medical emergency or if the flood duration was longer than anticipated. In practical terms for this development, it would mean the safe refuge would likely need to be higher than the first floor level of any proposed dwelling, or floor and site levels raised to ensure that the first floor level is 3.3m higher than existing ground levels. The details of how an internal safe refuge is to be provided would be a matter for detailed design and any future reserved matters application but would have implications for the scale, form and appearance of the development.

2.7.11 The Environment Agency does not have a written national or local policy on how they approach the exception test and how it determines if the development would be safe for the lifetime of the development. Informal discussions with the Environment Agency locally have indicated that for tidal flooding risk, as long as a safe refuge is provided above the design flood level plus an appropriate allowance for climate change, the Agency would not object to a planning application. However, it expects the local authority in consultation with emergency planners to make the judgement about whether that development is safe for the lifetime of the development taking into account additional measures not considered by the Environment Agency such as safe access, egress and the impact on essential services such as electricity, gas, telecommunications, water supply and sewerage in accordance with paragraph 47 of the PPG.

2.7.12 My evidence does not seek to challenge the assessment of the Environment Agency that providing a safe refuge only is sufficient to make the development safe for its lifetime, despite the impracticability of providing one but does use the depth of flooding to provide evidence for Mr Hewlett and his evidence about the impact that flooding would have on the proposed development site. As previously noted, the appellant's Flood Risk Assessment (CD 1.13) is based on superseded modelling and proposed safe refuge and finished floor levels are based on this. A re-appraisal of levels should be undertaken as part of any reserved matters application to inform the detailed design. Flooding can significantly damage buildings and contents and has a significant cost that I explain later in my evidence. The deeper the flood risk, the greater the likely cost of repair and recovery, I address this below.

2.8 Recent events

2.8.1 The risk of flooding around Weston-super-Mare was evident as recently as last year. Storm Eunice was an intense extratropical cyclone that was part of the 2021–2022 European windstorm season. A red weather warning was issued on 17 February 2022 for parts of South West England and South Wales, with a second red warning issued on 18 February 2022, the day the storm struck, for London, the South East and East of England.

2.8.2 Early modelling (5 days before the storm was to make landfall) by the Environment Agency indicated that the peak of the storm would coincide with the high tide on 18 February 2022**.** The modelling indicated that around 70,000 properties were at risk across the region.

2.8.3 Fortunately the progress of the storm slowed and only a 1m surge was recorded at hightide in Weston-super-Mare. Four hours later at the peak of the storm, a 2m surge was recorded with 3m high waves. If the storm had coincided with the hightide, it is estimated that it would have been a 1 in 1000 year event (0.1% AEP). The Environment Agency estimated that the storm surge would have exceeded the 1981 storms.

2.8.4 An event of this magnitude would have flooded much of the existing urban extent of Weston-super-Mare and considerable areas of agricultural land. The emergency services would have been under pressure, roads would be closed, health facilities and schools would be closed. It is probable that an event of that magnitude would have defeated the flood defences that protect the appeal site.

3.0 How the appeal site would flood

3.1 The majority of the UK storms that have a coastal impact are during the winter months and therefore it is likely that if the appeal site was to flood it would be during the winter months. The previous floods of 1981, 1990 and the near miss in 2022 have been in December, January and February.

3.2 A storm would be tracking across the Atlantic and up the north coast of Cornwall, Deven and eventually Somerset. High winds would be pushing and funnelling the sea water up the Bristol Channel towards the coast creating a storm surge.

3.3 The storm surge and high winds would combine with a high tide and large waves would put pressure on the structural integrity of the defences, weaknesses in the defences would be exposed by water pressure and wave action and earth would be eroded to the point where the defences are breached.

3.4 Once a defence has been breached, the water pours through the gap and continues to erode the embankment and a wave of water heads inland from the north and Woodspring Bay towards the appeal site. The velocity would be high close the embankment and would slow the further it travels from the breach. Local rhynes would fill with water and increasing water levels in the sustainable drainage system of the appeal site would be the first indication of a breach that the future residents would be aware of.

3.5 Water would continue to rise and cars would begin to float when the water reached 60cm deep by which time water would have entered the ground floor of properties. Floating cars would be blown by the high winds across the site towards Ebdon Road.

3.6 Residents would move to the safe refuge if they were home, or try and evacuate by wading in the flood water. Manhole covers would have lifted and there would a danger of being swept away or falling after tripping on an underwater hazard.

3.6 Such an event would also be impacting the West country more widely, roads would be impassable, the emergency services would be stretched and evacuation of affected properties would begin only once resources were found and safe routes out of the area were available.

3.7 The storm would pass and the tide would recede but further high tides would bring more flood water if the breach were not repaired between tides. Standing water is likely to be present on the appeal site for days and due to the low lying nature of land and constrained outlets it would take weeks for water levels to return to normal.

3.8 Homeowners would then have to clean the silt from inside their homes and dry and repair their properties, which would not be in a liveable condition.

4.0 How the coast is managed

4.1 Shoreline management plans (SMP)

4.1.1 The long-term management of the English coast is through policies in the adopted shoreline management plans. Coastal Groups develop, maintain and implement these plans with members from local councils, the Environment Agency and Natural England. They identify the most sustainable approach to managing the flood and coastal erosion risks to the coastline in the:

- short-term (0 to 20 years)
- medium term (20 to 50 years)
- long term (50 to 100 years)

4.1.2 In accordance with the PPG shoreline management plans should form part of the evidence base for plan making and how local plans can support the objectives of the SMPs.

4.1.2 North Somerset Council is a member of the South West Coastal Group and the Severn Estuary Coastal Group, with the boundary being Anchor Head at Weston-super-Mare. The site falls within the coastline that is within the Severn Estuary Shoreline Management Plan – SMP 19, and the flood risk is inundation from two different parts of the coast, firstly at Sand Bay and secondly at Woodspring Bay.

4.1.3 The Shoreline Management Plans assign one of the following policies to each section of the coast:

Policy	**What this means**
Advance the line	Actively take steps to move the current coastline and any associated flood defences further out to sea. There are no policies like this in North Somerset.
Hold the line	Actively take steps to maintain the coast and any flood defences in its current location. This may mean improvements to defences in places.
Management realignment	Actively take steps to change the alignment of the coast and associated defences. This could mean moving the location of flood defences and allowing natural erosion.
No active intervention	Natural processes will be allowed to continue. This could mean allowing erosion to take place or allowing dunes to migrate inland.

4.1.4 It is only sometimes possible, or advantageous, to stop natural processes along the coast. The coast of North Somerset is a critical habitat for many species, including rare wading birds in the winter. Climate change and rising sea levels will mean that this important habitat is slowly reducing through what is known as “coastal squeeze”. This is the loss of natural habitats or deterioration of their quality arising from artificial structures or human actions, preventing the landward movement of those habitats that would otherwise naturally occur due to sea level rise and other coastal processes. Coastal squeeze affects habitat on the seaward side of existing structures. Any interventions on the coast are therefore required to ensure that the natural environment is protected and, where possible enhanced. This will influence and limit the location and type of flood defence that could be constructed in the future, even if funding was available, and especially along the North Somerset coast which has a variety of SSSI, SAC, SAP and RAMSAR designations. The Natural England publication Assessment of the Coastal Access programme under regulation 63 of the Habitats Regulations 2017, July 2019 (CD 8.18) states '*The Waterbird assemblage of the Severn Estuary is one of the 15 largest aggregations in the United Kingdom according to the British Trust for Ornithology (BTO) Wetland Bird Survey, the principal scheme for monitoring the UK's non-breeding waterbirds. It supports significant populations of waterbirds over winter, notably shelduck, gadwall, dunlin and redshank, and is an important staging area in summer/autumn and spring for migratory waterbirds, notably whimbrel and ringed plover. Non-breeding waterbirds from the nearby Chew Valley Lake SPA and Somerset Levels and Moors SPA visit the Severn Estuary, in particular during cold weather when their freshwater habitats are frozen, notably teal, shoveler, golden plover and lapwing*.' Furthermore, defences will not be able to be retained in their current location because of coastal squeeze as Woodspring Bay has a policy of Managed Realignment and there will be a need to provide suitable compensatory habitat for coastal squeeze impacted habitats as shown on Map I of the HRA. The implication of this is that there is uncertainty about the location of future defences and that, due to coastal squeeze implications, the cost of construction will be higher and this increases the level of uncertainty of future funding, if any works are contemplated as SMP policy proposals are not funded The level of uncertainty highlights the need to consider the future undefended scenario when managing the residual risk to the proposed development.

4.1.5 The policies along the North Somerset coast that have an influence on the development site are summarised below. The wording in both tables is taken from the refresh of the second version of the SMPs that has been agreed at the Coastal Group, but is yet to be published:

Policy no.	Location	Policy for the management of the coast now	Policy for management of the coast in the medium term	Long-term policy target for the management of the coast
KIN1	Old Church Road, Clevedon to St Thomas' Head	Managed realignment – set back defence	Managed realignment – set back defence	Managed realignment – set back defence
Why is this policy in place, and what is the proposed management				
Whilst ensuring the impacts of flooding to people, property and infrastructure are reduced, the long-term plan is to allow the natural processes of the estuary to continue. Adaptation with time scales determined by actual sea level rise.				

Policy no.	Location	Policy for the management of the coast now	Policy for management of the coast in the medium term	Long-term policy target for the management of the coast
KIN3	Middle Hope car park at Sand Point to the southern end of Beach Road, Kewstoke	Hold the line	Hold the line	Hold the line
Why is this policy in place, and what is the proposed management				
Continued monitoring and maintenance of existing sand dune defences to continue to protect the wider community and consider issues of coastal squeeze and options for mitigating future flood risk, habitat requirements and future adaptation.				

The location of the policy units is shown in appendix SB2.

4.1.6 The map in appendix SB2 shows that although there is a long-term aspiration for defences that provide the current level of protection to the appeal site, the policies are not statutory, improvements that would flow from the approach contemplated by the SMP are unfunded and there are no assurance that they will be delivered. It follows that improvements to flood defences to match sea level rises associated with climate change cannot simply be assumed to occur when considering schemes of the kind advanced by the appellant. It is no answer to say, “well that would affect other people who presently benefit from the sea defences”. The cost and practicability of addressing that particular issue is something which is being grappled with by policy makers and the highest level, and the whole thrust of the NPPF and PPG is not to exacerbate the problem they must solve (or to distort future decision making) by avoiding the placement of development in unsustainable locations that are prone to flooding. I develop this argument in the next section of my evidence.

5.0 Climate change, funding and future uncertainty.

5.1 National transformational challenge and North Somerset

5.1.1 Shoreline Management Plans, as explained in the “Shoreline Management Plan Guidance” (Defra 2006), are not statutory, and the policies within them are unfunded but devised through a realistic assessment based on current legislation and potential future funding. Defra introduced flood and coastal resilience partnership funding in 2011 and updated it in 2020. This funding mechanism was not envisaged at the time of writing Shoreline Management Plans. The “Ocean and Coastal Management Journal Paper, Responding to climate change around England’s coast - The scale of the transformational challenge”, (Sayes, Moss, Carr and Payo, 2022 CD 8.11) evaluates the preferred shoreline management policy choices set out in the 2nd generation Shoreline Management Plans (SMPs) in the context of the combined influence of relative Sea Level Rise and the lowering of soft foreshores (due to wave-driven surface erosion) to identify those coastal communities likely to be under the highest pressure to relocate.

5.1.2 Table 5 below indicates properties that may experience significant uncertainty regarding the ability to ’Hold-the-Line’ in the longer term (accounting for length of shoreline and properties).

Table 5

Shoreline under pressure – Properties in the coastal floodplain taken from "Responding to climate change around England's coast - The scale of the transformational challenge" (CD 8.11)

	2050 2°C	2080 2°C	2050 4°C	2080 4°C
England				
Properties (res and non-residential) -	159,000	171,000	124,000	133,000
Percentage of all properties (including non-residential properties) in the coastal and tidal floodplain	0.20	0.22	0.16	0.17
Local Authorities with the largest challenge through to 2080s				
North Somerset	34,000 properties			
Wyre	12,000 properties			
Swale	9,000 properties			
Tendring	3,000 properties			
Maldon	3,000 properties			
Suffolk Coastal	3,000 properties			
North Norfolk	2,000 properties			
Cornwall	2,000 properties			
Medway	1,000 properties			
Sedgemoor	1,000 properties			

Note: This is based on top-down national assessment. Local issues that will impact both costs and benefits or the broader case for investment are not considered here.

5.1.3 This means that a more detailed assessment of costs and benefits would be required to be undertaken locally to fully understand the situation in North Somerset, however the assessment undertaken is currently the most detailed assessment of future funding need and assessment of the funding challenge associated with upgrading flood defences.

5.1.4 As can be seen from the table, North Somerset has the highest risk of uncertainty and faces the largest challenge in England. This highlights that using current national funding formula, obtaining national funding along the North Somerset Coast will be a challenge and without national funding existing infrastructure is unlikely to be improved.

5.2 <u>National Capital Funding</u>

5.2.1 Capital funding for replacement or new coastal defences is obtained through a national scheme known as flood defence grant-in-aid (FDGiA) funding and is subject to the government's partnership funding policy. The Environment Agency manages this. The amount of funding that can be applied for is calculated based on the cost of the scheme compared with the benefits of the scheme. The funding that can be claimed is based on the difference between the costs and the benefits. The principles are that a scheme where the benefits are twenty times the cost of the scheme will get more funding than a scheme where the benefits are only five times the cost of the scheme.

5.2.2 Defined 'Outcome Measures' (see list below) are used to determine which applications will receive funding, and if successful how much. To receive an element of FDGiA projects will need to meet strict criteria and, as a minimum in every case, demonstrate that in present value terms the expected whole-life benefits exceed the whole-life costs of the scheme. There are four categories under which projects can attract FDGiA. These are:

- All benefits arising as a result of the investment, less those valued under the other outcome measures (Outcome Measure 1)
- Households moved from one category of flood risk to a lower category (Outcome Measure 2)
- Households better protected against coastal erosion (Outcome Measure 3)
- Statutory environmental obligations met through flood and coastal erosion risk management (Outcome Measure 4)

5.2.3 Unless the scheme is eligible for 100% national funding, the remainder must come from other local sources, such as those that will benefit from a scheme. This could be:

- local communities
- businesses
- developers
- local councils

This is known as partnership funding.

5.2.4 For the defences that protect the development site, a detailed economic assessment of future improvements to the flood defences would be required to determine the level of national funding that would be available from government. An assessment of the cost of the scheme, which would involve upgrading and realignment of three large sluices on three rivers, the Banwell, Congresbury Yeo, and Oldbridge River, and over 20km of embankment. Simplistically, the cost of this would need to be less than the benefits achieved by the scheme i.e. the total number of properties protected. The works would be complex due to the likely ground conditions and the adjacent Severn Estuary SSSI, SAC, SPA and RAMSAR designations. In my opinion, there can be no certainty that, due to the complexity and extent of the works required, the benefits of the scheme would be great enough to obtain significant national funding.

5.2.5 Due to budget constraints, most of the funding must be available from national sources and other partners for an extensive scheme to progress in North Somerset as indicated in North Somerset Council's Local Flood Risk Management Strategy. In my opinion as the Council's Flood Risk Manager, with a responsibility to manage North Somerset Council owned flood defences and work with the Environment Agency on future large schemes that protect the coast, the funding and delivery of future schemes to protect the proposed properties is desirable, at best uncertain and at worst not possible. Consistent with the approach in the PPG, this underlines why the existence of flood defences ought to be ignored when determining flood risk and the sustainability of residential development at the appeal site.

7.0 Sustainability

7.1 The National Planning Policy Framework, sets out what is meant by "sustainable development" and has three overarching objectives: economic, social and environmental. As I will outline below, in my opinion, drawing on the evidence above and from the Environment Agency, the Association of British Insurers (ABI) and others, flooding has a negative impact on the sustainability of the development.

7.2 Economic

7.2.1 The Association of British Insurers (ABI), in its written evidence (FLO0092) (CD 8.7) to the Environment, Food and Rural Affairs Commons Select Committee's 2020 inquiry into flooding indicate that the average cost of repairing a home that has been flooded is estimated at £33,600. On this basis, for a 75 dwelling development such as that proposed by the appellant, the cost of repair would be £2,419,200 excluding the cost of repairing damage to vehicles, external areas and infrastructure associated with the development.

7.2.2 The University of the West of England undertook research on 702 insurance claims and produced a data sheet in 2020 titled, "Enhancing the evidence base for property flood resilience" (CD ref 8.10). One of the key findings of the research was that damage from deep and prolonged flooding can cost nine times as much to repair compared to shallow, shorter-duration flooding. Floods above 300mm were six times more expensive than those below 300mm. Flood duration for floods deeper than 300mm doubled, and drying times increased by a third. Damage from longer duration flooding also costs more and takes longer to repair. Floods lasting more than 24 hours cost on average 2.5 times more to repair than floods lasting less than a day. Claims for floods lasting more than 24 hours also took an extra 100 days to process on average (2/3 extra time). For the undefended 1 in 200 year design flood plus climate change and flood depths of excess of 3m the cost of recovery for a 75 property dwelling could exceed £9,000,000 and in excess of 1m it potentially could exceed £7,000,000.

7.2.3 In my opinion, the claimed economic benefits of the proposed new development and associated affordable housing would therefore be significantly reduced if the development was flooded for the 1 in 200 year plus climate change design event in both the defenced and undefended scenarios.

7.3 Social cost

7.3.1 The UK Health and Security Agency published guidance in 2022 titled “Flooding and health: assessment and management of public mental health” (CD 8.9) , which references the English National Cohort Study of Flooding and Health. The impact on health from flooding is a mixture of direct health effects associated with the flood water and its debris and longer-term health effects that may occur.

Direct health effects include:

- drowning
- physical trauma (for example, concealed or displaced objects, electrocution, fire)
- skin and gut infections from exposure to contaminated flood water

Longer-term health effects include:

- mental health impacts (secondary stressors)
- carbon monoxide poisoning due to inappropriate use of generators
- respiratory disease from mould and damp
- rodent-borne disease
- other health effects (for example, heart attacks)

7.3.2 The English National Cohort Study of Flooding and Health (PHE) 2014 study found that the prevalence of probable psychological morbidity remained high among people whose homes were flooded 2 years after the event (depression 10.6%, anxiety 13.6%, PTSD 24.5%).

7.3.3 In 2021 the Environment Agency published a methodology to enable a calculation of the mental health effects of flooding (CD 8.8). Assuming an average of 1.85 adults per household and £4,136 mental health losses per adult the cost for a 75 property development could be £573,870.

7.3.4 In my opinion, supported by the previously referenced guidance, this shows that there is a significant negative social cost associated with flooding.

7.4 Environmental impact

7.4.1 In 2023 AVIVA published a report titled “Building Future Communities Report – Homes for a changing climate” (CD 8.12). The report found that the emissions from restoring a 3 bedroom flood-hit home equated to 13.9 tonnes CO_2 emissions. That is the equivalent to the emissions from 6.5 return transatlantic flights or taking 55 car trips from Land’s End to John O’Groats.

7.4.2 The report also details the likely items that would need replacement and disposal of after a flood. This includes:

- Laminate flooring
- Furniture including upholstered sofa and upholstered chairs, dining table and chairs, TV units, bookcases and side tables.
- Kitchen consisting of MDF core units with integrated appliances including dishwasher, washing machine, fridge, oven, cooker hood and hob.

7.4.3 In my opinion, flooding of properties is not consistent with the aim of using natural resources prudently, minimising waste and pollution, and moving to a low carbon economy.

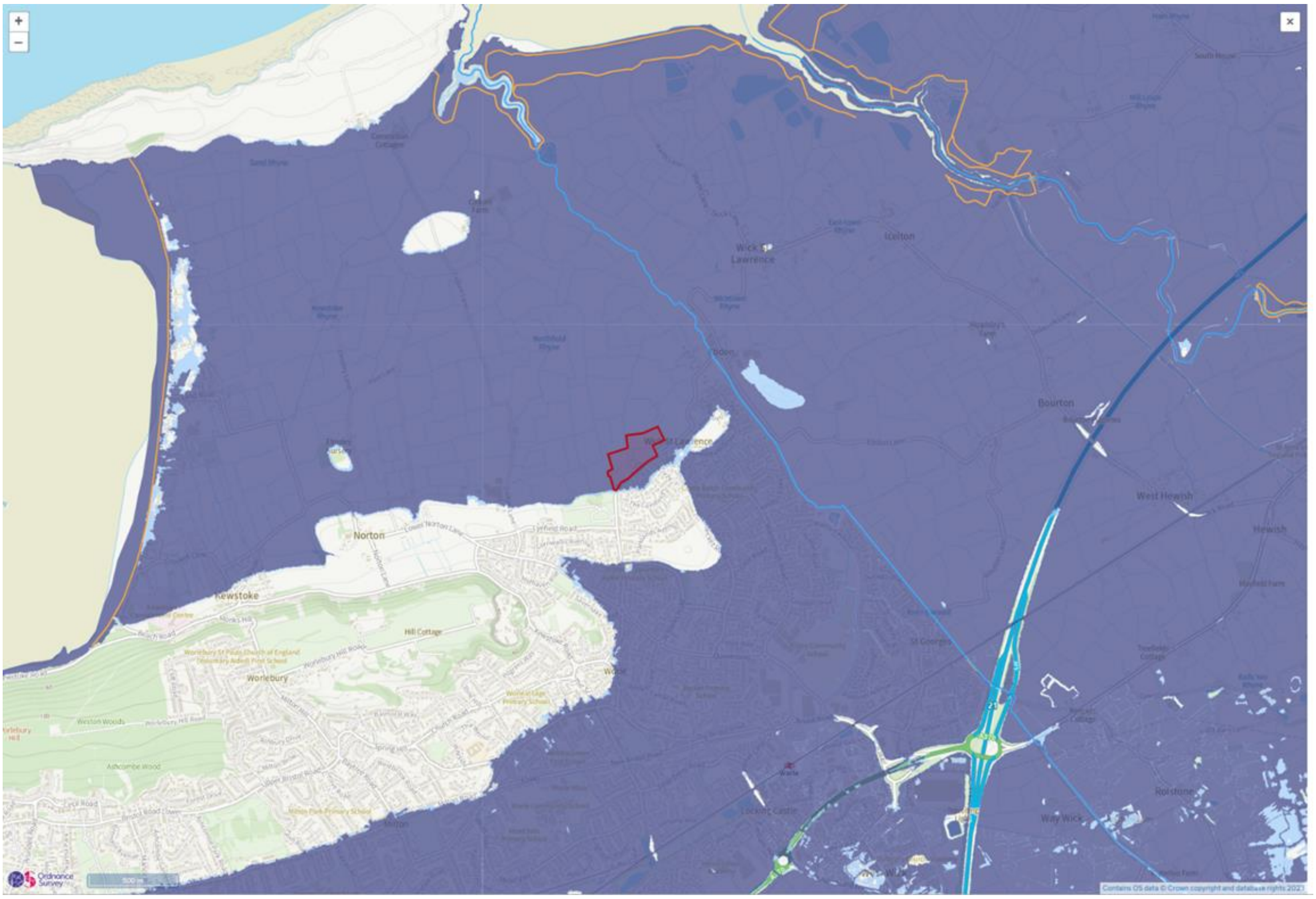
8.0 Conclusion

8.1 The evidence presented here shows that the development site is at risk of flooding for the 1 in 200 year plus climate change design flood event and would result in over 3m deep flood water in the undefended scenario and over 1m deep flood water inside the proposed dwellings in the defended scenario.

8.2 Although there are policies within the current version of the Severn Estuary Shoreline Management Plan to upgrade defences in line with climate change, the policies are not statutory and future funding for the works is at best uncertain.

8.2 In my professional opinion, based on both the undefended and defended 1 in 200 year plus climate change design flood impacts, the proposed development would have negative economic and social costs and negative environmental impacts. Therefore, by building in a flood risk area the development is inherently unsustainable.

Appendix SB1 – Extract from Flood Map for Planning



Appendix SB2 – Location plan of SMP policy units