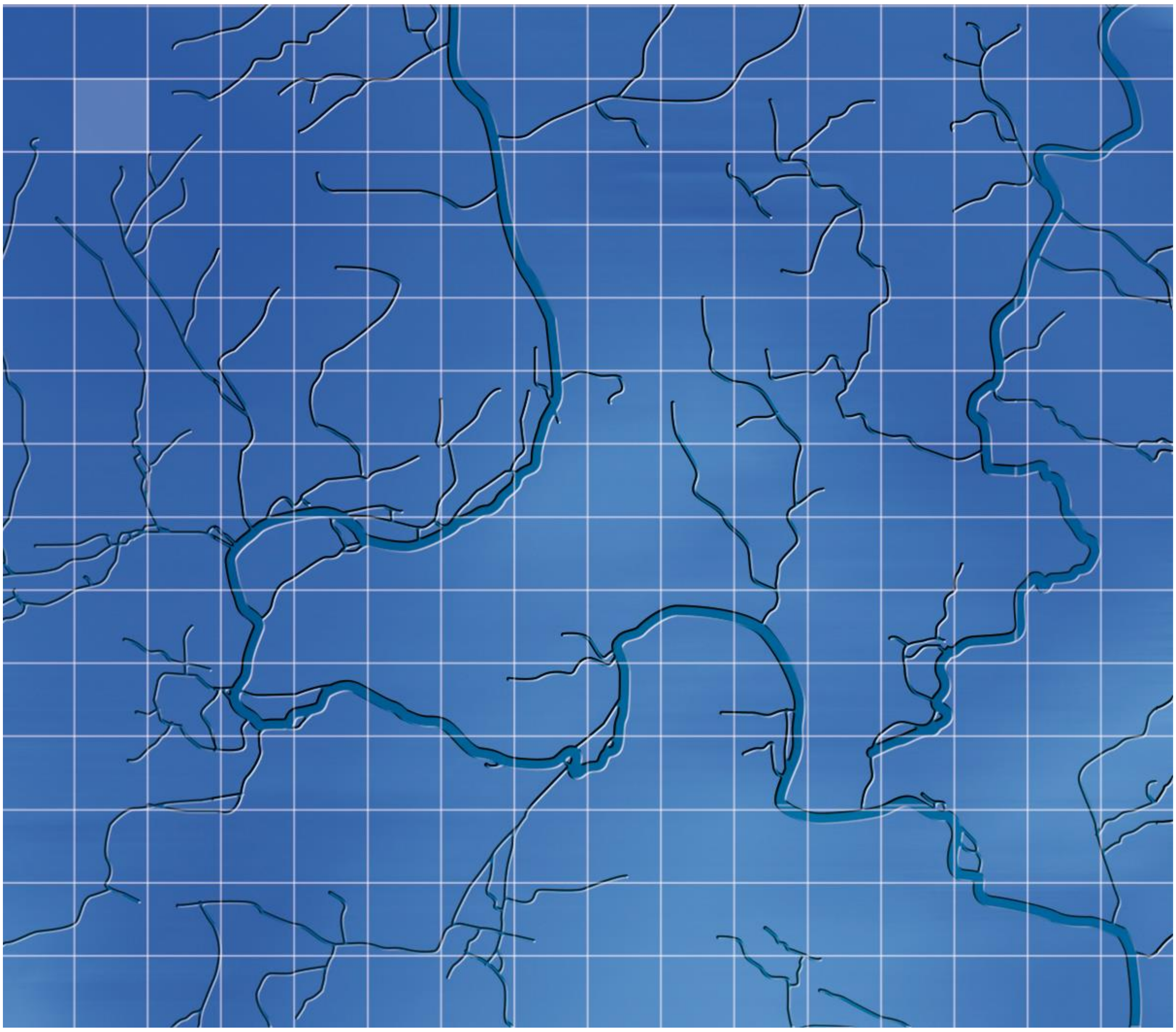
Basildon Borough Council

August 2024

Level 1 Strategic Flood Risk Assessment



WHS

Basildon Borough Council

Level 1 Strategic Flood Risk Assessment

Document issue details

WHS10090

Version	Issue date	Issue status	Prepared By	Approved By
2.2	16/08/2024	Final	Daniel Hamilton (*Principal Consultant*)	Paul Blackman (*Technical Director*)

For and on behalf of Wallingford HydroSolutions Ltd.

CERTIFIED ISO 9001 · ISO 14001 UKAS MANAGEMENT SYSTEMS 001

The WHS Quality & Environmental Management system is certified as meeting the requirements of ISO 9001:2015 and ISO 14001:2015 providing environmental consultancy (including monitoring and surveying), the development of hydrological software and associated training.

Registered Office Stables 4, Howbery Business Park, Wallingford, OX10 8BA
www.hydrosolutions.co.uk

Contents

1 Introduction

1.1 Scope of Assessment

Wallingford HydroSolutions (WHS) has been commissioned by Basildon Borough Council (BBC) to undertake a Strategic Flood Risk Assessment (SFRA) to identify the extent of flood risk and reflect the updated Critical Drainage Areas (CDAs) and climate change data that have occurred since the Borough's previous 2018 Level 1 SFRA. This updated work will therefore be used to inform the new Local Plan as well as to inform decision making by Planning Officers.

The study will identify key flood risk constraints within the development plan area to enable BBC to assess the suitability of future development and inform land use policy with regards to flood risk.

1.2 SFRA Objectives

SFRAs are overarching technical studies that are used to guide development and inform the selection of sites in relation to flood risk. A major part of this study will be to assess flood risk from all sources, which will involve the collation of available model data, historical information on flooding and details on flood risk management infrastructure. Flood risk will be assessed for the baseline and the future scenario, which will consider the latest climate change guidance.

This information will enable BBC to make informed decisions on allocating sites for development in the local plan and be used by BBC to identify sites where a further level 2 SFRA assessment is required. Figure 1 shows the main watercourses within the Basildon Borough administrative boundary.

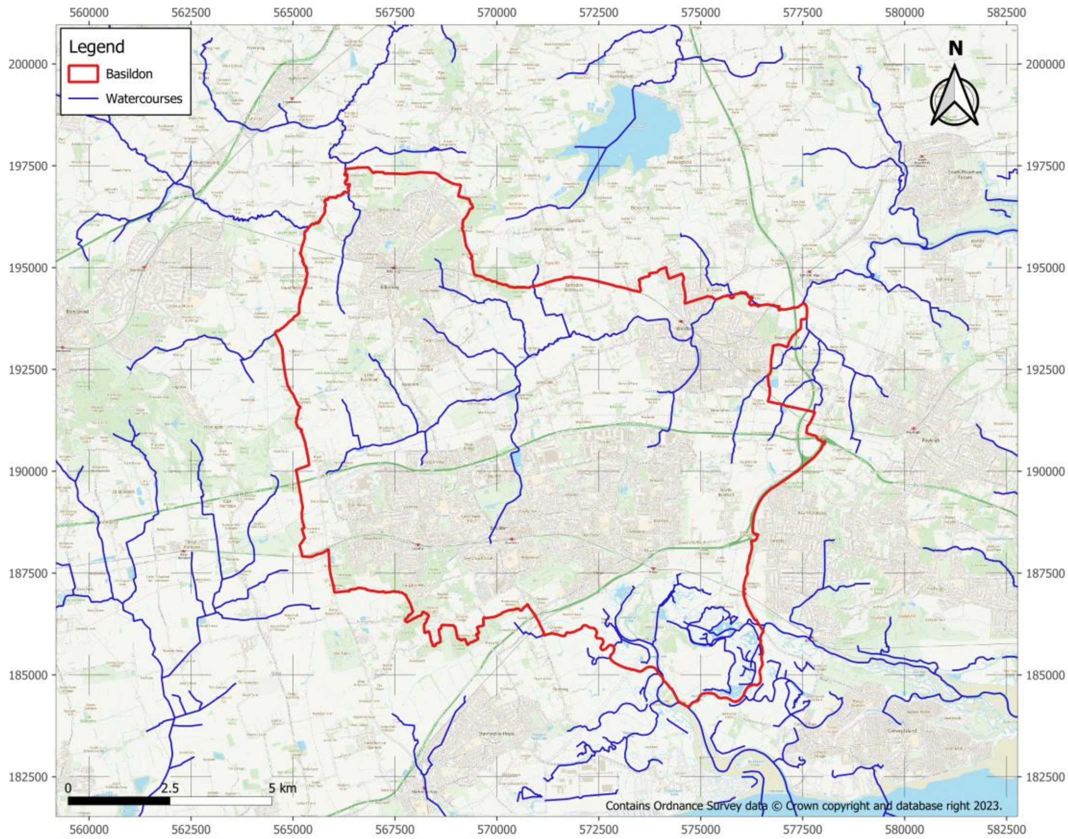


Figure 1 – Overview of Study Area

1.3 Overview of National Planning Policy

1.3.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF)[1] sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. The latest NPPF was revised in December 2023 and replaces the previous iteration of the NPPF published in September 2023.

In terms of flood risk, the NPPF states that a sequential risk-based approach (the sequential test) should be taken for development to ensure that it is directed away from areas at highest risk (see section 3.1 for more details). Where development is necessary in such areas, an exception test should be applied ensuring development is i) made safe for its lifetime without increasing flood risk elsewhere, and ii) provides wider sustainability benefits to the community (see section 3.2 for more details).

To inform strategic development policies in the context of flood risk, the NPPF specifies the requirement for an SFRA that considers flood risk from all sources, the potential impacts of climate change and the effects of development on flood risk. The SFRA should take account of flood risk management policies and provide the basis for application of the sequential test.

1.3.2 NPPF Flood Zones

Flood risk is a function of the probability of a flood occurrence and the direct consequences to the community or a receptor.

The NPPF categorises areas within the fluvial floodplain into zones of low, medium and high probability, as shown in Table 1.

---

[1] Ministry of Housing, Communities & Local Government (2023) *National Planning Policy Framework*, https://assets.publishing.service.gov.uk/media/65a11af7e8f5ec000f1f8c46/NPPF_December_2023.pdf

Table 1- Flood Zones

Flood Zone	Definition
Flood Zone 1 (Low Probability)	Land having a less than 0.1% annual probability of river or sea flooding.
Flood Zone 2 (Medium Probability)	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding.
Flood Zone 3a (High Probability)	Land having a 1% or greater annual probability of river flooding; or land having a 0.5% or greater annual probability of sea flooding.
Flood Zone 3b (Functional Floodplain)	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

1.3.3 Planning Practice Guidance - Flood Risk and coastal change

The Planning Practice Guidance (PPG)[2] advises how to take account of and address the risks associated with flooding and coastal change in the planning process. It supports and aligns with the principles espoused by the NPPF but sets out more specific guidance for developers and planners. The main areas covered by the PPG include:

- Taking flood risk into account in preparing plans
- Site-specific flood risk assessments (FRAs)
- The sequential approach & exception test
- The role of the Environment Agency (EA) and Lead Local Flood Authorities (LLFA)
- Addressing residual flood risk
- The flood risk issues raised by minor developments & changes of use
- Permitted development rights and flood risk
- Proximity to watercourses and the need for a flood risk activity permit
- Sustainable drainage systems (SuDS)
- Flood resistance and flood resilience
- Planning and development in areas of coastal change
- Flood Zone and flood risk tables

[2] Ministry of Housing, Communities & Local Government (2022) *Flood risk and coastal change*, https://www.gov.uk/guidance/flood-risk-and-coastal-change

In terms of taking flood risk into account in preparing plans, the document outlines how local planning authorities (LPAs) should use SFRAs to:

- Inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies;
- Apply the sequential test and, where necessary, the exception test when determining land use allocations;
- Inform the allocation of land to safeguard it for flood risk management infrastructure;
- Inform policies for change of use and reducing the causes and impacts of flooding;
- Identify the requirements for site-specific FRAs in particular locations, including those at risk from sources other than river and sea flooding;
- Determine the acceptability of flood risk in relation to emergency planning capability;
- Help demonstrate how the adaptation to climate change could be met.

1.3.4 Climate Change

The EA release guidance[3] on how local planning authorities, developers and their agents should use climate change allowances in FRAs. Making allowances for climate change minimises vulnerability and provides resilience to flooding and coastal change.

The climate change allowances are predictions of anticipated change and are provided for:

- Peak river flow
- Peak rainfall intensity
- Sea level rise
- Offshore wind speed and extreme wave height

There are allowances for different climate scenarios over different epochs, or periods of time, over the coming century. For Basildon the peak river flow and peak rainfall intensity allowances are relevant and are covered in more detail below.

Peak river flow

Peak river flow allowances show the anticipated changes to peak flow by management catchment. Management catchments are sub-catchments of river basin districts. The range of allowances is based on percentiles, as follows.

- Central allowance is based on the 50th percentile
- Higher Central allowance is based on the 70th percentile
- Upper End allowance is based on the 95th percentile

The BBC administrative boundary crosses two management catchments the Combined Essex Management Catchments and the South Essex Management Catchment. As the Combined Essex Management Catchment applies to the majority of the Borough, for consistency this has been applied when determining potential climate change impacts in the SFRA.

Note, applicants for non-strategic allocation sites falling within the South Essex Management catchment can use the allowances pertaining to this management catchment when applying the Sequential Test in their site-specific FRAs. This includes the allowances for peak flows and for peak

[3] EA (2022), *Flood risk assessments: climate change allowances*, https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

rainfall intensity. The peak river flow allowances for the two management catchments are summarised in Table 2.

Table 2- Peak River flow allowances for Basildon Borough Management Catchments

Allowance	Total Potential Change (2020s)	Total Potential Change (2050s)	Total Potential Change (2080s)
South Essex Management Catchment			
Central	6%	5%	17%
Higher	11%	11%	26%
Upper	22%	27%	48%
Combined Essex Management Catchment			
Central	7%	8%	25%
Higher	13%	16%	38%
Upper	27%	37%	72%

The guidance states that both the central and higher central allowances should be assessed as part of an SFRA. When applied at a site specific level for the purposes of a FRA, the flood risk vulnerability classification as defined in the NPPF should first be used to classify the vulnerability of your development. Subsequently the location of the development with respect to different flood zones should be determined. Following this exercise, the recommended allowances are summarised below:

In Flood Zones 2 or 3a for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – use central allowance (development should not be permitted in Flood Zone 3a)
- more vulnerable, less vulnerable & water compatible – use the central allowance

In Flood Zone 3b for:

- essential infrastructure – use the higher central allowance
- highly vulnerable, more vulnerable & less vulnerable – development should not be permitted
- water compatible – use the central allowance

The peak river flow allowances should also be applied to development that is currently located in Flood Zone 1 but might be in Flood Zone 2 or 3 in the future.

Peak rainfall

Increased rainfall affects surface water flood risk and the design of drainage systems. Peak rainfall allowances are provided for the central and upper percentile and across two epochs. Once more the allowances are specified for each management catchment. The two management catchments spanning the Borough have the same central and upper end allowances. These are summarised in Table 3.

Table 3- Peak rainfall allowances applicable to Basildon Borough

Allowance	Total Potential Change (2050s)	Total Potential Change (2070s)
South Essex Management Catchment		
Central	20%	25%
Upper	45%	40%
Combined Essex Management Catchment		
Central	20%	25%
Upper	45%	40%

In terms of what allowances to apply the guidance is based on the proposed lifetime of the development. For developments with a lifetime beyond 2100, FRAs should assess the upper end allowances for both the 1% and 3.3% annual exceedance probability (AEP) events for the 2070s epoch (2061 to 2125).

For development with a lifetime between 2061 and 2100 take the same approach but use the central allowance for the 2070s epoch (2061 to 2125).

For development with a lifetime up to 2060, take the same approach but use the central allowance for the 2050s epoch (2022 to 2060).

Tidal Allowances

There are a range of allowances for sea level with the higher central and upper end allowances being based on the 70th and 95th percentiles respectively. A percentile defines the proportion of possible scenarios that fall below an allowance level.

The sea level allowances for the Anglian area which is relevant to the Basildon Borough can be seen in Table 4 below.

Table 4 – Sea level allowances by Anglian area for each epoch in mm for each year (based on a 1981 to 2000 baseline) – the total sea level rise for each epoch is in brackets.

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Anglian	Higher central	5.8 (203)	8.7 (261)	11.6 (348)	13 (390)	1.20
Anglian	Upper end	7 (245)	11.3 (339)	15.8 (474)	18.1 (543)	1.60

1.3.5 Flood and Water Management Act 2010

The Flood and Water Management Act (FWMA) (2010)[4], sets out legislation on the management of risks in connection with flooding and coastal erosion for the United Kingdom. It highlights the need for an effective flood risk strategy, which must be developed, maintained, applied, and monitored regularly to adequately manage flood risk.

[4] UK Parliament (2010) *Flood and Water Management Act*, https://www.legislation.gov.uk/ukpga/2010/29/contents

It gives a new responsibility to the EA for developing a National Flood and Coastal Risk Management Strategy and gives a new responsibility to local authorities (LAs), as LLFAs, to co-ordinate flood risk management in their area. Essex County Council (ECC) is the LLFA for BBC, whilst Thurrock Council is the neighbouring LLFA. ECC acting as the LLFA carries out a range of functions including the following:

- Being statutory consultee to LPAs in determining major planning applications and the preparation of their Local Plans. The LLFA provide consultation responses on surface water drainage and implement Sustainable Drainage Systems (SuDS) through the planning process.
- Undertaking Section 19 Flood Investigations for significant flooding incidents (typically defined as five or more properties).
- Maintaining a register of flood assets and managing assets which have an impact on flood risk from ordinary watercourses and surface water (Main River assets are managed by the EA).
- Developing flood risk management plans and strategies, including the mapping of critical drainage areas.
- Managing and granting ordinary watercourse consent for any works on or near an ordinary watercourse
- Managing the planning and installation of flood alleviation schemes, in addition to commissioning works to plan and prioritise flood risk management activities in relation to surface water runoff or groundwater.

Further details relating to ECC's role as the LLFA can be found on the ECC website[5] and are summarised in the Essex Local Flood Risk Management Strategy 2018[6].

1.3.6 National Flood and Coastal Erosion Risk Management Strategy for England

The Flood and Water Management Act 2010 sets out how the EA must develop, maintain and apply a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England.

The most recent strategy was published in July 2020[7] and additional updates to the document were last made on the 7th of June 2022 at the time of writing. The strategy sets out how the EA will manage the risks from flooding and coastal erosion across England. It clarifies roles and responsibilities before setting out the policies and direction for all England's Flood Risk Management Authorities to follow, with measures to explain how targets will be achieved. The strategy highlights the importance of climate resilience in the development of future infrastructure.

---

[5] Essex County Council (2024), *Our duties as a Lead Local Flood Authority*. https://flood.essex.gov.uk/our-strategies-and-responsibilities/our-duties-as-a-lead-local-flood-authority-llfa/#:~:text=maintain%20a%20register%20of%20assets,results%20from%20these%20investigations%20public

[6] Essex County Council (2018) *Essex Local Flood Risk Management Strategy (LFRMS)* https://flood.essex.gov.uk/our-strategies-and-responsibilities/our-local-flood-risk-management-strategy/

[7] EA (2020) *National Strategy for Flood and Coastal Erosion Risk Management*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/920944/023_15482_Environment_agency_digitalAW_Strategy.pdf

1.3.7 Non-statutory guidance for SuDS

The non-statutory guidance[8] for SuDS published by DeFRA (2015), sets out the technical Standards for SuDS systems in England. For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year and 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event. For developments which were previously developed, the peak runoff rate from the development must be as close as reasonably practicable to the equivalent greenfield runoff rate over the same area; never exceeding the rate of discharge from the development prior to redevelopment for any event.

1.3.8 Overview of Local Guidance and Past Studies

LLFA Documents

As the LLFA, ECC is responsible for flooding from surface water, groundwater and ordinary watercourses and develop a Local Flood Risk Management Strategy. The strategy sets a long-term programme for the reduction of flood risk, establishes how to identify areas where flood risk management will achieve multiple benefits and seeks to facilitate greater engagement with the community. The current strategy published in 2018[6] is due for review and an update in the near future.

The LLFA also sets local standards for SuDS, which they expect major planning applications for development to meet and adhere to. These are detailed in the SuDS Design Guide for Essex[9].

The LLFA also provides a pre-paid SuDS planning advice service[10] which enables planners to be informed of SuDS and drainage requirements for their proposed development.

The LLFA also prepares and maintains Surface Water Management Plans (SWMP). These are key strategic documents which enable the LLFA to plan for future flooding and to better understand the flood risk within different parts of the county. The South Essex SWMP[11] defines the Critical Drainage Areas (CDA's) within the study area. It also provides evidence to inform the determination of planning applications and local plan preparation.

Related to this is the Essex Design Guide[12] (EDG), it is an Essex-wide supplementary guidance developed through the Essex Planning Officers' Association (EPOA) endorsed by all the Essex local planning authorities (LPAs) including BBC. The EDG links to the SuDS Design Guide for Essex and provides extensive guidance on the application of SuDS in relation to a number of issues, for example climate change and health and wellbeing.

ECC have also published a Water Strategy for Essex[13]. It identifies Essex as a water stressed area, explains how the county is performing in relation to national targets for consumption and what steps should be taken to address the issues raised. Specifically, the high likelihood of Essex suffering water

---

[8] Department for Environmental, Food and Rural Affairs (2015) *Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

[9] ECC (2020) *SuDS Design Guide for Essex* https://www.essexdesignguide.co.uk/suds

[10] Essex County Council (2020) *Apply for SuDS planning advice* https://flood.essex.gov.uk/new-development-advice/apply-for-suds-advice/

[11] Essex County Council (2020), *South Essex SWMP*, https://www.essexdesignguide.co.uk/suds/surface-water-management-plans/south-essex-inc-rochford-castle-point-and-basildon/

[12] EPOA (2018) Essex Design Guide https://www.essexdesignguide.co.uk/

[13] Essex County Council (2024) *Water Strategy for Essex*, https://www.essex.gov.uk/sites/default/files/2024-03/Water%20Strategy%20for%20Essex%20March%202024.pdf

shortages by 2050 is highlighted and the priority for water reuse to be implemented at the top of the SuDS drainage hierarchy where possible.

Local Plan Documents

Proposed updates to existing planning policy in Basildon Borough were previously put forward in the Local Plan 2014 - 2034[14] until its subsequent withdrawal[15]. It will be replaced by a new Local Plan that will be supported by this report. The Local plan 2014-2034 previously provided a proposed framework for the development of new homes, jobs, community facilities and infrastructure within the Borough intended for up to 2034 prior to its removal. This was largely informed by the Level 1 SFRA completed in 2018. The plan previously set out several polices relevant to the management of flood risk, however following its withdrawal these were not applied.

1.4 Data Sources

To inform the assessment of flood risk, existing information and model data have been identified and collated for different sources of flooding. Any recent and relevant studies on flood risk within the study area have also been incorporated into the SFRA, along with details on flood defences and flood management schemes. This information and the available model data have been used to assess flood risk across the study area. Detailed flood maps utilising the latest GIS software have also been created. The main sources of data to inform this SFRA include:

- EA Rivers and Sea Flood Maps[16] – to quantify fluvial flood risk where detailed model data are not available.
- EA Surface Water Flood Maps[17] – to quantify the pluvial flood risk and flood risk from ordinary watercourses where appropriate.
- EA Reservoir Flood Mapping[18] – to quantify the risk of reservoir flooding.
- EA Historical Flood Map[19] and Recorded Flood Outlines[20] – to review historical flood events.
- Ordnance Survey Open Rivers[21] – to map the location of main rivers and ordinary watercourses.
- Crouch model (2016)[22] – CH2M 1D to assess fluvial flood risk from the River Crouch and affected tributaries.

[14] Basildon Borough Council (2018) *Basildon Borough Revised Publication Local Plan 2014 – 2034* https://www.basildon.gov.uk/media/8646/Basildon-Council-Revised-Publication-Local-Plan-Oct-2018/pdf/Basildon_Council_-_Revised_Publication_Local_Plan_-_Oct_2018.pdf
[15] Basildon Borough Council (2023) *Statement from Council Leader following withdrawal of Local Plan* https://www.basildon.gov.uk/article/9092/In-the-news-Statement-from-Council-Leader-following-withdrawal-of-Local-Plan
[16] EA (2024) *Flood Map for Planning (Rivers and Sea) – Flood Zone 3* https://www.data.gov.uk/dataset/cf494c44-05cd-4060-a029-35937970c9c6/flood-map-for-planning-rivers-and-sea-flood-zone-3
[17] EA (2024) *Risk of surface water flooding* https://environment.data.gov.uk/DefraDataDownload/?Mode=rofsw
[18] EA (2024) *Risk of Flooding from Reservoirs - Maximum Flood Extent* https://www.data.gov.uk/dataset/44b9df6e-c1d4-40e9-98eb-bb3698ecb076/risk-of-flooding-from-reservoirs-maximum-flood-extent-web-mapping-service
[19] EA (2024) *Recorded Flood Outlines,* https://www.data.gov.uk/dataset/16e32c53-35a6-4d54-a111-ca09031eaaaf/recorded-flood-outlines
[20] EA (2024) *Historic Flood Map,* https://www.data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map
[21] Ordnance Survey (2023) OS Open Rivers *https://www.data.gov.uk/dataset/dc29160b-b163-4c6e-8817-f313229bcc23/os-open-rivers*
[22] CH2M (2017) *Crouch Modelling*

- Thames Estuary model (TE2100) (2022)[23] – to assess tidal flood risk from the River Thames and affected tributaries.
- East Anglian Coastal Modelling (2018)[24] – to assess coastal flood risk along the East Anglian Coastline which includes the Thames Model.
- JBA (2015) Essex Critical Ordinary Watercourse modelling (COWS)[25] – This relates to modelling of the Rawreth Brook and the JBA 2015 re-run of the model.
- Flood incident data provided by LLFA[26] – to provide information on local and historical flooding from surface water flooding across the study area.
- EA flood defence structures[27] - to assess existing and informal flood defences present.
- British Geological Survey (BGS) geoviewer[28] - To determine local bedrock and its expected permeability informing assessment of groundwater flood risk.
- Soilscapes map[29] – To determine local soil and its expected permeability informing assessment of groundwater flood risk.
- Anglian Water Sewer Flooding Data[30] – To determine risk of sewer flooding based on incidences of sewer flooding.
- Previous flood risk studies previously completed by BBC and the LLFA (see section 1.3.8).
- The South Essex SWMP 2020 – Including model findings and Critical Drainage Area (CDA) designations.

1.5 Limitations & Assumptions

1.5.1 Age and Extent of Modelling Data

The EA regularly review and update the Flood Map, with any amendments to the Flood Zone mapping being informed by more detailed information as and when it becomes available. This can either be as a result of more detailed hydraulic modelling carried out by the EA and/or external parties; or recorded flood extents following a flood event. Furthermore, real-world upgrades to flood defence infrastructure will also alter the degree of flood risk in a particular area. In this regard, this SFRA is a snapshot of flood risk based on data available at the time of publication, with the conclusions on flood risk presented subject to change in accordance with any updates to the EA Flood Map and existing flood defence infrastructure.

Detailed modelling data are available for the main watercourses running through Basildon Borough, however there are many watercourses which are not included in the available detailed hydraulic models. The flood extents for these watercourses are likely to be based on JFLOW mapping. JFLOW is appropriate for a strategic assessment of flood risk, however it is generally not advised for site-specific purposes. In this regard a site-specific FRA should undertake detailed modelling to derive flood levels and extents for a range of events considering the impacts of climate change. The findings of which should be used to inform site design and ensure the site is safe for its lifetime.

---

[23] EA (2022) *Thames Estuary Modelling*
[24] JBA (2019) *East Anglian Coastal Modelling*
[25] JBA (2015) Essex Critical Ordinary Watercourse Modelling (COWS)
[26] BCC (2023) *Flood Incidents*
[27] EA (2023) *AIMS Spatial Flood Defences (inc. standardised attributes)* https://www.data.gov.uk/dataset/cc76738e-fc17-49f9-a216-977c61858dda/aims-spatial-flood-defences-inc-standardised-attributes
[28] BGS (2023) *BGS Geology Viewer*, https://geologyviewer.bgs.ac.uk/
[29] Cranfield Soil and Agrifood Institute (2023) *Soilscapes map*, http://www.landis.org.uk/soilscapes/
[30] Anglian Water (2023) *Sewer Flooding Data for Basildon Borough* (*DG5)*

1.5.2 Flood Zone 3b (Functional Floodplain)

In the EA flood map, the functional floodplain or Flood Zone 3b (FZ3b) is not distinguished from zone 3a. As part of their SFRAs, LPAs should identify areas of functional floodplain and its boundaries accordingly.

As shown in Table 1, the flood extents for the 3.3% AEP (30-year) event and/or any land that is designed to flood is generally considered the basis for the delineation of FZ3b. Therefore, as a starting point, it is proposed that land which naturally floods during a 30-year event or is designed to flood should be classified as FZ3b.

The SFRA designates flood storage reservoirs and washlands as FZ3b, this is to ensure that this land is safeguarded for current and future flood risk management purposes thereby ensuring that they retain their flood risk function.

Note, existing solid buildings falling within the FZ3b extent are demarcated as FZ3a in this SFRA and for future planning purposes.

The 3.3% extent is available for some of the modelling data supplied, however a number of the models do not include this scenario. These include the following:

- Coastal modelling within the Thames Model for which events are run for the 0.1% and 0.5% AEP events (in addition to those same events run with climate change factors).
- Tidal Modelling for the Thames Estuary model for which events are run for the 5%, 0.5%, 0.1%, 0.05% and 0.01% AEP (in addition to those same events run with climate change factors).

As a precautionary approach in these areas the FZ3a extent pertaining to the 0.5% AEP event was assumed to be FZ3b. This approach is suitable for the purposes of a level 1 SFRA. However, where detailed modelled outlines for 3.3% AEP event are unavailable for sites at risk of fluvial flooding, further detailed modelling will need to be undertaken to derive extents for this event. This should be carried out as part of a site-specific FRA.

1.5.3 Assessing the impacts of Climate Change

As part of their SFRAs, LPAs should assess and map the effects of climate change on flood risk to identify areas where flood risk will increase and ensure that future development is sustainable.

Where modelling predates the latest climate change allowances and has not been updated, the modelling results supplied do not contain a suite of runs assessing the latest allowances. Instead, the models (Essex COWS and River Crouch) apply the old blanket allowance of 20%. Fortunately, the old 20% allowance aligns reasonably well with current central allowances (25%) for the Combined Essex Management Catchment. Thus, results from the 1.0% AEP + 20% event are used as a proxy to assess the central allowance in this case. Additionally, as the there is no upper allowance associated with the models, the 0.1% AEP event is utilised as a proxy.

Within the Thames Estuary Model a range of fluvial and tidal allowances have been assessed. The fluvial uplifts for the higher central and upper end allowances of 35% and 70% were applied. The central allowance was not applied. The allowances applied align sufficiently well with 38% and 72% for the Combined Essex Management Catchment to be used as proxies. In terms of the tidal allowances the magnitude of sea level rise align with the UKCP18 Climate Change Allowances Report[31] and the allowances stated for the Anglian area pertaining to Basildon.

Where detailed modelling data is unavailable, the Flood Zone 2 extent shown in the EA's fluvial flood map is used to assess the impacts of climate change in general.

For surface water flooding the EA's current flood maps do not incorporate climate change. However, as part of the South Essex SWMP, the LLFA carried out surface water modelling which includes an assessment of the 1.0% AEP plus 20% event and 1.0% AEP plus 40% event, aligning with the latest allowances used for rainfall intensity. This data is presented in section 2.1.3.

The approach outlined above is suitable for the purposes of a level 1 SFRA. However, where detailed modelled outlines for new climate change scenarios are unavailable for sites at risk of fluvial flooding, further detailed modelling will need to be undertaken to refine the assessment of the latest allowances. This should be carried out as part of a site-specific FRA.

2 Summary of Flood Risk in Basildon Borough

2.1 Review of Flooding Sources

The following sections provide a detailed summary of baseline flood risk from all relevant sources across the Basildon Borough. They identify where flood risk is most significant and is likely to pose a risk to people or property. Where data are available, the future scenario considering the impacts of climate change is also considered. A series of supporting GIS maps offer a visual representation of the risks outlined and are provided in Appendix 1-8 of this report.

The assessment of flood risk has been based on the collation of available model data, historical information on flooding and details on flood risk management infrastructure.

2.1.1 Fluvial and Tidal Flood Risk

The risk of fluvial flooding has been assessed using the mapped flood extents through the Basildon Borough, as shown by existing hydraulic modelling data and the EA's Fluvial Flood Map. Flood risk from the main rivers running across the Borough is summarised below. Larger watercourses are usually designated as main rivers, they are managed by the EA.

River Crouch

The risk of fluvial flooding has been assessed using the mapped flood extents through the Basildon Borough area, as shown by the EA's Fluvial Flood Map. The predicted flood extents for the River Crouch within the Basildon Borough appears to be largely informed by the River Crouch Model which was developed by CH2M as part of the Modelling and Forecasting 2015-2016 Fluvial Q2 package. This work formed an update to the 2007 River Crouch model constructed by JBA.

The model includes modelled sections of Runwell, Wickford, Basildon (including Pipps Hill Washland) and Laindon Barnes. In addition to these areas, Anglian Water's surface water model as well as Basildon Gloucester Park and Nevendon Brook models are incorporated.

The River Crouch, the largest river within the Basildon Borough, flows eastwards through the Borough beginning North of Southfields and exiting the Borough's boundary to the North East of Wickford. The river is adjoined by multiple tributaries that confluence with the main channel at regular intervals during its eastwards flow through the Borough. The Basildon Brook constitutes one of the three main tributaries to the River Crouch.

The main body of the River Crouch passes through the north of Wickford where it presents a flood risk to areas including the High Street within Flood Zone 2. Following a confluence with a tributary, the main body of the river then runs northeast adjacent to the Runwell Road, again presenting a flood risk to the surrounding built up area within Flood Zone 2. From here, the River Crouch then extends along an area of the North East boundary of the Basildon Borough where it is surrounded by farmland, thereby limiting the flood risk posed to built up areas in this section.

Within the River Crouch's western section, it is joined by its first notable tributary to the north of Steeple View. Flood maps demonstrate that whilst only a few houses within Steeple View are at risk within Flood Zone 3, a number of houses are at risk within Flood Zone 2. This is also the case in the area east of the confluence with the main body of the river where a notable number of properties are at risk in the river's immediate vicinity of the A176 and St Agnes Road.

Moving eastwards along the River Crouch, the tributary running adjacent to Pipps Hill Road North and Harding's Elms Road presents significant risk to a number of properties in this area within Flood Zone 2. Additionally, within the Nevendon Brook, the tributary extending northwards from Burnt Mills through Wickford presents significant flood risk to roads either side of the Golden Jubilee Way A132 and Radwinter Avenue.

It is additionally noted here that the River Crouch is tidally influenced, and as such joint probability analysis was carried out to determine the impact of tidal influence on flooding to the area as part of the River Crouch model. This demonstrated that flood risk can be influenced by the local tidal levels, however the flood extents of the joint probability events were observed to be less extensive than the equivalent fluvial only event. Therefore, fluvial flood risk is considered to be the primary flood mechanism for the River Crouch within Basildon Borough.

River Wid

In addition to the Crouch, several other watercourses pose a flood risk to built up areas. These include the Northeast area of Billericay and buildings along London Road to the east of Haverings Grove which are exposed to flood extents from the River Wid.

Thames Estuary

The Thames Estuary is the primary source of tidal flood risk to the Basildon Borough. Its floodplain surrounds Pitsea where extents cover much of Timberman's Creek and affect areas near Cambridge Lodge and Honey House to the south. The southeast of Pitsea is in proximity to Flood Zones 2 and 3 however the flood extents primarily extend over a rural area consisting of a series of connected waterbodies that act as a flood plain. As a result, flood extents are on the opposing side of the A13 to the significantly built-up areas, and extents do not reach the Pitsea Train Station. However, parts of the connecting railway track appear to be impinged upon by Flood Zone 2, and in some cases Flood Zone 3.

Other Watercourses

Looking to the Rawreth Brook, floodwater extents extend over parts of the North Benfleet (particularly Flood Zone 2) as well as across the Southend Arterial Road and A130 in areas close to the Eastern boundary of the Basildon Borough Area.

A Borough-wide map and local maps showing modelled flood outlines in the affected areas for the main rivers in Basildon are provided in Appendix 4.

Risk of Breach

It should be noted that some areas contain flood defences within Basildon Borough and a risk of breaching can be seen to occur in areas including the Vange Creek in the south of the Borough, the main body of the River Crouch and the Rawreth Brook.

Should BCC allocate any sites for development in areas which have been shown to inundate during a breach event, these will be assessed as part of a level 2 SFRA with new breach modelling potentially required. Note, any windfall or unallocated sites will require new breach assessments to be included as part of their site level FRAs if in applicable locations.

2.1.2 Climate change

This section provides a summary of potential impacts of climate change on fluvial flood risk based on the modelling data available. Appendix 2 shows the fluvial flood mapping when accounting for climate change.

River Crouch

When considering the Crouch Model outputs under the central allowance (25%) for the 1% AEP event there are significant increases in flood extents within the centre of Wickford including along London

Road and Nevendon Road. There is also increased risk to the sewage treatment works at Burnt Mills, Pipps Hill Road North and to residential areas along the Hardings Elms Road and Runwell road. Note, flood extents also increase in more open areas such as the Wickford Memorial Park and north of Dunton Road adjacent to Steeple View.

When considering the higher central allowance (65%), the same areas are affected. In particular, the centre of Wickford experiences significantly increased flood extents; even compared to those of the central climate change allowance. Specifically, a high number of additional residential structures are observed to be at risk from the increased extents along London Road, A132 and Runwell Road. An increased number of properties north of Steeple view are also observed to be inundated.

Essex Ordinary Watercourse Modelling

For the Rawreth Brook, the 1% AEP event with the 20% uplift (utilised as a proxy for the Central Allowance) there are limited increases in flood extents impacting upon built up areas. The main built-up area impacted upon is seen to the north of North Benfleet. This includes to the north of the Southend Arterial Road adjacent to Pantile Farm where a number of properties can be observed to be at an increased risk of flooding. Additionally, increased extents affect a number of properties within the northwest of the Basildon Borough by Rawreth Shot.

East Anglian Coastal Modelling

For the East Anglian Coastal Modelling, a different approach is taken to that of the relevant fluvial models, with the tidal allowances applied. Specifically, sea level rise estimates were based on the latest UKCP09 sea-level change guidance using the medium emission 95th percentile scenario and the NPPF sea level rise guidance for the Anglian and South east area.

For the most part, the impact of climate change on the 1% AEP event exacerbates flood risk to areas already affected by flood extents rather than bringing substantial new areas into risk zones. Examples of areas where pre-existing flood risk is exacerbated include the areas around Pound Lane and near the intersection of Cranfield Park Road as well as Rawreth Shot. The modelling affects a very limited area within the Basildon Borough Boundary to the northwest.

Thames Estuary Model

The Thames Estuary Model employed a combination of fluvial and tidal uplift factors under varying climate change severity scenarios and different epochs. The modelling did not include any 2D flood extents, therefore the impacts of climate change have been interpreted from the contents of the Product 5 model report for the Thames Estuary Model, which states the changes in the 1D flood levels.

The Thames Estuary model is constructed within a 1D domain, and the node locations modelled closest to the Basildon Borough are at Mucking and Canvey. Table 5 and Table 6 show the increase in extreme floodwater levels predicted by the model at the 95th percentile for the 2070 and 2170 scenarios; with the Thames Barrage closed and open respectively. Note, typically a 100-year lifetime (2120) is considered for residential and most other developments which falls between the two available epochs.

Table 5 – Differences in extreme still water levels at the 95th percentile between baseline (2020) vs 2070 and 2170 scenarios within the Thames Model (Barrier closed).

	2070 Scenario Increase In Floodwater Elevations (m)			
Location	2%	1%	0.5%	0.1%
Mucking	0.51	0.50	0.49	0.43
Canvey	0.52	0.51	0.52	0.45
	2170 Scenario Increase In Floodwater Elevations (m)			
Mucking	2.11	2.04	2.01	1.96
Canvey	2.16	2.08	2.08	2.05

Table 6 – Differences in extreme still water levels at the 95th percentile between baseline (2020) vs 2070 and 2170 scenarios within the Thames Model (Barrier open).

	2070 Scenario Increase In Floodwater Elevations (m)			
Location	2%	1%	0.5%	0.1%
Mucking	0.52	0.52	0.52	0.52
Canvey	0.52	0.52	0.52	0.52
	2170 Scenario Increase In Floodwater Elevations (m)			
Mucking	2.16	2.08	2.04	1.94
Canvey	2.19	2.14	2.13	2.09

To determine the likely changes in extent as a result of these level changes, the tidally influenced Flood Zone 3 area within Basildon Borough stemming from the Thames (therefore representing the 0.5% AEP tidal event) was assessed at the outermost points of the extents to identify the corresponding LiDAR levels. The increases in extreme floodwater levels under the 0.5% AEP event 2070 scenario were visually extrapolated to provide an approximate estimate of areas that may be at risk due to these increases in levels.

Areas that may be at increased risk of flooding include:

- Sections of the residential areas around Brook Drive, Woodlands Drive and Hertford Drive
- Sections of the Gardners Industrial Complex
- Sections of the Magnum Industrial Complex
- Areas of the railway line from Stanford-le-Hope leading into Pitsea Train Station, and out of the station eastwards towards Benfleet.

As 2D mapping of tidal climate change scenarios is not available from the Thames Estuary Model, it is recommended that the impacts of climate change are assessed in more detail for developments adjacent to the Thames tidal flood zone as part of site specific FRAs.

2.1.3 Surface Water Flooding

Surface water flooding is often the result of high peak rainfall intensities, and/or insufficient capacity in the sewer network. Surface water flooding is a significant flood risk in urban areas due to the high proportion of impermeable surfaces, which cause a significant increase in runoff rates and consequently the volume of water that flows into the sewer network.

Although managing the risk of flooding from surface water is the responsibility of LLFAs, the EA has produced the updated Flood Map for Surface Water (uFMfSW) under its strategic role in England. This combines the EA's nationally produced surface water flood mapping and appropriate locally produced maps from LLFAs.

The nationally produced maps are currently based on a number of assumptions, and only indicate where surface water flooding would occur as a result of local rainfall. Caution should be exercised when reviewing the nationally produced mapping as it may show an over or under-estimation of the surface water flood risk in certain areas. Furthermore, due to the modelling techniques used, the mapping picks out depressions in the ground surface and simulates some flow along natural drainage channels and rivers. Where this is the case, the dominant flooding mechanism is considered to be fluvial and these areas are ignored in the assessment of surface water flooding.

It should be noted that in many locations in Basildon, more detailed local models developed as part of the South Essex SWMP underlie the uFMfsW. There is greater confidence in the outputs from these models.

The surface water flood map shows areas of High Risk which relates to land estimated to flood in a 3.3% AEP pluvial event, Medium Risk which relates to land estimated to flood in a 1.0% AEP pluvial event and Low Risk which relates to land estimated to flood in a 0.1% AEP pluvial event.

Based on the assumptions and limitations listed above, the maps should only be used at the strategic planning level. To further assess surface water flood risk, the pluvial flood incident data belonging to Basildon Borough (recorded since 2003 but also containing some historic records) and ECC (recorded since 2007) was utilised. In this regard, the analysis has sought to combine both data sources to identify areas at significant risk of surface water flooding; particularly where recorded incidents corroborate flooding shown by the mapping.

The pluvial flood risk is demonstrated to be highly widespread within the Borough, the most at-risk areas are summarised below:

- Basildon – surface water flood risk is widespread across the town including in the following areas:
  - Ghyllgrove – A northwards flowing branch of floodwater presents a high risk to the area with notable pooling south of the A1321. This affects roads including Ghyllgrove Road, Honeypot Lane and Butneys. Flood incidents are recorded in the area also including those dated 2016 at Landemere, 2009 at Honeypot Lane, 2008 at Broad Green, and 2015 at Priors Close.
  - Kingswood – A northwards flowing branch of floodwater presents a high risk to the area with particular flood risk presented to Sparrows Herne, Clay Hill Road, Codenham Straight, Hawksway and Curlew Crescent. Three flood incident records are recorded here also.
  - Lee Chapel North – A pluvial flow route flows north-eastwards through the area. This presents a high risk particularly to residential areas around Great Knightleys, Elizebeth Way and in the vicinity of Laindon Train Station. Eight flood incidents have been recorded in the area, many of which around Great Knightleys specifically.

  - Lee Chapel South – Two pluvial flow routes coalesce at the centre of Lee Chapel South. The largest flow route occurs from the Longwood Area, affecting residential areas adjacent to Rostravor Path and the Knares. The smaller flow route extends through Sporehams presenting a high flood risk to this area. The combined flow route moves through to Basildon presenting a high flood risk to properties around Ingleway and Great Gregorie. Three instances of recorded flood incidents are recorded here however these are not aligned with pluvial flow paths.

- Billericay – there is a high risk of surface water flooding along several roads in Billericay including Crown Road and Valley Road. Surface water flow paths flow southeast and northwest of the centre. Several flood incidents have been recorded in the area, with dates ranging from 2003 to 2017.
- Wickford – whilst the main flood risk to this area is fluvial in nature, there are localised areas where surface water flooding presents a high risk. These include along Wick Lane, the A129 by St Catherine's Church, the residential areas around Long Meadow Drive, Farnham Avenue, Elder Avenue and Melville Drive. Flood incidents are recorded within Wickford, although these appear to be more aligned with fluvial flood extents.

Most of the areas identified above tend to be located outside of the floodplains of the main rivers, meaning that the primary source of flooding is likely to be pluvial in origin.

Note, the detailed local models developed as part of the South Essex SWMP were also updated and ran for the latest climate change scenarios. These updates were applied to the 1.0% AEP Event. The allowances applied are the central and upper end allowances for the 1.0% AEP event for the 2070s epoch which is advised for development with a lifetime between 2061 and 2125. The central and upper end allowances applied for the study area are 25% and 40% respectively, these are identical for the two management catchments crossing the study area (Combined Essex & South Essex)

Maps showing the extent of the baseline flood outlines for the surface water flood maps, the updated climate change outlines and a spreadsheet showing the flood incidents recorded for the Basildon Borough are provided in Appendix 3.

2.1.4 Ordinary Watercourses

Ordinary watercourses include every river, stream, ditch, drain, cut, dyke, surface water sewer (other than public sewers) and passage through which water flows, above ground or culverted, which is not designated as a main river. To assess flood risk from these watercourses the EA's flood maps are used. The EA's fluvial flood map does not typically show flood extents for catchments less than $3km^2$, therefore the EA's surface water flood map is used in combination to determine flood risk from these watercourses.

The surface water maps, accounting for local rainfall patterns and topography, show the majority of ordinary watercourses. It should be noted that not all the conveyance area of ordinary watercourses is explicitly modelled nor structures such as culverts in most cases. Therefore, they usually provide a conservative assessment of the flood risk from ordinary watercourses and should not be used as definitive mapping. This said they remain a valuable tool when combined and validated against local experience and knowledge.

Further to this, whilst BBC has not supplied a map of the ordinary watercourses and assets within Basildon Borough that would identify the majority of the watercourses in the area (alongside culverted stream lengths and in-line structures), a brief overview of ordinary watercourses has been provided using mapping. This, combined with the outputs from the EA's surface water flood maps has been used to identify the key ordinary watercourses which include the following:

- Open Ditch adjacent to Courtauld Rd and crossing the Southend Arterial Road (A127) to the northwest of Basildon. This is believed to be privately owned.
- Open Ditch North of Frithwood, in proximity to Billericay. This is believed to be privately owned.
- Open Ditch adjacent to Christopher Martin Road to East Mayne. Owned by BBC
- Open Ditch adjacent to Heathleigh Drive leading to Berry Lane. Owned by BBC
- Stock Brook north of Potash Road, ownership unknown.
- Open drain leading into an unnamed brook adjacent to Pound Lane. Culvert maintained by ECC.
- Open drain under private ownership found at the rear of 22 to 32 The Meadow Way
- Privately opened open ditch running west from North of junction between Wiggins Lane and Tye Common Road.
- Privately owned open ditch running northwest from the junction between Broomshill Chanse and Tye Common Road at Little Burstead.
- Privately owned open ditch joining the River Crouch between Tye Common and St Agnes roads.

Maps showing the location of primary watercourse are provided in Appendix 4. Further information can also be found on the LLFA's flood risk and asset register mapping[32]. The Ordnance Survey open rivers layer[33] also maps the location of main rivers and many ordinary watercourses.

2.1.5 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at ground level. There are limited local data with respect to groundwater flooding. However, for a strategic level assessment of the potential for groundwater flooding, the BGS UK Geoviewer has been used to determine the bedrock across the study area, with the Landis Soilscapes map used to determine the soils present.

BGS mapping shows that the majority of Basildon Borough is underlain by the London Clay Formation consisting of clay, silt and sand. Areas to the southwest of Basildon town and the centre of Billericay are underlain by the Bagshot Formation consisting of sand. The general permeability of the bedrock is considered to be low in the areas underlain by clay and moderate in the areas underlain by sand.

Based on the Soilscapes mapping, areas within the floodplains of the River Thames and River Crouch, are underlain by loamy and clayey floodplain soils with naturally high groundwater levels. Where this is the case, flood risk is considered to be high.

In areas outside of the floodplains, the majority of areas within Basildon and Billericay are sited on more slowly permeable loamy and clayey soils. In these locations, groundwater flood risk is likely to be moderate to low. The majority of Wickford and Shotgate are sited on slightly acid loamy and clayey soils which are more likely to have impeded drainage. In locations groundwater flood risk is considered to be low.

Maps showing the bedrock and soils across Basildon Borough are provided in Appendix 5.

2.1.6 Sewer Flooding

Sewer flooding often occurs because of an existing drainage system having insufficient capacity to drain rainfall, consequently causing the release of water at manholes. Sewer flooding can also occur should there be a fault/failure at an existing drainage system.

---

[32] Essex County Council (2024) *Mapped flood information* https://flood.essex.gov.uk/mapped-flood-information/
[33] Ordnance Survey (2023) OS Open Rivers *https://www.data.gov.uk/dataset/dc29160b-b163-4c6e-8817-f313229bcc23/os-open-rivers*

The responsible authority for sewer flooding across the study area is Anglian Water (AW), the sewerage undertaker. AW was contacted to gather available data on sewer flooding. A total of 1,630 historic records of sewer flooding have been recorded for the study area since records began in 2014. It should be noted that the records are somewhat dependent on reporting. In this regard, caution should be exercised when ascribing a sewer flood risk to a particular location.

The spatial distribution of historical incidents of sewer flooding is summarised in Figure 2. These predominantly demonstrate that the built-up areas in Basildon, Billericay, and Wickford generally have the most incidents, although it is noted that Wickford perhaps contains a lower density of events compared to the other two towns.

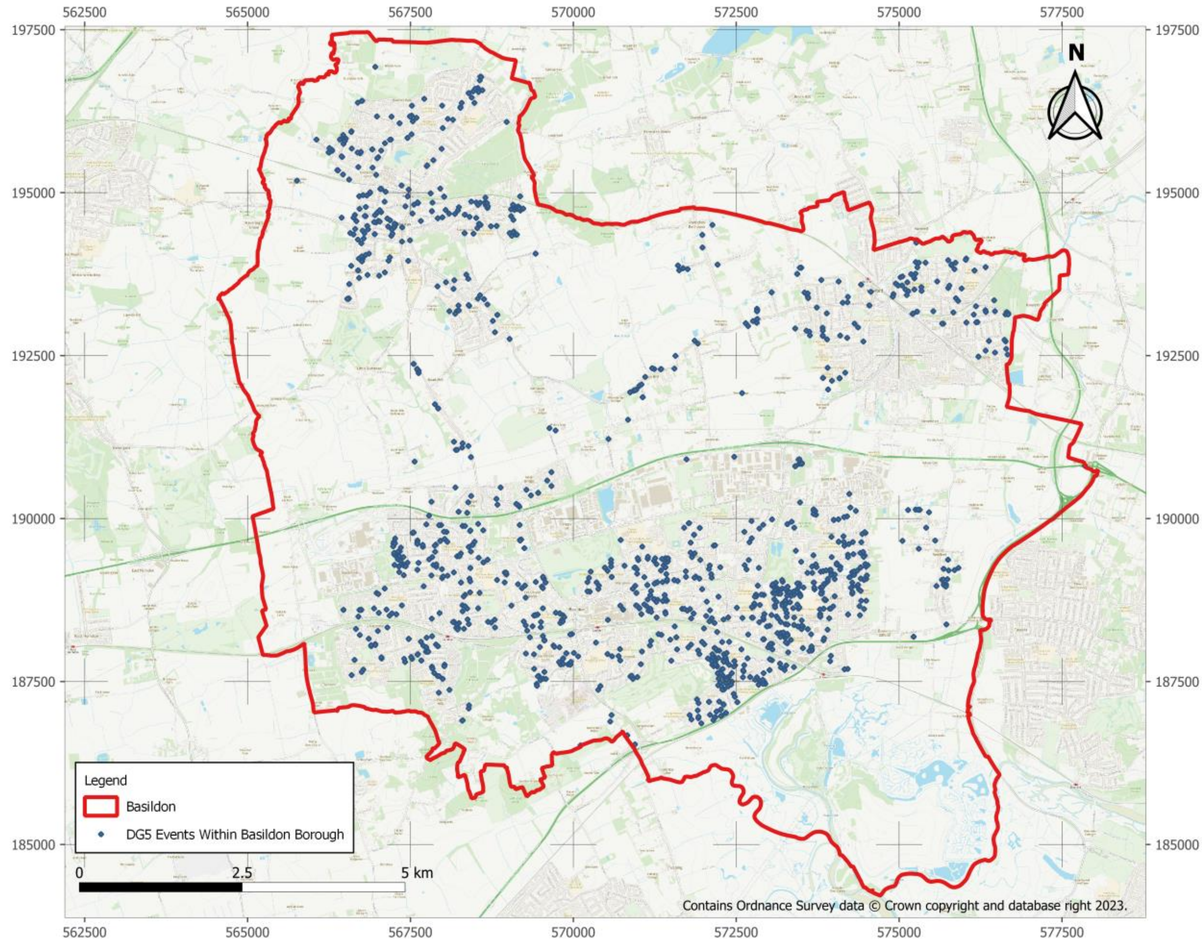


Figure 2 –Map showing location of Director General 5 (DG5) records within the Basildon Borough

2.1.7 Reservoir Flooding

In 2021 the EA published updated maps showing the flood risk associated with reservoirs. Dam breach and flood modelling techniques were used to produce a new national set of reservoir flood maps for England. The maps show two flooding scenarios, including a 'dry-day' and a 'wet-day'. The 'dry-day' scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal levels. The 'wet day' scenario predicts how much worse the flooding might be if a river is already experiencing an extreme natural flood.

The following large reservoirs (as defined by the Reservoirs Act 1975) within the Basildon Borough are identified below.

- Laindon Barns (Noak Bridge) Flood Storage Area
- Pipps Hill Washland/Festival Leisure Park
- Zen Reservoir (Courtauld Road) –
- Bowers Marsh Reservoir
- Pitsea Leachate Lagoon

The Laindon Barns Flood Storage Area, Pipps Hill Washland/Festival Leisure Park and Zen reservoirs all present flood risk to the centre of Wickford and areas running adjacent to Crays Hill Road in both wet and dry day scenarios.

The Bowers Marsh Reservoir present flood risk to areas southwest of the Rookery farm under the wet day scenario, however not under the dry day scenario.

The Pitsea Leachate Lagoon area present flood risk to an area southeast of Canvey Way under both wet and dry day scenarios. This is an area of mostly open land.

Whilst these areas are shown to be at risk, reservoir failure is a rare event with a very low probability of occurrence. Current reservoir regulation, which has been further enhanced by the FWMA, aims to ensure that all reservoirs are properly maintained and monitored to detect and repair any problem.

Maps showing the reservoir flood extents in Basildon Borough are provided in Appendix 6.

2.2 Review of Historic Flood Events

Historical flood events are recorded by the EA and subsequently documented in the form of reports, photographs and maps. This information is used to update the recorded flood outlines map, which shows the extent of all individual recorded flood outlines.

In Basildon Borough three flood events have been identified. The largest of these is the fluvial flooding that occurred along the River Crouch in 1958 which covered an area of approximately 7.23 km^2 within the Borough and affected a number of built up areas. The second largest recorded outline is the tidal storm surge which occurred on January 1953. It covered an area of approximately 6.80 km^2. In contrast to the 1958 event occurring along the River Crouch, the flood extents from the 1953 event within the Basildon Borough occur primarily in open land along the tidal flood plains. The third flood event was recorded in September 1968, it had minimal impact, consisting of only 850m^2 of flooded area impinging on Lower Dunton Road within the West of the Borough.

Based on all available records, the greatest historical impacts have been associated with the River Crouch. Areas impacted include the centre of Wickford, North of Felmore, Pipps Hill Road North and Steeple View. It is noted that the historic flooding seen around Burnt Mills and the North of Farmore covers a significantly larger expanse of land compared to those of Zones 2 or 3 of the Flood Map for Planning Rivers and Sea. This is also the case for the stretch of the A132 that runs southwards into the roundabout connecting with Cranfield Park Road and Nevendon Road within the centre of Wickford. In both locations, a significant number of residential properties are within the recorded historical flood extents but are not within the EA Flood Zone 2 and 3 extents.

Flooding from the River Thames during the 1953 event is mainly isolated to the open areas of recreational land which characterise the floodplain. No properties are explicitly listed as having flooded in the 1953 tidal flood event in data provided by the council.

Appendix 7 shows the recorded flood outlines for Basildon.

2.3 Review of Flood Defences

The EA AIMS Spatial Flood Defences (inc. standardised attributes) has been used to identify significant flood defence infrastructure across the Borough. Maps showing the location of flood defences and washland systems in Basildon Borough are provided in Appendix 8.

The majority of the defences within the area can be divided into three groupings relating to the River Crouch and Tributaries, the River Wid and Tributaries, and the River Thames and Marshland. These are detailed in sections 2.3.1, 2.3.2 and 2.3.3 respectively. The defences listed do not include flood storage areas. The Basildon Washland System is also covered in section 2.3.4.

Note, the AIMS database lists a condition grade for some defences, these are defined as follows:

- 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 the performance of the asset.
- 4- Poor – Defects that would significantly reduce the performance of the asset.
- 5- Very Poor – Severe defects resulting in complete performance failure.

2.3.1 River Crouch and Tributaries

Within the centre of the Borough and moving northeast, defences are primarily located along the River Crouch and its corresponding tributaries.

These defences include large stretches of embankments and natural high ground, as well as two walls by Laindon Barnes. The majority of these are purposed to provide protection from fluvial events. However, the seawall embankments found on the left bank (LB) of the River Crouch Railway Bridge to Mayphil Caravan Park, as well as the right bank (RB) of the River Crouch upstream of the confluence with Rawreth Brook, are purposed to defend against tidal flooding events.

Note, natural high ground (NHG) covers all extents along watercourses that are not defined as any other Defence Asset Type. It covers situations where the only defence is the ground itself, rather than anything manmade. Examples include the top of a riverbank or a cliff adjacent to a watercourse.

Table 7 provides a summary of the flood defences including where available their condition, extent and standard of protection (SOP).

Table 7 – Flood Defences along River Crouch and Tributaries within Basildon Borough

Location	Type	Length (m)	Condition	SOP
Laindon Barnes FSA FR/04/A003 concrete parapet wall	Wall	91	-	100
LB Dunton Brook - Laindon Washland to HOMR	NHG	2365	3	10
RB Runwell Brook	NHG	1076	3	100
RB River Crouch - Castledon Rd DS to London Rd	NHG	1219	3	100
RB Basildon Brook - Conf. with Crouch to Cranes Farm Rd	NHG	2621	3	10
LB River Crouch - engineered channel - Castledon Rd DS to London Rd	NHG	1242	3	100
RB Nevendon Brook	NHG	2602	3	100
LB Benfleet Brook - A127 ds to cnf w/ Rawreth Brk	NHG	3538	3	10
LB of Wickford Flood Channel	NHG	943	4	100
RB of Wickford Flood Channel	NHG	950	4	100
LB Nevendon Brook	NHG	2559	3	100
LB Runwell Brook	NHG	1081	3	100
RB Crouch - Noak Bridge DS to Castledon Rd	NHG	7224	3	100
RB through New Nevedon Washlands	NHG	431	-	25
LB through New Nevedon Washlands	NHG	444	-	25
LB North Benfleet Brook (US of A127)	NHG	1411	3	
RB North Benfleet Brook (US of A127)	NHG	1420	3	
LB Basildon Brook - Conf w/ Crouch to Cranes Fm Rd	NHG	2608	3	10
LB Crouch - from Wickford Conc channel DS to gates.	NHG	2321	3	10
RB Crouch - from Wickford Conc channel DS to gate	NHG	2306	3	10
RB Nevendon Bushes Brook - Nevendon Rd to Burnt Mills Rd	NHG	2164	3	100
LB Nevendon Bushes Brook – Same as above	NHG	2171	3	100
LB Jolly Cricketers Ditch	NHG	416	3	100
RB Jolly Cricketers Ditch	NHG	413	3	100
RB North Benfleet Brook - A127 to cnf w/ Rawreth Brk	NHG	3527	3	10
RB Dunton Brook - Laindon Washland to HOMR	NHG	2372	3	10
LB - Nevendon Bushes Brook - alongside Burnt Mills Rd	NHG	381	3	
RB - Nevendon Bushes Brook – same as above	NHG	403	3	
RB River Crouch - behind Winchester Gardens, Laindon	NHG	196	3	10
LB River Crouch - behind Winchester Gardens, Laindon	NHG	196	3	10
LB Crouch - Noak Bridge DS to Castledon Rd	NHG	7191	3	100
RB of Basildon Brook - thru Gloucester Park	NHG	866	3	
LB of Basildon Brook - thru Gloucester Park	NHG	853	3	
Embankment West of Crouch - South of Dunton Rd/FSA compartment 3	Embankment	165	-	100
Embankment west of Crouch - FSA compartment 3 (starting at Dunton road bridge)	Embankment	358	-	100
Embankment west of Crouch - FSA compartment 3 (nearest to confluence)	Embankment	98	-	100
Embankment North of Crouch- FSA compartment 4	Embankment	151	-	100
Embankment West of Crouch- FSA compartment 4	Embankment	66	-	100
Embankment North of Crouch- South of St Agnes Road	Embankment	314	-	100
Embankment south of Crouch- FSA compartment 3	Embankment	291	-	100
Bank - LB DS of Church Rd Rawreth	Embankment	744	3	50
LB of new Nevendon Washlands	Embankment	607	-	100
RB of New Nevendon Washlands	Embankment	571	-	100
Embankment East of Crouch - South of Dunton Rd	Embankment	159	-	100
Embankment East of Crouch - FSA compartment 1/2	Embankment	358	-	100
Embankment east of river Crouch- FSA compartment 1	Embankment	158	-	100
Embankment west side of FSA compartment 5	Embankment	136	-	100
Embankment west of FSA compartment 1	Embankment	37	-	100
Embankment around Eastern section of FSA compartment 1	Embankment	384	-	100
Laindon Barnes FSA- spillway compartment 2 into compartment 3	Embankment	33	-	100
Embankment east of Crouch - FSA compartment 2	Embankment	36	-	100
Seawall - LB of Crouch R'way Bridge to Mayphil C'van Park	Embankment	1037	3	
Seawall RB of Crouch US of conf' with Rawreth Brook	Embankment	895	3	

2.3.2 River Wid and Tributaries

Within the northwest of the Basildon Borough, the River Wid and its associated tributaries lie. There are no formal flood defences only natural high ground (NHG).

Table 8 provides a summary of the location of NHG and its condition, extent and SOP.

Table 8 – Flood Defences in River Wid and Tributaries within Basildon Borough

Location	Type	Length (m)	Condition	SOP
RB of R.Wid - Billericay to Doddinghurst	NHG	7460	2	10
RB River Wid from London Rd A414 to near Hutton STW	NHG	13542	4	10
LB Haveringsgrove Brook	NHG	4209	3	10
LB Mountnessing Brook - DS from Billericay to Wid	NHG	1241	3	10
RB Mountnessing Brook - DS of Billericay to Wid	NHG	1247	3	10
RB Haveringsgrove Brook	NHG	4217	3	10
LB River Wid from London Rd A414 to near Hutton STW	NHG	13545	-	10
LB Mountnessing Brook - behind The Warren, Billericay	NHG	344	4	-
LB Mountnessing Brook - US of Mountnessing Rd to HOMR	NHG	56	3	-
RB Mountnessing Brook - behind The Warren, Billericay	NHG	351	4	-
RB Mountnessing Brook - US of Mountnessing Rd to HOMR	NHG	59	3	-

2.3.3 River Thames and Marshland

In the southeast of the Basildon Borough area, the flood defence features are in the Bowers Marsh and Vange Creek area.

There are a number of embankments including those seen at East Haven Barrier NW, by Pitsea PS, at Bowers Marshes, Fobbing Marshes and RSPB Vange Marsh. These, along with the engineered high ground at Pitsea Landfill are purposed to defend against tidal events.

There are also three sections of walls that can be seen; these include at Fobbing Barrier, Easthaven Barrier and Bowers Marshes. Again, these are also purposed to defend against tidal events.

The walls at Easthaven Barrier are understood to be operated by the EA, whilst the engineered high ground at Pitsea Landfill is understood to be operated by a private entity.

There are also a number of areas where natural high ground is present, including along the left bank of Merricks Farm Ditch, the right bank of Pitsea Hall Fleet, the north bank of Great Mussels Sewer and the right bank of Bowers Gifford Marsh Drain. These defend against fluvial events.

Table 9 provides a summary of the flood defences including where available their condition, extent and SOP.

Table 9 - Flood Defences in River Thames and Marshland within Basildon Borough

Location	Type	Length (m)	Condition	SOP
Fobbing Barrier northern tie in wall	Wall	118	3	1000
Easthaven Steel Piling wall	Wall	203	3	1000
Easthaven Barrier - Sheet Pile Wall 1	Wall	31	3	-
Easthaven Barrier - Sheet Pile Wall 2	Wall	25	2	-
Bowers Marshes - Piling	Wall	37		-
LB Vange Wick Ditch	NHG	2438	3	1000
RB of Bowers Gifford Marsh Drain	NHG	3138	3	1000
LB of Bowers Gifford Marsh Drain	NHG	3143	3	1000
RB Pitsea Hall Fleet	NHG	2977	3	1000
North bank of Great Mussels Sewer	NHG	2824	3	5
South bank of Great Mussels Sewer	NHG	2814	3	5
LB Merricks Farm Ditch	NHG	1942	3	1000
RB Vange Wick Ditch	NHG	2481	3	1000
RB Merricks Farm Ditch	NHG	1902	3	1000
LB Kiln Farm Ditch	NHG	246	4	1000
RB Kiln Farm Ditch	NHG	251	4	1000
LB of Pitsea Hall Fleet	NHG	2419	3	1000
Pitsea Landfill - Fobbing and Easthaven Connecting Section	Engineered High Ground	373		1000
East Haven Barrier NW tie in embankment	Embankment	210	3	1000
Embankment by Pitsea PS	Embankment	202		1000
Embankment - Bowers Marshes (Jotmans to near Easthaven Barrier)	Embankment	2749		1000
Earth Embankment - Fobbing Marshes (Fobbing Barrrier to Vange Wharf)	Embankment	5264	5	1000
RSBP Vange Marsh	Embankment	1221		1000

2.3.4 Basildon Borough Washland Basin System

In order to manage surface water runoff from Basildon New Town which was initially developed in 1949, a series of drainage reservoirs and storage areas were constructed. Many of these are interconnected, and an assessment provided as part of the South Essex SWMP 2012 *(the CDA modelling element is superseded by the SE SWMP 2020 following a CDA model update in 2018)* indicated that these are effectual to the 0.5% AEP event. The South Essex SWMP (2012) and previous SFRAs (2011 & 2018) have highlighted the need to better maintain and organise the management of this Washland system to ensure it remains effective. The 2011 SFRA[34] additionally noted that washland sites with frequent amenity usage often corresponded to being in a more positive condition. The actions proposed within previous reports are summarised as follows:

- Comprehensive survey of connecting channels and pipework to locate any blockages.
    - This would also provide important information for the construction of hydraulic models covering the Basildon area.
- Develop a program of routine washland maintenance to ensure flood storage capacity and effectual connectivity of channels involving:
    - Clearance of vegetation.
    - Ensuring incoming and outgoing pipework and structures are fully functional.

[34] Basildon Borough Council (2011) Level 1 Strategic Flood Risk Assessment https://www.basildon.gov.uk/media/3280/Basildon-Borough-Strategic-Flood-Risk-Assessment-Level-1-Report-June-2011/pdf/Basildon_Borough_Strategic_Flood_Risk_Assessment_-_Level_1_Report_June_2011.pdf?m=1310461332733

- Designate attenuation areas as Flood Risk Management Infrastructure thereby providing legal protections against potentially damaging activity from third parties.

On the last point, this SFRA designates flood storage reservoirs and the washlands as FZ3b, this is to ensure that this land is safeguarded for current and future flood risk management purposes thereby ensuring that they retain their flood risk function.

ECC was contacted regarding the status of the washland basins with respect to the maintenance actions proposed by previous reports and provided the following information:

"*The recommendation should be used in relation to FSA's/floodplain reconnection that was carried out as part of the Basildon Hospital sponge project. it will also be recorded as an asset on our register and will be inspected annually by ECC as part of our statutory LLFA responsibilities. If any changes to the storage areas are proposed, they should come through the team for consultation. The benefits provided by the project need to be retained.*"

2.4 Thames Estuary 2100 Plan (TE2100)

In addition to the flood defences listed in the sections above, Basildon Borough is also protected by a number of tidal barriers and will also be impacted by the Thames Estuary 2100 Plan (TE2100)[35]. This is a strategic plan for adapting to rising sea levels in the Thames Estuary. The Estuary is divided into 23 areas known as policy units and two of these can be seen to coincide with the Borough; the Bowers Marsh Policy Unit as well as parts of the Shell Haven and Fobbing Marshes Policy Unit.

The Bowers Marsh policy unit is designated a P4 policy area, meaning that DEFRA and the EA will take further action to keep up with climate and land use change so that flood risk does not increase.

Flood Risk in this area is managed by the following structures and systems:

- Fobbing Horse Barrier controls tidal water levels on Vange Creek
- East Haven and Benfleet Barriers control tidal water levels on East Haven Creek
- Benfleet Hall Sewer and Bowers Marshes have drainage systems
- Vange and East Haven Creeks have secondary tidal flood defences

The Shell Haven and Fobbing Marshes area is designated as a P3 policy area meaning that existing flood defences will be maintained in their current condition with the acceptance that flood risk will increase as sea levels rise.

Flood Risk in this Area is managed by the following structures and systems:

- Tidal defences on the Thames and Holehaven Creek
- Fobbing Horse Barrier and defences on Vange Creek
- Drainage system outfalls at Mucking Creek, Shell Haven, Fobbing Marshes and Vange Marshes

Riverside Strategy as part of TE2100

The Thames Estuary 2100 Plan introduces the riverside strategy approach. This approach integrates upgrades to flood defences with riverside improvements and wider benefits. Riverside strategies are visions for a stretch of riverside for an area. Councils or other organisations can create riverside strategies. For instance, organisations interested in riverside development and improvement may produce a strategy. They can be standalone documents or form part of a Local Plan.

[35] DeFRA and EA (2023) *Thames Estuary 2100 Plan* https://www.gov.uk/government/collections/thames-estuary-2100-te2100

A riverside strategy is required for the Borough by 2030. Any work to reshape riversides during flood defence maintenance or upgrades should be done in accordance with this strategy once it is available. More detail on Riverside Strategies can be found in the TE2100 plan[36].

2.5 Review of Flood Warning

The EA is responsible for issuing flood warnings in the Basildon Borough area. In regularly monitoring the river network it aims to give the public notice of any local main river overtopping its bank (flood alert) or flooding properties (flood warning).

Water levels are monitored at a number of locations, and this information is used to inform flood warnings at the four flood warning areas within the Borough. Flood warning areas are geographical areas where the EA expect flooding to occur and where the EA provide a flood warning service. The flood warning areas in the study area are listed below:

- The Thames Estuary from Shellhaven, to and including Tilbury
- The Thames Estuary at Canvey Island North
- The River Crouch from Noak Bridge to Runwell
- The Tidal River Crouch from Creeksea to Battlesbridge

Gauges along watercourses are also used to issue flood alerts across wider flood alert areas. Flood alert areas are geographical areas where it is possible for flooding to occur. For Basildon Borough there are five flood alert areas, these are listed below Figure 3 shows the flood alert areas relative to the flood warning areas.

- Essex coast at Canvey Island to South Benfleet
- Essex coast at Fobbing to Purfleet
- Essex coast along St Peters Flat & Crouch and Roach estuaries
- The River Crouch from Noaks Bridge to Runwell
- The Rivers Wid and Can

The timings of flood alerts and warnings are typically determined by trigger levels at the gauges which relate to the following:

- **FAL – Flood Alert**
  Flooding is possible and that you need to be prepared. .
- **FW – Flood Warning**
  Flooding is expected and that you should take immediate action. You should take action when a flood warning is issued and not wait for a severe flood warning.
- **SFW – Severe Flood Warning**
  There is severe flooding and danger to life. These are issued when flooding is posing significant risk to life or disruption to communities.

  Flood alerts and warnings are available from the EA by a preferred contact method e.g. by phone or email. It is recommended that landowners/property owners in flood risk areas sign up to this service.

---

[36] DeFRA and EA (2023) *Creating benefits and riverside strategies: Thames Estuary 2100* https://www.gov.uk/guidance/creating-benefits-and-riverside-strategies-thames-estuary-2100

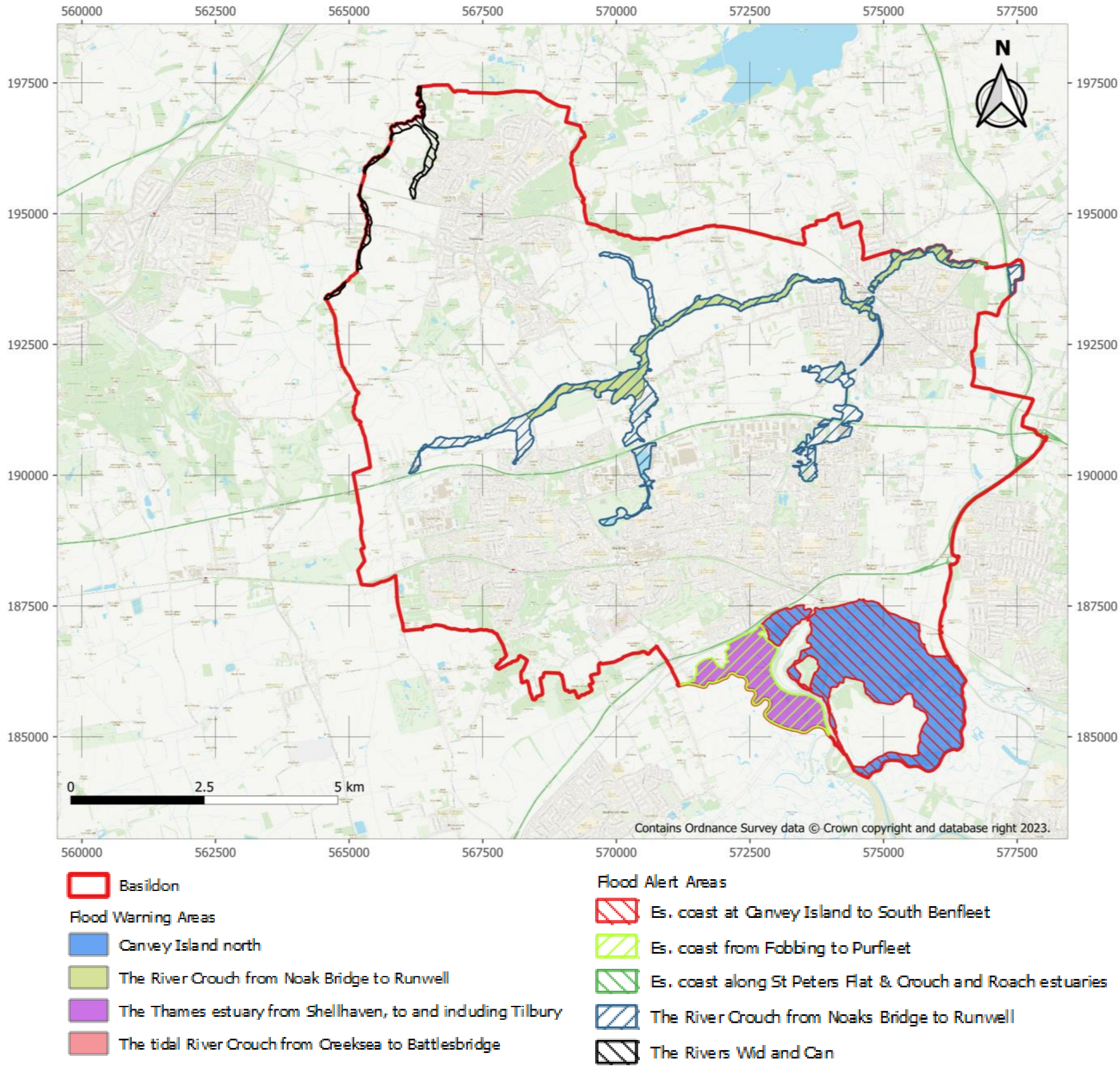


Figure 3 – Flood Warning Areas and Flood Alert Areas in Basildon Borough

3 Flood Risk at Site Allocations (Informing the New Local Plan)

3.1 Sequential Test

This SFRA provides information to support application of the sequential test at the site allocations to be brought forward by BBC in their local plan.

The sequential test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. Where it is not possible to locate development in low-risk areas (Flood Zone 1), the sequential test should go on to compare reasonably available sites:

- Within medium risk areas (Flood Zone 2); and
- Within high-risk areas (Flood Zone 3), only where there are no reasonably available sites in low and medium risk areas.

The sequential test should then consider the spatial variation of risk within medium and then high flood risk areas to identify the lowest risk sites in these areas.

Site specific FRAs should apply the sequential test at a site level locating the most vulnerable infrastructure in lower risk areas. To support such an assessment information on flood depth, velocity, hazard and speed-of-onset should be considered, along with the role of flood risk management infrastructure and the potential impacts of climate change.

After applying the sequential test at the site level, BBC acting as the Local Planning Authority needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere. This needs to be demonstrated within an FRA and is necessary regardless of whether the Exception Test discussed in the section below is required. See section 4.6 for more information on what to include in a site-specific FRA.

3.2 Exception Test

In situations where sites at lower risk of flooding are not available following application of the sequential test, potential development may be located in medium to high-risk areas. In these cases, it may be necessary to apply the exception test.

The exception test requires two additional elements to be satisfied before allowing development to be allocated or permitted. It should be demonstrated that:

- development will provide wider sustainability benefits to the community that outweigh flood risk; and
- 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.

In the latest Flood Risk and Coastal Change PPG, greater responsibilities are given to local authorities to better enable them to ensure that developers demonstrate capability in showing development be safe, and specifically to adapting to the challenges of a changing climate.

The PPG[37] also states that local authorities need to set their own criteria when determining whether a site provides wider sustainability benefits, having regard to the objectives of their Plan's

[37] Ministry of Housing, Communities & Local Government (2022) *Paragraph: 036 Flood risk and coastal change*, https://www.gov.uk/guidance/flood-risk-and-coastal-change

Sustainability Appraisal framework. As part of the review process, advice will be provided to applicants on sustainability benefits and the evidence that is required.

Note, one example of how a developer could demonstrate wider sustainability benefits, would be to deliver an overall reduction in flood risk to the wider community through the provision of, or financial contribution to flood risk management infrastructure.

Table 10 sets out the circumstances when the exception test will be required. More guidance on application of the sequential and exception test is provided in the NPPF and flood risk and coastal change PPG. More detail is provided in section 4 on how development can provide wider sustainability benefits and be made safe in accordance with the exception test.

Table 10- Flood risk vulnerability and flood zone 'incompatibility'

Flood Zones	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	x	Exception Test required	✓	✓
Zone 3b	Exception Test required	x	x	x	✓

In view of the table above, it should also be noted, that even for sites in Flood Zone 1 a site-specific FRA will still be required where developments are:

- More than 1 hectare (ha)
- Less than 1 ha in Flood Zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential),
- Where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs)
- In an area within Flood Zone 1 which has critical drainage problems as notified by the EA.

3.3 Cumulative Impacts of Development and Land Use Change

Land use and land management influences the characteristics of how rainwater runs off land into local water networks such as drains, streams and rivers. Localised changes in land use can alter the pre-existing baseline behaviour of an individual area, and when this occurs collectively over multiple areas within a catchment, it can cause a change in flooding characteristics for the area. As such, this may incur detrimental impacts downstream on a catchment-wide scale.

Instances in which this can occur can be seen in the development of previously rural land which increases the amount of impermeable surface. If insufficient measures are taken to mitigate this, surface runoff following rainfall can increase in volume and velocity. When instances of this happen repeatedly across a catchment, this can result in a catchment experiencing shorter amounts of time between rainfall events and peak flood levels resulting in greater magnitude floods and making effective flood response more difficult.

In addition, the development of pre-existing open land may result in loss of floodplain area, causing reduced floodplain storage capacity which could have a detrimental impact on flood risk on immediately neighbouring land as well as downstream. Instances of practices that may cause this include changes in a buildings footprint which could reduce flood storage area, whilst the raising of land levels above the existing floodplain may interfere with storage and floodwater conveyance.

The strategic policies of BCC's local plan will be informed by this SFRA, with a sequential approach taken in the allocation of land to steer new development to the areas with the lowest flood risk based on an understanding of flood risk from all sources.

For allocated and non-allocated sites, developers must follow advice provided by the EA and LLFA to mitigate against detriment to downstream areas in the instance of a flooding event. FRAs supporting developments should incorporate evidence that the cumulative effects of development in the area – both in terms of past and present developments – have been considered and shown to be sufficiently mitigated.

Additionally, developers should have a suitable surface water drainage strategy and SuDS plan that demonstrate there is no increase in surface water flood risk as a result of any new impermeable surfaces that may be present within a development. This should follow the guidance provided in Essex SuDS design guide. A further cumulative impact of development that should be considered is the impact on sewer capacity, Anglian water should be consulted in this regard.

More detail is provided in section 4 on the requirements for site specific FRAs and how development impacts can be mitigated.

4 Flood Risk Management

SFRAs should include information on i). opportunities to reduce the causes and impacts of flooding and ii). recommendations on how to address flood risk in development. This section focuses on these two areas and details the specific requirements for site-specific FRAs.

Both these areas are closely tied into the requirements of the exception test in ensuring development is safe and provides wider sustainability benefits that outweigh the flood risk incurred by it. This includes benefits that could reduce flood risk to the wider community.

As outlined in PPG[38], developers should refer to the SFRAs and site-specific FRAs to identify opportunities to reduce flood risk overall and to demonstrate that the measures go beyond just managing the flood risk resulting from the development.

4.1 Opportunities to Reduce Flood Risk

This section identifies at a strategic level how a proposed development has the potential to improve the water environment via the use of SuDS and Natural Flood Management (NFM), in addition to remedial work on structures (i.e. culverts and bridges) and the provision of green spaces. Some of the potential measures and key benefits are outlined below:

- Runoff control using SuDS - SuDS slow the rate of surface water run-off and improve infiltration, by mimicking natural drainage in both rural and urban areas. This reduces the risk of "flash-flooding" which occurs when rainwater rapidly flows into the public sewerage and drainage systems. Runoff is controlled at or near source and typically, greenfield rates are maintained or there is betterment on brownfield rates at existing development sites. This minimises excess runoff to third party land, thereby managing and reducing flood risk where possible. Provided SuDS is correctly implemented it should safeguard against the cumulative impact of development causing an increase of flood risk within Basildon Borough.
- Promoting the use of rainwater re-use – In accordance with the drainage hierarchy contained in Approved Document H of the Building Regulations, PPG[39] and the need to mitigate against water scarcity the Essex SuDS design guide states that all surface water runoff must aim to utilise rainwater re-use (e.g. rainwater harvesting, greywater recycling) before discharge to the ground, a watercourse or a sewer is considered. This approach recognises water as a valuable resource with rainwater collected (harvested) for non-potable use where practicable. This not only reduces potable water demand, but it can also reduce the volume of surface water runoff requiring disposal.
- Promoting the use of infiltration SuDS –Water re-use can be used for small rainfall event events but for larger order events typically water will need to be discharged elsewhere. The PPG sets out the hierarchy of drainage to promote the use of SuDS, by aligning modern drainage systems with natural water processes. The most sustainable option is considered to be infiltration of surface water run-off into the ground as it aligns closely with natural processes. This generally requires i) soils and/or bedrock to be permeable ii) groundwater levels to be a significant distance below the surface reducing the risk of groundwater emergence, iii) minimal land stability issues and iv) sites to be flat or gently sloping. Where infiltration is proposed, infiltration rates should be

---

[38] Ministry of Housing, Communities & Local Government (2022) Paragraph: 037 Flood risk and coastal change, https://www.gov.uk/guidance/flood-risk-and-coastal-change
[39] HM Government (2010) *Approved Document H- Drainage and waste disposal* https://www.gov.uk/government/publications/drainage-and-waste-disposal-approved-document-h

confirmed through BRE Digest 365 Soakaway Tests. Additional groundwater monitoring may also be required where there is a risk of groundwater emergence.

- Increasing flood storage and attenuation using natural flood management (NFM) - NFM involves techniques that aim to work with natural hydromorphological processes, features and characteristics to manage the sources and pathways of flood waters. Examples include the introduction of storage/conveyance features such as water meadows along with incorporation of riverside vegetation or leaky barriers to help slow overland flows and increase interception. This in turn prevents a flashy catchment response and serves to attenuate peak flows; mainly for lower order rainfall events and in smaller catchments.
- Land Management using NFM - Incorporating good practice into the management of land for the purpose of increasing infiltration of water and sediments into soils and reducing surface runoff. Woodland creation is also encouraged in some cases. The former relates to encouraging the use of infiltration SuDS where feasible at new development sites, but also improving management on existing land.
- River and Floodplain restoration using NFM - The stabilisation of excessively eroding riverbanks in order to reduce deposition of sediment downstream and works that restore an altered river to a more appropriate shape and in turn reconnect the river with its floodplain. These options could be considered at the catchment scale and at the site scale. For example, where future development is located in the vicinity of an eroding riverbank or altered river, restoration could be considered as part of the scheme to bring wider benefits.
- Maintaining and removing existing structures/channels - developments can serve to adapt problem structures within a watercourse/floodplain, which can improve conveyance and reduce impact of flooding. Diverting and daylighting of watercourses can also provide more effective flow routing through an area as well as environmental benefits.
- Managing water quality using SuDS - incorporation of SuDS features which provide filtration and capture of pollutants. These can include features such as permeable pavements and swales within the surface water system, which can settle and filter contaminants to provide treatment of surface water before being discharged. The level of treatment provided can be set relative to the risk index of the site. Particular attention should be applied to sites in groundwater source protection zones (SPZs) where additional measures may be necessary to protect the water environment. In sites where waterbodies are proximal, the EA and LLFA should be consulted to determine local sensitivities and any specific requirements.
- Enhancing biodiversity & amenity - developments can improve the quality of existing habitats and help create new habitats through landscape change. Sites offer an opportunity to establish green corridors and create coherent ecological networks. Development sites can also provide amenity benefits in the form of publicly accessible green spaces and improved access networks. SuDS and NFM often create new water features which can if correctly implemented bring associated educational benefits. For the allocated sites and for future development in general, biodiversity and amenity should always be factored into site design and the provision of SuDS/NFM.

4.2 SuDS

This section provides more detail on SuDS design considerations and requirements at a site-level. The NPPF states that any development should give priority to their use, and local authorities assess planning proposals based on their ability to mitigate the impacts that development has on surface water runoff rates and volumes.

In Basildon the SuDS Design Guide for Essex states the Local Standards the LLFA expects developments to meet with respect to sustainable drainage measures. Meanwhile, the South Essex SWMP outlines the preferred surface water management strategy for the Borough, describes flooding from surface water and identifies the relevant critical drainage areas (CDAs).

There are many types of SuDS component, which means that sustainable drainage can be tailored to a range of sites. They are generally split into two categories; infiltration systems and attenuation systems which can be defined as follows:

- Infiltration Systems - Infiltration components facilitate the infiltration of water into the ground. These often consist of temporary storage zones which allow for the slow release of water into the soil. They include permeable surfaces such as gravel, grassed areas, swales and permeable paving, and sub-surface components such as filter drains, geocellular systems and soakaways.
- Attenuation Systems – Attenuation SuDS capture runoff and control its subsequent discharge off-site. They are divided into conveyance systems which convey flows to downstream storage systems, and storage systems, which control the flows being discharged from a site by storing water and slowly releasing it. Examples of attenuation SuDS include detention basins, wetlands, ponds and swales.

The use of both systems tends to be determined by the permeability of the soil, and a site's topography. Relatively flat or gently sloping sites are often necessary for infiltration SuDS, and geotechnical investigations required to determine whether infiltration rates are sufficient. If ground conditions cannot support infiltration systems, surface water may need to be attenuated using measures to capture surface water. Attenuation systems do not offer the same range of sustainability benefits as infiltration systems and therefore infiltration SuDS are always preferred where viable.

At a number of sites SuDS designs often include a combination of infiltration and attenuation systems. A central design component for SuDS is the SuDS management train. SuDS should not be thought of as individual components, but as an interconnected system designed to manage, treat and make best use of surface water. The use of a sequence of components that collectively provide the necessary processes to control runoff and water quality is therefore often encouraged.

In developing an interconnected system, the layout and function of drainage systems should be considered at the start of the design process for a new development. This will help ensure better integration with road networks and other infrastructure which can maximise the availability of developable land. This in turn can lead to the provision of multi-functional benefits and reduced land-take. Maintenance requirements and adoption arrangements should also be incorporated into the planning process for any SuDS systems proposed. These should consider and encompass the lifetime of the development.

In terms of guidance for SuDS design, the SuDS Manual published in 2007 and updated in 2015 incorporates research, industry practice and construction methods for a range of SuDS components. In delivering SuDS there is also a requirement to meet the framework set out by the Government's 'non statutory technical standards' and the SuDS Manual complements these.

When determining SuDS design it is necessary to estimate runoff rates and volumes for a development site. These can be derived using the FEH methods specifically the rainfall runoff method implemented in ReFH 2. This is the current recommended method outlined in the CIRIA SuDS Manual[40]. Existing run-off rates are estimated by extracting point or catchment data. This data includes variables which describe rainfall and runoff characteristics in a particular area. For a development site the runoff characteristics derived can be linearly scaled based on the site area, yielding runoff rates and volumes for that area.

In terms of runoff rates, in the Basildon Borough, the LLFA requires a maintained greenfield rate for all events up to the 1% AEP plus climate change for greenfield sites, and a minimum 50% betterment at Brownfield sites, which is a last resort option when lower rates are proven to be unviable.

Note, when considering Brownfield sites specifically, these often coincide with CDAs, and the incorporation of SuDS is seen as key opportunity that may benefit existing hardstanding areas at flood risk. Furthermore, older drainage systems are often present within existing browfield sites within the Borough, these do not support the SuDS' principles laid out by the LLFA. Therefore, developers should be advised that approaches of "minimum SuDS onsite" are unlikely to be supported so as not to compound pressures on existing sewers.

In addition to runoff control, developers are encouraged to utilise SuDS to provide water quality inputs. This should be conducted in adherence to the CIRIA SUDS Manual, and align with criteria set out in the SuDS Design Guide for Essex.

At the time of writing Schedule 3 of the Flood and Water Management Act 2010 is expected to be forthcoming following the January 2023 review[41] of its proposed implementation. Schedule 3 will make SuDS mandatory on all developments exceeding 100m^2 and provides a framework for the approval and adoption of drainage systems. A sustainable drainage system approving body (SAB) will be formed within unitary and county councils, and national standards on the design, construction, operation, and maintenance of sustainable drainage systems for the lifetime of the development should be published.

---

[40] CIRIA (2015) *The SuDS Manual (C753)*
[41] DeFRA (2023) The review for implementation of Schedule 3 to The Flood and Water Management Act 2010 *https://assets.publishing.service.gov.uk/media/63bc504dd3bf7f263846325c/The_review_for_implementation_of_Schedule_3_to_The_Flood_and_Water_Management_Act_2010.pdf*

4.3 Surface Water Management and Critical Drainage Areas

The South Essex SWMP encompasses administrative areas including Basildon Borough as well as Castle Point and Rochford District Councils. This area collectively is ranked highest within the ECC's area of responsibility with respect to the number of properties at risk of surface water flooding. The EA additionally recognises this as a Flood Risk Area.

Across the Basildon Borough 19 areas have been identified as being critical drainage areas (CDA) based on the updated SWMP mapping which incorporates the latest EA climate allowances. Large areas of the Borough are at risk of surface water flooding and developers need to take a sequential approach to ensure develop is located in lower risk areas where possible. The implementation of SuDS also needs to be carefully considered.

The CDAs within the Borough's area and its immediate vicinity are shown in Figure 4. Figure 5 shows the CDAs identified across the Essex as a whole. The LLFA have put together an Action Plan[42] as part of the SWMP which sets out investment across the CDAs identified.

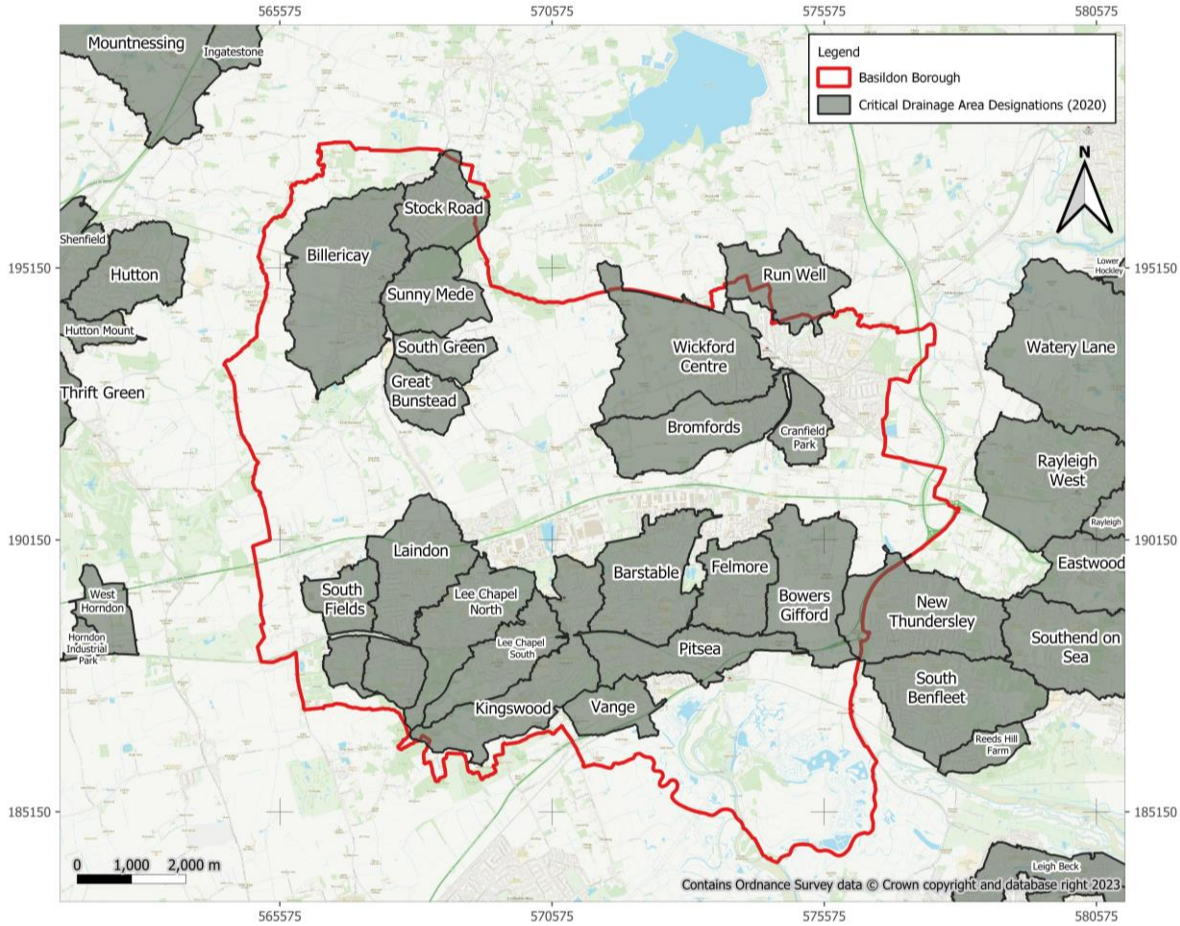


Figure 4 – Critical Drainage Areas within the Basildon Borough and immediate vicinity

[42] Essex County Council (2020) *South Essex Surface Water Management Plan Action Plan* 20200924 FINAL South Essex District Level Action Plan 00.pdf

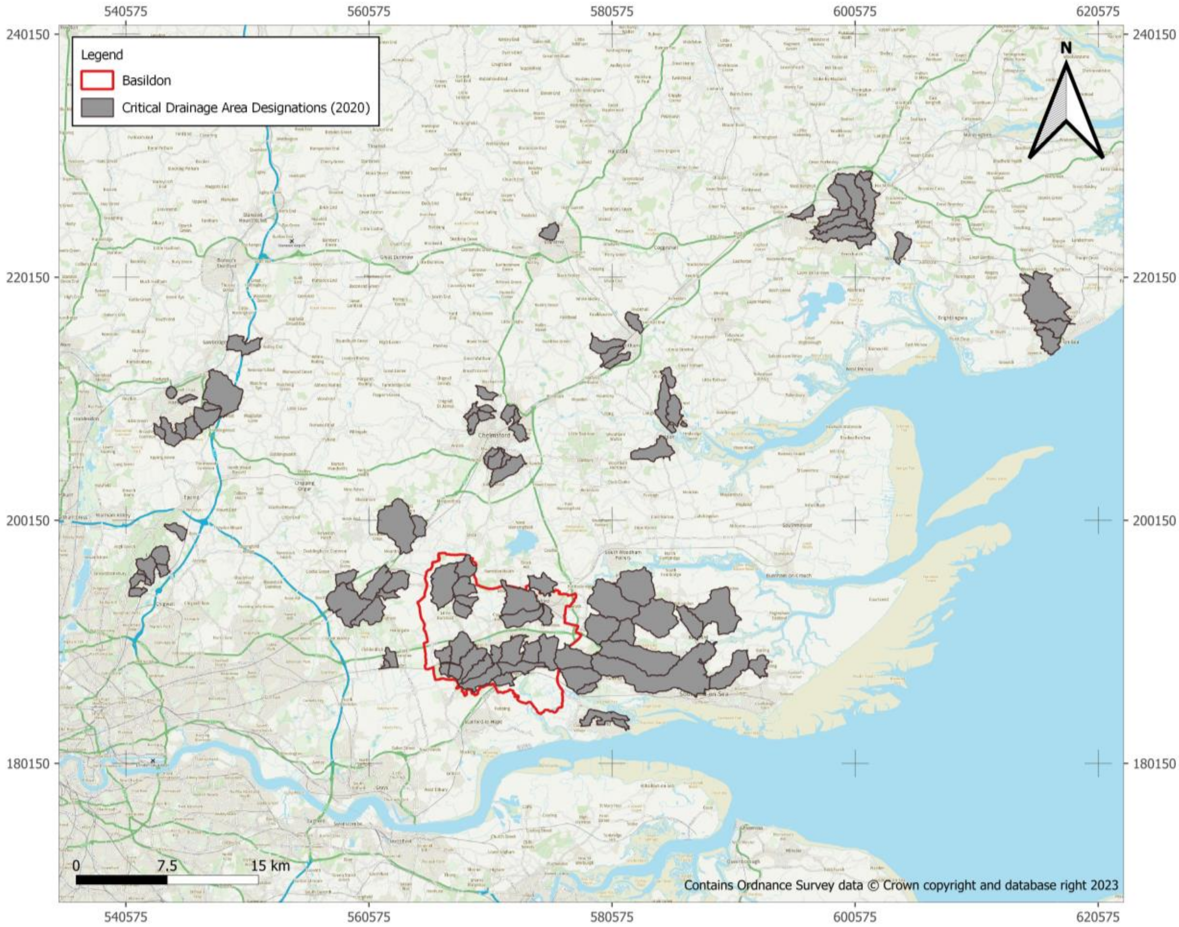


Figure 5 – Critical Drainage Areas within the ECC Area.

4.4 Flood Resilience

Property Flood Resilience (PFR) is another flood risk management option available for new and existing development. It is an approach to building design which aims to reduce flood damage and speed up recovery and reoccupation following a flood. It uses a combination of flood resistance and recovery measures.

It is described in the industry-developed CIRIA Property Flood Resilience Code of Practice[43], which provides advice for both new-build and retrofit. PFR is also now a key consideration in the NPPF (paragraph 173b) for new developments in flood risk areas. This states that all new development in areas at risk of flooding should be appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment. The associated PPG for Flood Risk and Coastal Change also identifies flood resilience in new developments as a way of ensuring that developers can adapt to the challenges of a changing climate. The latest EA national strategy on flood risk and coastal change, also identifies flood resilience measures as a key means to adapt to the threats from flooding and coastal change, enabling growth in a sustainable and climate resilient way.

The NPPF is supported by the PPG for Flood Risk and Coastal Change, this states that the first preference is to apply the avoidance measures set out in the sequential approach to planning. Where this is not possible, flood resistance and flood resilience measures may need to be incorporated into the design of buildings and other infrastructure, including behind flood defence systems.

Resistance and resilience measures are unlikely to be suitable as the only mitigation measure to manage flood risk, but they may be suitable in some circumstances, such as:

- Water-compatible and less vulnerable uses where temporary disruption is acceptable, and the development remains safe;
- Where the use of an existing building is to be changed and it can be demonstrated that the avoidance measures set are not practicable, and the development remains safe;
- As a measure to manage residual flood risk from flood risk management infrastructure when avoidance measures have been exhausted.

In these cases, and where existing development is already in flood risk areas, flood resilience measures could be considered. These are typically defined as sustainable measures that can be incorporated into the building fabric, fixtures and fittings to reduce the impact of floodwater on property. They allow for easier drying and cleaning, ensure that the structural integrity of the building is not compromised and reduce the amount of time until the building can be re-occupied. Flood repairability should also be considered which involves the design and construction of building elements, to ensure the ease of replacement and repair, should they suffer flood damage.

4.5 Structural Safety

As part of being resilient, buildings should be structurally sound and remain in situ during the worst case flooding effects (depth and velocity). Any measures in place to ensure structural soundness during a flood should not cause a hazard to people.

Some of the main measures to ensure structural safety and resilience are outlined below:

---

[43] CIRIA (2021) *Code of practice for property flood resilience (C790)* https://www.ciria.org/CIRIA/Resources/Free_publications/CoP_for_PFR_resource.aspx

- Flood doors and windows - These can prevent water from entering a property by creating a watertight seal during a flood.
- Flood barriers - These can be fitted to external doorways, windows, across driveways, garage doors and gardens. It is recommended that they are not fitted higher than 600mm in order to prevent structural damage to walls.
- Flooring - Concreate floors with damp proof membranes can be used in properties which are at particular risk of groundwater flooding as they prevent water rising up through the floors.
- Walls - Pointing which is in poor condition should be repaired with a water-resistant mortar and any cracks or holes in brickwork can be repaired with a waterproof silicone sealant.
- Drains and pipes - Fitting non-return valves to pipes will prevent backflow from toilets, sinks, drains and manholes when drains and sewers become overwhelmed with flood water.
- Airbricks and vents - There are a number of products available, examples include automatic (self-closing) air bricks which allow ventilation but prevent flood water coming in when needed. Alternatively, air brick covers can be placed over airbricks.
- Adaption measures - Where flooding does occur waterproof plaster, solid concrete floors and tiled floor coverings, can reduce flood damage and greatly shorten the recovery time after a flood. Other steps include raising electric sockets to preserve electricity supply and moving paperwork and valuables to higher levels to minimise potential damage.

Planning and building standards have a complementary role in flood management and the use of flood damage resistant and mitigation measures could be considered at the proposed preferred sites where appropriate. These may be required as part of ensuring that consequences of flooding are acceptable.

It should be noted that mitigation and flood resilience measures are not sufficient justification to permit a development if the tolerable conditions are exceeded during an extreme flood event. High velocities and/or depths of floodwater pose a potential risk to life, may cause structural damage to buildings and could impact on human health and wellbeing.

4.6 Site Specific FRA Considerations

An FRA is required for the following development scenarios:

- In Flood Zone 2 or 3 including minor development and change of use
- More than 1 hectare (ha) in Flood Zone 1
- Less than 1 ha in Flood Zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs)
- In an area within Flood Zone 1 which has critical drainage problems as notified by the EA

In general, FRAs should address the points below, full advice is available within the EA's FRA guidance[44]:

- The proposed site's address.
- Description of the proposed development.
- An assessment of the flood risk from all sources of flooding for the proposed development, including consideration for an allowance for climate change.
- The estimated flood level for the proposed development which takes into account the impacts of climate change over the proposed development's lifetime.
    - The estimated flood level is the depth of flooding predicted on a proposed development site in either a) a 1 in 100-year annual probability river flood plus an allowance for climate change b) a 1 in 200-year annual probability tidal flood event plus an allowance for climate change.
    - It should also be noted that if a proposed development is in an area with flood defences present, that the estimated flood level should account for residual flood risk of they breached or were overtopped.
    - Flood Risk Levels may be available from the EA, Local Planning Authority but if not, these can be calculated by specialist flood risk consultants if required.
- Details of the finished floor levels; these should be a minimum elevation of the design flood level plus a freeboard.
- Details of flood resistance and resilience plans.
- All supporting plans and drawings.
- All other information for example planning correspondence.

As indicated in the final bullet point, liaison should be sought when making a planning application and it is also recommended that the LLFA and local authority be contacted for area specific advice on flood risk requirements. The following sections go on to more detail on some of the areas mentioned above.

---

[44] DeFRA & EA (2017) *Flood risk assessments if you're applying for planning permission* https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

4.7 Residual Risk

In terms of residual risk, it should be minimised at each stage of the planning process. Residual risks include those that result from the failure or overtopping of flood defences, the blockage of drainage systems, failures in flood forecasting or flood warning issue, receipt or response, and failure of active measures such as demountable flood barriers. It can be minimised by taking a sequential approach to development. For example, in locating the buildings in areas at lowest risk, raising floor levels, managing site levels (where appropriate), raising vulnerable uses to upper floors and ensuring that appropriate passive flood resistant/resilient and recovery measures have been incorporated.

Where an assessment shows that flood risk and residual risks are a consideration for a plan or development proposal, the Avoid, Control, Mitigate, Manage residual risk process should be followed. More detail is provided in paragraph 4 of the Flood risk and Coastal PPG.

To determine the level of risk and safety implications for development proposed in a site allocation or planning application, the following should be considered:

- the characteristics of a possible flood event,
- the safety of people within a building if it floods,
- the safety of people around a building and in adjacent areas,
- the structural safety of buildings; and,
- the impact of a flood on the essential services provided to or from a development.

More detail is provided in paragraph 5 of the Flood risk and Coastal PPG.

4.8 Emergency Planning

Another consideration to ensure that development is safe is whether adequate flood warnings would be available to people using the development. An emergency plan will be needed wherever emergency flood response is an important component of making development safe. Emergency plans will need to take account of the impacts of climate change on escape routes. Residual risk mitigation measures may also include the provision of a safe refuge above the extreme (0.1% with climate change AEP) residual risk flood levels with a freeboard. Emergency flood plans should follow the ADEPT and EA guidance[45]. More detail is provided on managing residual risk and emergency planning in paragraph 42-48 of the Flood risk and Coastal PPG.

Across the Borough as a whole, the Civil Contingencies Act 2004[46] is one of the most relevant pieces of legislation to emergency planning for flooding. It lists local authorities, the EA and emergency services as 'Category 1' responders to emergencies. It places duties on these organisations to:

- Undertake risk assessments
- Manage business continuity
- Carry out emergency planning
- Warn and advise the public during times of emergency.

The EA has a key role in relation to flooding. It is the lead agency for warning those at risk and maintaining and improving flood defences.

---

[45] Adept and EA (2019) Flood risk emergency plans for new development
https://www.adeptnet.org.uk/system/files/documents/ADEPT%20%26%20EA%20Flood%20risk%20emergency%20plans%20for%20new%20development%20September%202019....pdf

[46] UK Parliament (2004) Civil Contingencies Act
https://www.legislation.gov.uk/ukpga/2004/36/section/1/enacted

Local resilience forums (LRFs) – of which the EA is a member in all regions – have developed multi-agency flood plans (MAFPs). These cover various elements associated with a flood. The LRF applicable to Basildon is the Essex Resilience Forum[47]. All the organisations that make up the Essex Resilience Forum work together to ensure that preparations and plans are in place for major emergencies and incidents affecting the county. These are regularly reviewed, tested and updated so that agencies can respond immediately and effectively to any threat or incident.

4.9 Finished Floor Levels

As mentioned in section 4.6, details of the finished floor levels should be included within an FRA. These need to consider design flood levels and climate change in view of the nature and lifetime of the development. More detail on the design event and climate change allowances applicable to different development types is provided in the PPG on climate change allowances[3]. Development should be set at a floor level to provide an appropriate freeboard above the design flood level which should be calculated with climate change considered. A freeboard can be defined as an additional amount of height above the design flood level which is used as a factor of safety to account for any uncertainty. Typically, it is set to 300 or 600mm above the design flood level. The freeboard allowance should be agreed with the EA, LLFA and/or local authority depending on the scale of the development and flood risks present. More detail is provided in the PPG for preparation of an FRA.

4.10 Third Party Impacts

Development or the cumulative impacts of development may result in an increase in flood risk elsewhere as a result of impacts such as the loss of floodplain storage, the deflection or constriction of flood flow routes or through inadequate management of surface water. Floodplain storage can also be lost where finished floor levels are raised above the design flood level.

Where this is the case, a site-specific FRA should include an assessment of 3rd party impacts. If 3rd party impacts are found, mitigation may be required including the provision of compensatory storage. Compensatory storage refers to a practice of offsetting the effects of a development that encroaches into floodplain storage by providing a hydraulically equivalent, excavated floodplain storage capacity onsite or elsewhere. The EA and LLFA should be contacted to confirm the requirements for assessing 3rd party impacts (e.g. hydraulic modelling), mitigation and compensatory storage.

4.11 Flood Risk Activity Permits

Applicants may need an environmental permit for flood risk activities if they want to do work in, under, over or within 8 metres (m) from a fluvial main river and from any flood defence structure or culvert or 16m from a tidal main river and from any flood defence structure or culvert. If works are required close to an ordinary watercourse, ordinary watercourse consent may be required.

The carrying out of these activities without a permit in a situation where one is required is considered to constitute a breaking of the law. Further information regarding flood risk permits can found in the EA guidance for permits[48]. More detail on ordinary watercourse consent is provided on the ECC website[49].

---

[47] Essex Resilience Forum (2024) http://www.essexprepared.co.uk/

[48] EA (2024) *Flood risk activities: environmental permits* https://www.gov.uk/guidance/flood-risk-activities-environmental-permits

[49] Essex County Council (2024) *Maintaining or changing a watercourse* https://flood.essex.gov.uk/maintaining-or-changing-a-watercourse/.

5 Conclusions and Recommendations

5.1 Conclusions

1. A collation of potential sources of flood risk has been carried out in accordance with NPPF and associated legislation and guidance. The SFRA has been developed in close consultation with BBC, the LLFA and the EA.
2. The Basildon Borough is affected by multiple flooding mechanisms with the severity of each varying according to the location within the Borough.
3. Fluvial flooding is the dominant flood mechanism within Basildon and Billericay, whilst a combination of fluvial and pluvial flooding forms the dominant flood mechanism within Wickford.
4. Tidal flooding is the dominant flooding mechanism in the southeast of the Borough, notably around Timberman's Creek, Pitsea Creek and Vange Creek. This primarily affects open land and has minor impact on built up areas.
5. A number of properties lie within River Crouch fluvial flood extents. These include north and central Wickford, Runwell Road, Steeple View, Harding's Elms Road, Golden Jubilee Way and the A132.
6. The River Wid presents a risk to parts of the Northeast area of Billericay and buildings along London Road to the east of Haverings Grove.
7. The Thames Estuary presents a source of tidal flood risk to a collection of industrial buildings to the south and southeast of Pitsea and a small number of houses around Woodlands Drive.
8. There are a number of ordinary watercourses within the Borough. Modelled data is available for the Rawreth Brook and demonstrates that floodwater extents present risk to areas around the Southend Arterial Road and A130 close to the eastern area of the boundary.
9. Widespread flood risk also arises from surface water flooding across significant proportions of the Borough. This includes the following built up areas:
    a. Within Basildon, most notably at Ghyllgrove, Kingswood, Lee Chapel North and Lee Chapel South.
    b. Within Billericay, flooding is shown across Crown Road and Valley Road. In addition, floodwater routes flow southeast and northwest of the town centre.
    c. Within Wickford, areas including Wick Lane, the A129 by St Catherine's Church, the residential areas around Long Meadow Drive, Farnham Avenue, Elder Avenue and Melville Drive.
10. In terms of groundwater risk, areas within the floodplains of the River Thames and the River Crouch are at potential risk of groundwater flooding. Outside of these areas, the majority of Basildon and Billericay are situated in areas likely to have less mobile groundwater levels and a lower risk of groundwater flooding.
11. Sewer flooding incidents have been recorded across the Basildon Borough area and particularly in built up areas, with Basildon and Billericay having a higher density of these compared to Wickford.
12. Reservoir flooding has been assessed using the EA reservoir flood maps. Heavy regulation means a low probability of failure occurring, however the areas shown to be at risk if this did occur include:
    a. Reservoir flooding along the River Crouch floodplain includes central Wickford, the west of Crays Hill, north of the A129 and areas adjacent to the A132.
    b. Reservoir flooding along the River Wid floodplain includes areas of Buckwyns and Mountnessing Road.

13. Where present, flood defences generally offer moderate levels of protection along the River Crouch and Tributaries, low protection along the River Wid and tributaries, and high protection along the River Thames and Marshland.
14. The Basildon Borough washland basin system has the potential to provide a significant level of protection from surface water flood risk up to the 0.5% AEP event. ECC plans to record the washland basin system on their register as an asset and to perform annual inspections on the condition of the system.
15. There are a total of four flood warning areas and four flood alert areas within Basildon Borough.

5.2 Recommendations

1. In general, development should be located in Flood Zone 1 wherever possible. In cases where this is not possible, a sequential approach should be taken with highly or more vulnerable development prioritised for areas where flood risk is lowest and less vulnerable development located in areas at higher risk if necessary.
2. Sustainable drainage principles, as set out in the National and Local Standards including the SuDS Design Guide for Essex should be followed at every site to safeguard against increasing flood risk both onsite and to third party land.
3. For greenfield development sites runoff rates and volumes should be controlled to be no greater than the existing greenfield rate and volume of runoff from the site.
4. For developments on previously developed brownfield sites the rate of runoff should not exceed the runoff of the site in its previously developed condition, and will always seek a betterment on pre-existing rates, especially in locations where drainage is poor. ECC as the LLFA will always seek an absolute minimum 50% betterment.
5. Essex is a water stressed area and there is a high likelihood of Essex suffering water shortages by 2050, in this regard discharge of surface water should prioritise water reuse (e.g. rainwater harvesting, greywater recycling) first before infiltration and attenuation systems are considered for large flood events.
6. Whilst much of the Basildon Borough is underlain by impermeable soils, infiltration SuDS should be encouraged in areas with more permeable geology. This includes those locations seen to the southwest of Basildon town as well as the centre of Billericay.
7. The LLFA would expect developments to reduce flood risk on sites and to mitigate any risk to downstream areas. Any risks should be identified and mitigated with reference to the SuDS Design Guide for Essex. Methods to reduce flood risk at sites and downstream may include the creation of wetland features, promotion of vegetation growth and use of NFM practices. The limited rural spaces in the Borough prevent NFM being implemented in some areas.
8. Where sites are located in flood risk areas requiring an exception test, they will need to provide wider sustainability benefits to the community that outweigh flood risk. This could include delivering an overall reduction in flood risk to the wider community through the provision of, or financial contribution to, flood risk management infrastructure.

9. For site at flood risk, an emergency flood plan to help manage residual risk should be considered. This will seek to ensure residents and users can safely access and exit site buildings during a design flood and to evacuate before an extreme flood (0.1% AEP with allowance for Climate Change). Emergency flood plans should follow the ADEPT and EA guidance.
10. This SFRA does not replace the need for site specific FRAs. A greater level of detail should be provided by such assessments.
11. Site specific FRAs are required for all sites over 1 hectare in size and for all sites located within Flood Zones 2 and 3. FRAs for sites within Flood Zone 1 may be required to assess surface water and non-fluvial forms of flood risk. FRAs should factor in the latest climate change guidance. More guidance on FRAs is provided in the PPG for FRAs.

6 Living Document

This SFRA has been developed with reference to existing data and knowledge with respect to flood risk within Basildon Borough. The flood maps informing this SFRA are regularly updated with new information, and modelling software. This, in addition to observed flooding that may occur throughout any given year, will improve the current knowledge of flood risk within the Borough. Subsequently, the predicted flood extents may be altered in some locations. Furthermore, future amendments to the NPPF are anticipated. Given that this is the case, a periodic review of the Basildon Borough Level 1 SFRA is imperative when considering its contents.

Appendix 1 – Baseline Fluvial Flood Maps

Appendix 2 – Fluvial Climate Change Flood Maps

Appendix 3 – Surface Water Flood Maps & Incidents

Appendix 4 – Primary Watercourse Maps

Appendix 5 – Geology and Soils Mapping

Appendix 6 – Reservoir Flood Maps

Appendix 7 – Recorded Flood Outlines Maps

Appendix 8 – Flood Defences & Washland System Maps