AECOM

North Benfleet Flood Risk Scoping Study

Locality, on behalf of, Bowers Gifford and North Benfleet Parish Council

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Quality information

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1. Introduction

Terms of Reference

1.1.1 Locality, on behalf of Bowers Gifford and North Benfleet Parish Council, has commissioned AECOM to undertake a review of the flood risk within the Bowers Gifford and North Benfleet parish council administrative area. This document provides a high-level assessment of the flood risk from surface water and fluvial flooding within North Benfleet and provides initial suggestions for the management of these risks.

1.1.2 Essex County Council (ECC) as the Lead Local Flood Authority (LLFA) has been consulted during the preparation of this document.

Project Background

1.1.3 North Benfleet is a village within the parish of Bowers Gifford and North Benfleet, in the borough of Basildon, Essex. The village is located north of Bowers Gifford and approximately 3km east of Basildon.

1.1.4 A Neighbourhood Development Order (NDO) has previously been established which seeks to grant planning approval for appropriate development within the plotlands.[1] The NDO aims to encourage development that is cohesive through the village, retaining the grid like appearance which defines the character of the plotlands.

1.1.5 The plotlands has been divided into two parcels, as illustrated in **Figure 1**. Parcel A is located to the south-east of the village spanning 14.03 hectares and Parcel B is located in the western part of North Benfleet and encompasses approximately 65.54 hectares.

1.1.6 The village comprises various types of residential development, undeveloped plots, incomplete roads and unadopted single lane roads. The NDO aims to ensure future development within the village is well connected by creating a loop road which runs through Parcel B.

1.1.7 The village has been divided into mini masterplan areas involving five phases, with a loop road which runs through all phases, linking Pound Lane with the north of the plotlands.

1.1.8 The loop road has been designed to support future development in a more cost-effective way than updating the current road network to an adoptable standard.

1.1.9 A review of flood risk across the area will help inform design measures that need to be considered as part of future development within the plotlands.

[1] Oneill Homer. 2023. *Neighbourhood Development Order, North Benfleet.*

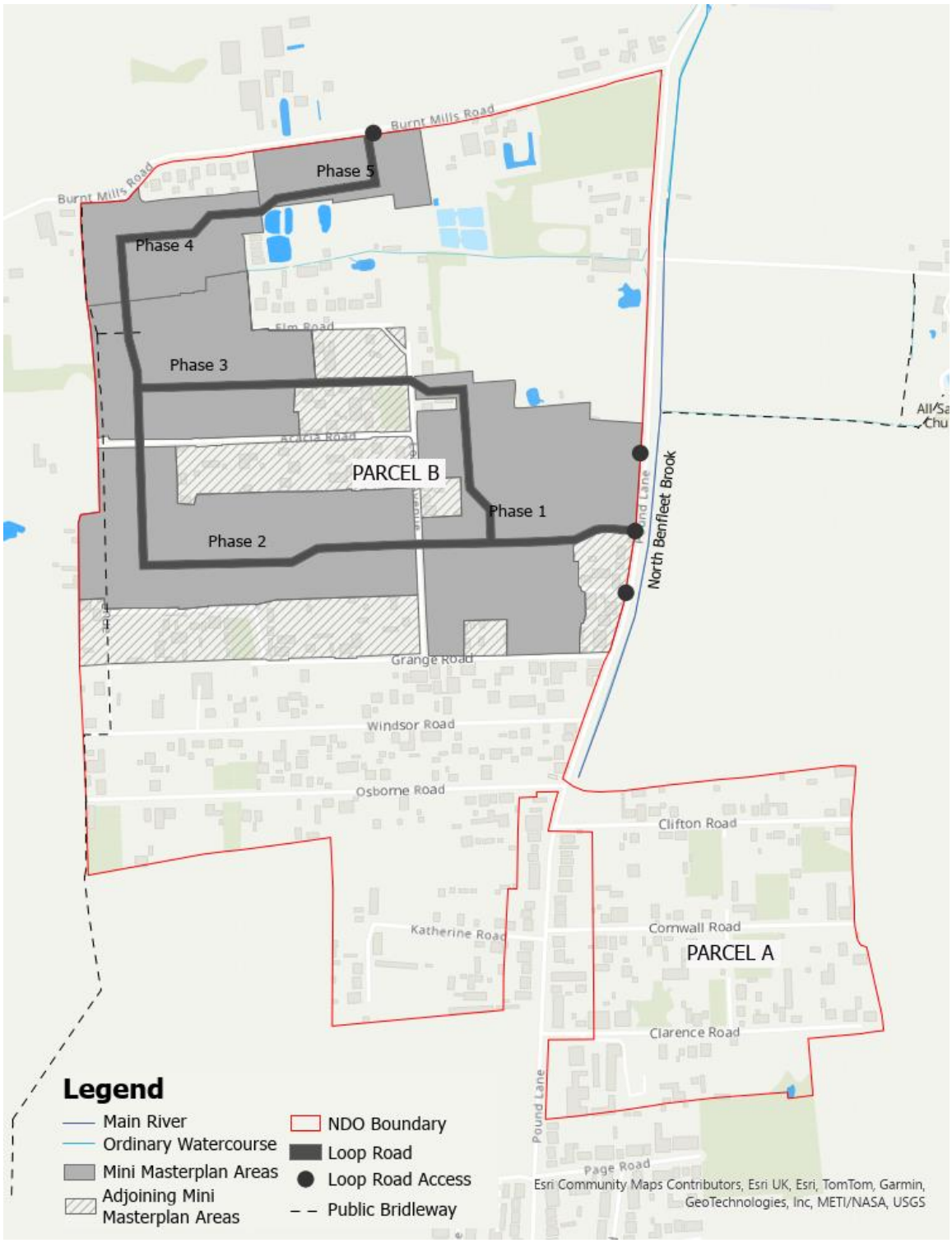

Figure 1 North Benfleet plan illustrating Parcels and Phases

Source: Oneill Homer NDO Mapping 2024. © Environment Agency copyright and/or database right 2025. All rights reserved.

2. Legislative and Planning Policy Context

Overview

2.1.1 This section provides the legislative and policy context in relation to planning and flood risk. Information has been reviewed from national policy and guidance, the LLFA, Basildon Borough Council and the Environment Agency.

Planning Policy Guidance

2.1.2 The National Planning Policy Framework (NPPF)[2] sets out the government's planning policies for England, and the Planning Practice Guidance Flood Risk and Coastal Change[3] adds further context to the NPPF, advising how to address the risks associated with flooding. The overall approach for the consideration of flood risk, as set out in paragraphs 003 and 004 of the PPG, is summarised as:

- **Assess flood risk** (For sites in areas at risk of flooding, or with an area of 1 hectare or greater, developers must undertake a site-specific Flood Risk Assessment (FRA) to accompany planning applications (or prior approval for certain types of permitted development, or technical details consent).
- **Avoid flood risk** (Apply the Sequential Test to the selection of sites, and apply a sequential approach within development areas, to steer development towards areas at least risk of flooding first before consideration of areas at greater risk).
- **Control flood risk** (Use flood risk management measures or features, and/or Sustainable Drainage Systems).
- **Mitigate flood risk** (Implement appropriate flood resistance and resilience measures).
- **Manage residual risk** (Consider safe access and escape routes and flood warnings and preparedness).

2.1.3 The PPG Flood Risk and Coastal Change defines Flood Zones based on the probability of flooding from rivers and sea, as shown in Table 2-1.

[2] Ministry of Housing, Communities and Local Government, Ministry of Housing, Communities & Local Government (2018 to 2021) and Department for Levelling Up, Housing and Communities National Planning Policy Framework https://www.gov.uk/government/publications/national-planning-policy-framework--2

[3] Ministry of Housing, Communities and Local Government, Ministry of Housing, Communities & Local Government (2018 to 2021) and Department for Levelling Up, Housing and Communities (2022) *Flood risk and coastal change* https://www.gov.uk/guidance/flood-risk-and-coastal-change

Table 2-1 Flood Zone Definitions

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
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. (Land shown in light blue on the Flood Map)
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. (Land shown in dark blue on the Flood Map)
Zone 3b The 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). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map).

2.1.4 Annex 3 of the NPPF defines flood risk vulnerability classifications for different types of development, based on the vulnerability of their users. Table 2 of the PPG Flood Risk and Coastal Change sets out which types of development are compatible (or not) within each Flood Zone and when the Exception Test is required.

2.1.5 For the Exception Test to be satisfied, it should be demonstrated that:

- development that has to be in a flood risk area 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.

Lead Local Flood Authority

2.1.6 ECC are designated the Lead Local Flood Authority (LLFA) in accordance with the Flood and Water Management Act (FWMA). ECC has a duty to take the lead in the coordination of local flood risk management, specifically

defined as flooding from surface water, groundwater, and ordinary watercourses. ECC is responsible for regulation and enforcement on ordinary watercourses and is a statutory consultee for future sustainable drainage systems (SuDS) for major developments. ECC is also the Highways Authority and therefore has responsibilities for the effectual drainage of surface water from adopted roads insofar as ensuring that drains, including kerbs, road gullies and ditches and the pipe network which connect to the sewers, are maintained.

Where Water Goes Study

2.1.7 The Where Water Goes report[4] was commissioned by ECC in 2017 to investigate the nature of the flooding within Bowers Gifford and North Benfleet.

2.1.8 The ditch to the north of Elm Road drains large amounts of water during flooding events but the area around it floods. It takes a long time to drain due to the ditch being filled in at several locations and debris blocks flow. This flooding is made worse by foul sewer system being pumped out to the ditch north of Elm Road, subsequently flooding the area. Anglian Water are unsure as to how surface water enters the foul sewer network.

2.1.9 The report outlines the following strategies which may be beneficial in alleviating flood risk in the area:

- Maintaining/restoring the drainage channel network.
- Unblocking Elms Road Channel.
- Channel widening to two stage channel from Osbourne Rd to the north. However, this would increase flows downstream so compensation storage areas would be needed to avoid this.
- Prevent surface water flowing into the sewer network.
- Constructing Earth Bunds or Flood Walls north of the A127.
- Online flood storage area upstream of Osborne Road and on Pound Lane opposite Clarence Road.
- Floodplain lowering to alleviate flooding north of the A127.

To ECC's knowledge, none of the strategies mentioned above have been put into action, nor are there any future plans for the area.

Sustainable Drainage Systems Design Guide for Essex

2.1.10 The Sustainable Drainage Systems Design Guide for Essex[5] is a useful guide for understanding the key objectives that the LLFA has for planning.

[4] Essex County Council (2018) *Bowers Gifford Initial Assessment - Where Water Goes*
[5] Essex County Council. 2020. Sustainable Drainage Systems, *Design Guide*.

2.1.11 The drainage hierarchy[6] should be applied to all sites to manage surface water, where water should be discharged via rainwater re-use as a primary approach:

1. Rainwater re-use (rainwater harvesting/greywater recycling)
2. An adequate soakaway or other infiltration system
3. Hybrid solution of infiltration and discharging to a surface water body
4. To a surface water body (e.g. an ordinary watercourse)
5. To a surface water sewer, highway drain, or other drainage system
6. To a combined sewer

2.1.12 An upper climate change allowance of 45%[7] for the South Essex catchment has been used in this report as per the Climate Change section from the Essex design guide.

Surface Water Management Plan

2.1.13 ECC has produced a Surface Water Management Plan (SWMP) for South Essex[8]. The South Essex area has the highest number of properties at risk of surface water flooding in the country.

2.1.14 Within the SWMP, North Benfleet is shown to be located within a Critical Drainage Area (CDA) which is *'a discrete geographic area (usually a hydrological catchment) where multiple or interlinked sources of flood risk cause flooding during a severe rainfall event thereby affecting people, property, or local infrastructure.'*

2.1.15 CDAs are the focal point for ECC in their role as the LLFA when considering the implementation of measures to reduce flood risk.

Basildon Borough Council

Basildon Borough Draft Local Plan 2023 – 2024

2.1.16 Basildon Borough Council (BBC) has prepared a Local Plan which details the vision for future development within the borough, in line with the National Policy.

[6] Essex County Council (2020) *The Sustainable Drainage Systems Design Guide For Essex – The Drainage Hierarchy* https://www.essexdesignguide.co.uk/suds/discharge-locations/the-drainage-hierarchy/
[7] Essex County Council (2020) *The Sustainable Drainage Systems Design Guide For Essex – Climate Change* https://www.essexdesignguide.co.uk/suds/rates-and-storage/climate-change/
[8] South Essex Surface Water Management Plan. https://www.essexdesignguide.co.uk/suds/surface-water-management-plans/south-essex-inc-rochford-castle-point-and-basildon/

2.1.17 As per Basildon Borough Local Plan,[9] *'new development must be safe from all types of flooding and should not increase the risk of flooding elsewhere. Suitable strategic and Site level measures will need to provide appropriate flood risk management, including the use of SUDS. Policy INF1 states that new developments will be expected to fully mitigate their impact on infrastructure, services, and the environment.'*

Level 1 Strategic Flood Risk Assessment

2.1.18 The Basildon Borough Level 1 Strategic Flood Risk Assessment (SFRA)[10] was commissioned by BBC in 2024. The SFRA assesses flood risk from all sources and this evaluation is used to guide development and the allocation of potential sites.

2.1.19 *'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.'*

2.1.20 *'Typically Finished Floor Levels (FFLs) are set to 300 or 600mm above the design flood level. The freeboard allowance should be agreed with the Environment Agency, LLFA and/or local authority depending on the scale of the development and flood risks present.'*

Environment Agency

2.1.21 The Environment Agency is a non-departmental public body who provide a strategic overview of all sources of flooding. The Environment Agency has a breadth of informative data to download and details on flood risk.

2.1.22 Data from the Environment Agency has been used to understand flood risk within the area. This information is shown in **Figure 2** to **Figure 5** in **Section 3**. This data includes Flood Risk Area, Risk of Flooding from Surface Water mapping and the Flood Map for Planning.

[9] Basildon Borough Council (2024) *Basildon Borough Draft Local Plan 2023 – 2034.*
[10] Wallingford HydroSolutions Ltd. (2024) *Basildon Borough Council Level 1 Strategic Flood Risk Assessment.*

3. Flood Risk Review

Overview

3.1.1 This section provides an overview of the risk of flooding from all sources, with reference to readily available information and datasets.

Tidal

3.1.2 The study area is located approximately 2km north of the Holehaven Creek and Hadleigh Ray. The Flood Map for Planning (Rivers and Sea) shows that the plotlands are located in Flood Zone 1 ‘Low probability of flooding’ from tidal sources.[10]

Main Rivers and Ordinary Watercourses

3.1.3 Several Ordinary Watercourses and a Main River[11] (North Benfleet Brook) lie within the vicinity of the plotlands. The locations of the watercourses are shown in **Figure 2**.

- North Benfleet Brook flows parallel to Pound Lane from Osbourne Road in the direction south to north.
- An Ordinary Watercourse flows through Phase 4, north of Elm Road and south of Burnt Mills Road, from west to east.

3.1.4 The Flood Map for Planning (Rivers and Sea),[12] reproduced in **Figure 2,** shows that the central and southern portions of the plotlands are located in Flood Zone 1 ‘Low probability of flooding’. The northeastern corner of the village and areas within the north and west of the plotlands within Phases 3, 4 and 5 are located within Flood Zone 3 ‘High probability of flooding’ associated with the North Benfleet Brook. Flood Zone 2 (Medium probability of flooding) encroaches upon the Flood Zone 3 outline and there are localised areas of Flood Zone 2 ‘Medium probability of flooding’ in the north, east and west of Parcel B.

[11] Environment Agency (2023) *Statutory Main River Map* https://environment.data.gov.uk/defra/25dde009-ba7d-40de-8380-c5c3bb32ccdc/details Accessed on 25 January 2025.
[12] Environment Agency (2025) *Get flood risk information for planning in England* https://environment.data.gov.uk/dataset/b5aaa28d-6eb9-460e-8d6f-43caa71fbe0e Accessed on 17 April 2025.

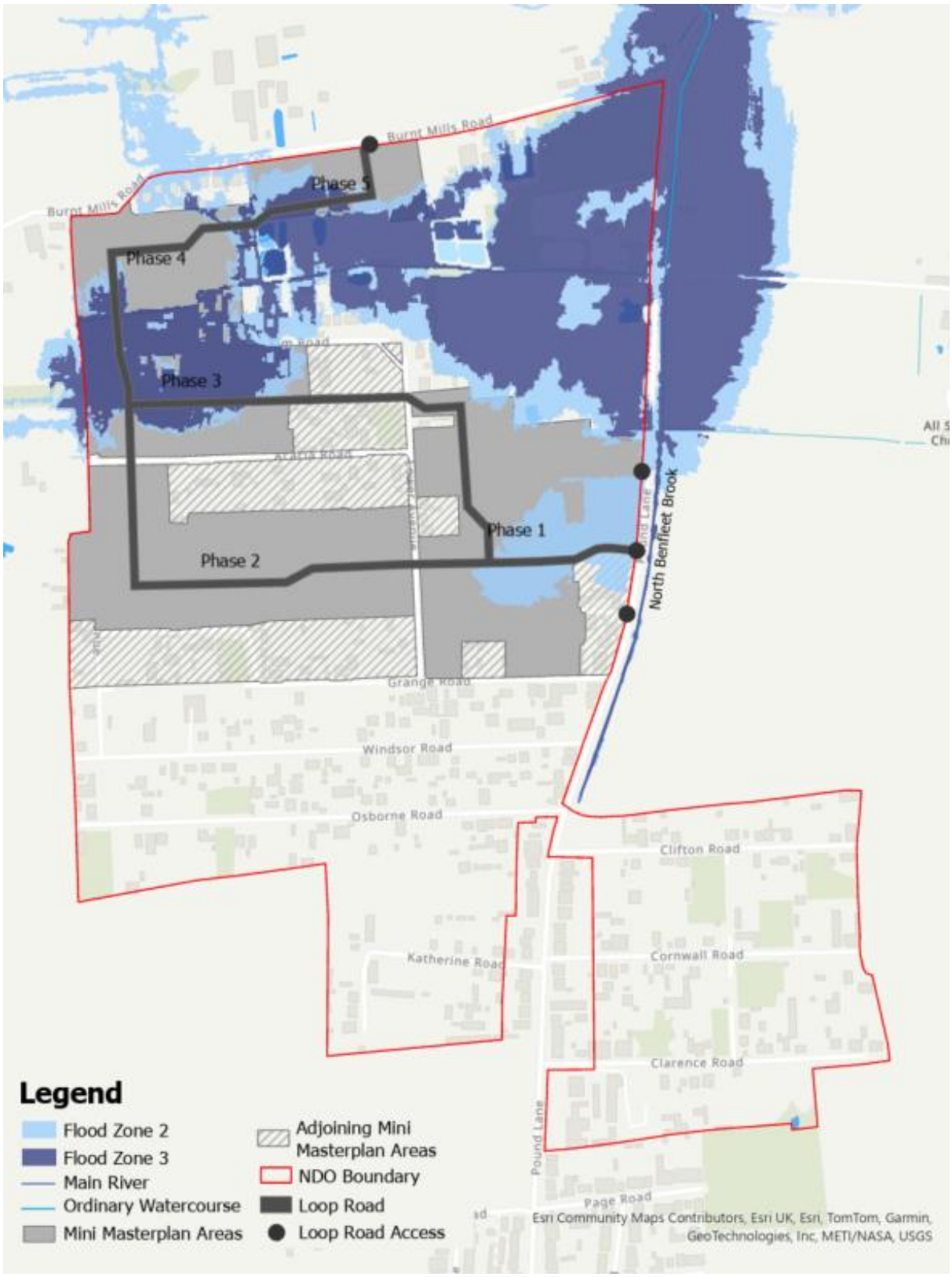

Figure 2 Flood Zones and Watercourses

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Surface Water

3.1.5 Risk of Flooding from Surface Water (RoFfSW)[13] mapping has been reviewed. This shows areas at risk of flooding during High (3.3% AEP), Medium (1% AEP) and Low (0.1% AEP) probability rainfall events.

3.1.6 The mapping indicates there is a significant flow path through the south-west and west of Parcel B and through the north of Parcel B.

3.1.7 The Environment Agency's RoFfSW mapping used in this high-level assessment considers a medium probability (1% AEP) rainfall event with an allowance for climate change of 20%.

3.1.8 The Environment Agency climate change allowances for the Combined Essex Management Catchment[14] (in which the site is located), are shown in Table 3-1. This shows that the 20% allowance applied within the RoFfSW mapping corresponds to the central climate change allowance for the 2050s for the 1% AEP rainfall event.

Table 3-1 Combined Essex Management Catchment peak rainfall allowances - 1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	45%
2070s	25%	45%* (Note EA exceptions policy)

3.1.9 For residential development an upper end climate change allowance for the 2070s epoch of 45% is recommended as stated in 2.1.12. Given the central climate change allowance is applied rather than the upper end allowance, the mapping should be taken as an under underestimate of the predicted risk of flooding for the 1% AEP event with an allowance for climate change. Additionally, it is also noted that the modelling behind the RoFfSW mapping may not take into account existing flood management infrastructure such as culverts.

3.1.10 Outputs for the 3.33% AEP, 1% AEP and 0.1% AEP events with a 20% allowance for climate change are presented in **Figure 3**.

3.1.11 The mapping in **Figure 3** indicates there is a significant flow path through the south-west and west of Parcel B. In particular through the plot infill areas in

[13] Environment Agency (2025) *Risk of Flooding from Surface Water* *https://environment.data.gov.uk/dataset/e5b38de2-99b3-44ee-b10c-b244926878ef* Accessed on 17 April 2025.
[14] Department for Environment Food & Rural Affairs (2025) Climate Change Allowances Climate change allowances for peak rainfall Accessed on 23 August 2025

the south-west, Phase 1 and along Pound Lane during high probability rainfall events with a 20% climate change allowance.

3.1.12 During high probability rainfall events, mapping indicates there is a flow path through the north of Parcel B (Phases 3, 4 and 5).

3.1.13 Although Phase 2 is not subject to flooding via a flow path, there are areas of ponding during high probability rainfall events.

3.1.14 The RoFfSW mapping indicates there is a high probability of flooding along Pound Lane, which runs along the eastern boundary of Parcel B and follows the path of North Benfleet Brook.

3.1.15 North Benfleet is located within the South Essex Flood Risk Area.[15] Flood Risk Areas are identified by the Environment Agency (in the case of risk from main rivers and the sea) and Lead Local Flood Authorities (in the case of surface water risk) where there is believed to be significant flood risk.

3.1.16 North Benfleet is also located within a Critical Drainage Area (CDA) as defined in the South Essex SWMP. A CDA is defined as 'a discrete geographic area (usually a hydrological catchment), where multiple or interlinked sources of flood risk cause flooding during a severe rainfall event thereby affecting people, property, or local infrastructure.' These CDAs are the focal point for ECC in their role as the LLFA when considering the implementation of measures to reduce flood risk.

[15] Environment Agency (2024) *Flood Risk Areas* https://www.data.gov.uk/dataset/42c31542-228d-439b-8dbe-e72135dae71c/flood-risk-areas Accessed on January 2025.

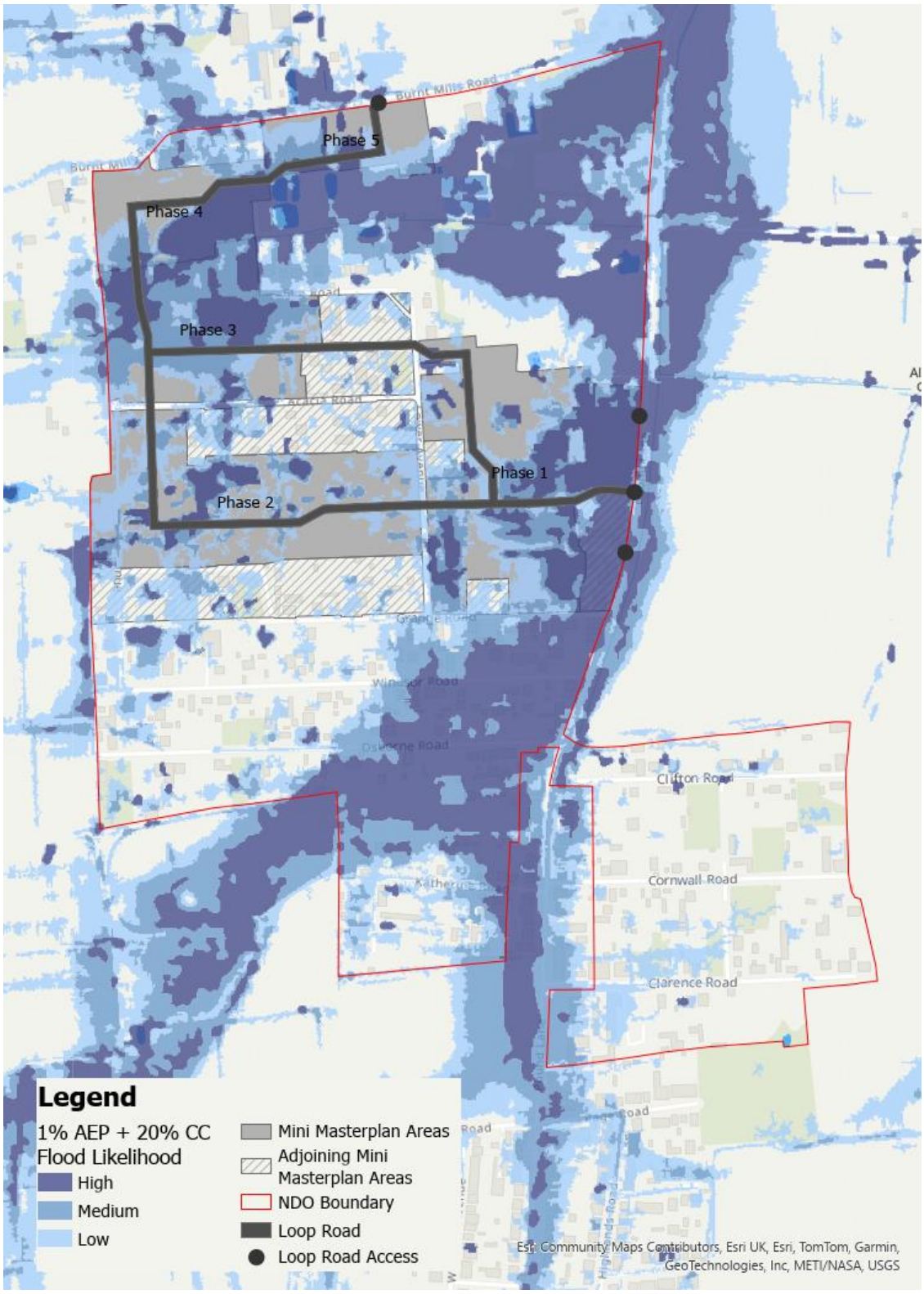

Figure 3 1% AEP + 20% Climate Change Likelihood of Surface Water Flooding

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Groundwater

3.1.17 Basildon is situated in an area which has less mobile groundwater levels and a lower risk of groundwater flooding than other areas within the county.[10]

Sewers

3.1.18 Within the NDO boundary, there is limited highway drainage infrastructure. Road gullies are present along Pound Lane, but no further surface water sewers are present throughout the plotlands. Sewer flooding incidents have been recorded in the past within Basildon, particularly within urban areas, however the extent of this flooding is unknown.[10]

Reservoirs

3.1.19 North Benfleet is not predicted to be at risk of flooding during the unlikely event of a reservoir breach.[16]

Summary

3.1.20 Table 3-2 provides a summary of the risk of flooding to North Benfleet based on the information reviewed.

Table 3-2 Summary of risk of flooding

Source of flooding	Risk of flooding
Tidal (Thames Estuary)	Low
Rivers (North Benfleet Brook and Ordinary Watercourses)	High
Surface Water	High
Groundwater	Low
Sewers	Medium
Reservoir	Low

[16] Environment Agency (2024) *Check the long term flood risk for an area in England* https://www.gov.uk/check-long-term-flood-risk

4. Flood Risk Management Measures

Sequential Test

4.1.1 The first step in considering flood risk in planning, as set out in paragraphs 003 and 004 of the PPG (and Section 2.2.1 of this Report), is to **avoid** areas at risk of flooding.

4.1.2 As part of the Basildon Borough Local Plan[9], six other sites have been identified within the borough of Basildon as potential for development, listed in Appendix A.

4.1.3 Upon reviewing the alternative sites it is concluded that all sites have areas at high risk of surface water flooding and two of these sites are at risk of flooding from rivers or the sea.

4.1.4 Whilst the alternative sites are viable options, North Benfleet remains a feasible brownfield site that should be considered for development. Development should be considering taking a sequential approach and steering development towards those areas of lowest risk within the North Benfleet plotlands, as described in the following Section.

Sequential Approach

4.1.5 Where possible, development should be steered towards areas within Flood Zone 1, and away from those areas in Flood Zone 3 associated with the North Benfleet Brook. In cases where this is not possible, a sequential approach should be taken, steering “Highly Vulnerable” and “More Vulnerable” development to areas with a lower risk of flooding. In areas where flood risk is unavoidable such as in Phases 1 and 3, water compatible development will be prioritised such as amenity open space and outdoor sports and recreation (Ref 1 in **Figure 4**). "Less Vulnerable" development will be considered where appropriate.

4.1.6 A sequential approach should also be followed for surface water flood risk. The RoFfSW mapping indicates that whilst there are flood risk concerns within each of the plots, Phase 2 is the most suitable for development as the risk of surface water flooding is lower; the areas of risk are primarily small localised areas of ponding. Development should therefore be steered to this area where possible.

4.1.7 It is recommended that an updated detailed direct rainfall hydraulic model be completed by developers within the NDO area to better understand the existing surface water flood risk within North Benfleet. This should include the latest climate change allowances as well as the existing condition of the flood management infrastructure.

4.1.8 The area in the south-east of Parcel B is currently designated as ‘infill sites’, however in line with a sequential approach it is not recommended to develop in this area due to significant flood risk (Ref 2 in **Figure 4**).

4.1.9 **Figure 5** shows areas at a high risk of surface water flooding during the 1% AEP event with a 20% allowance for climate change. (As described in

Section 3.1.7 the 1% AEP event should be taken as an underestimate given the climate change allowance used is 20% rather than the ECC upper end allowance of 45%). Flood Zone 3 mapping is also overlaid and subsequently it is recommended that further development is avoided in these areas. This primarily includes the plot infill area in the south of Parcel B and areas within Phases 1, 3, 4 and 5. In areas with ponding, specifically within Phase 2 and the plot infill areas, development should be designed around these features as detailed in 4.1.14.

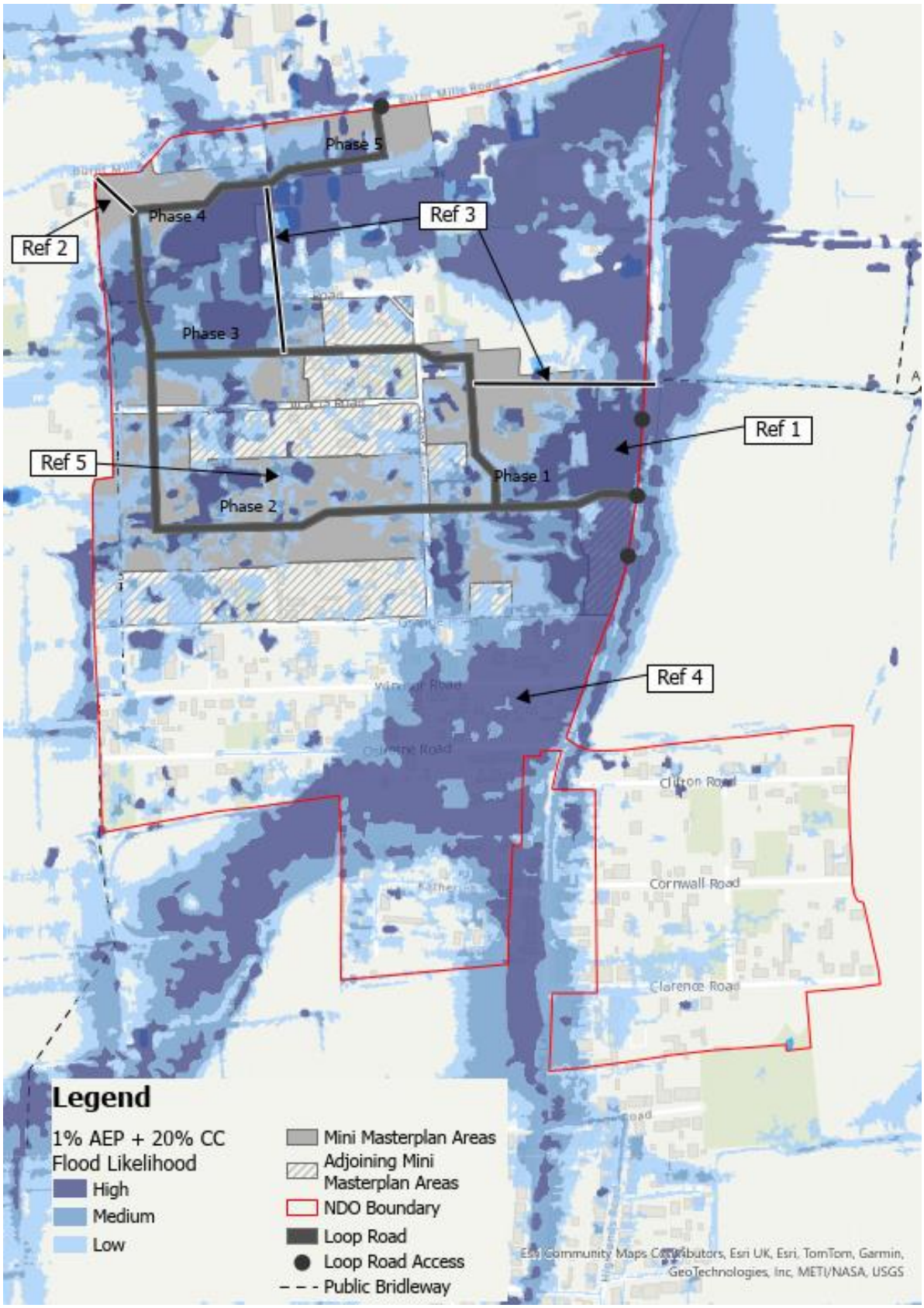

Figure 4 Flood risk management considerations

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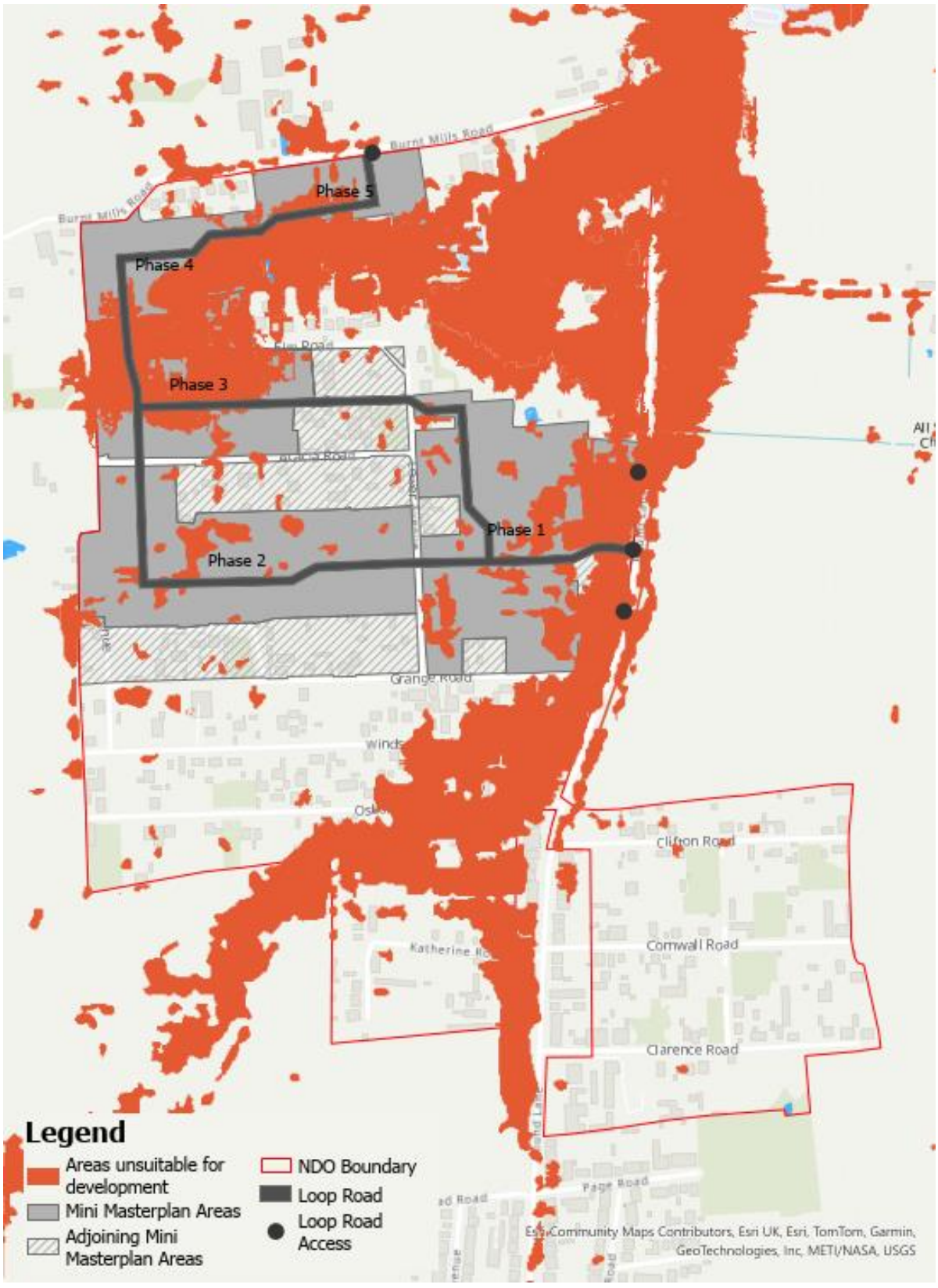

Figure 5 Areas unsuitable for development

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Controlling Flood Risk

De-culverting

4.1.10 Where possible, an appropriate flood risk management strategy may include daylighting the existing culverts. The ditches along Osborne Road have previously been filled in and replaced with culverts. Daylighting culverts can bring a range of benefits, including, but not limited to, increasing the capacity of the channel, promoting biodiversity and improving water quality.

Maintenance of Watercourses and Channels

4.1.11 The maintenance of proposed and existing channels is essential in reducing flood risk within the NDO area. Most of the channels within the NDO area are the responsibility of the private owners and therefore support to these private owners may be required by developers to safeguard the flood risk management function afforded by these features.

Floodplain Compensation Storage

4.1.12 Where land is currently being used to store fluvial water such as the north-east of the NDO area, these storage features should be retained and safeguarded. Where this is not possible, floodplain compensation would need to be provided for any loss of floodplain storage on a 'level for level' and 'volume for volume' basis to ensure that flood risk is not increased elsewhere.

Retaining Existing Topographical Features

4.1.14 In areas where surface water ponding is present due to existing topography (Ref 3 in **Figure 4**), development should be designed around these features to retain their existing function as storage features. Where this is not possible, the drainage strategy should be designed to ensure that the surface water is retained on-site and flood risk is not increased elsewhere.

Greenfield and Brownfield Sites

4.1.15 For greenfield sites, development will be required to control surface water runoff arising from the Site, discharging surface water to the 1 in 1-year greenfield rate for all events up to and including the 1% AEP rainfall event with an allowance for climate change.[17]

4.1.16 For brownfield sites, the development will be required to control surface water runoff arising from the Site and discharge to the 1 in 1-year greenfield rate or as close as feasibly possible. In the event that this is not possible, a minimum 50% betterment should be provided as a last resort option.[18]

[17] Essex County Council (2021) *The Sustainable Drainage Systems Design Guide For Essex – Greenfield Runoff Rates* https://www.essexdesignguide.co.uk/suds/rates-and-storage/greenfield-runoff-rates/

[18] Essex County Council (2020) *The Sustainable Drainage Systems Design Guide For Essex – Brownfield Rates* https://www.essexdesignguide.co.uk/suds/rates-and-storage/brownfield-rates/

Green Solutions

4.1.17 The drainage hierarchy should be applied to all sites to manage surface water, where water should be discharged via rainwater re-use as a primary approach.

4.1.18 Attenuation storage should be provided for rainfall events up to 1% AEP with an allowance for climate change.[19] This should either be of a capacity with 50% storage available after 24 hours during 3.33% AEP rainfall events or able to hold a 10% AEP rainfall event and 3.33% AEP rainfall event simultaneously. Above ground storage is preferred as it can enhance biodiversity and green areas. Any site subject to unplanned development, for example through permitted development rights, should account for an additional 10% of roof area within the storage calculations to accommodate for urban creep.

4.1.19 Exceedance routes should be provided to the LLFA when submitting an application to demonstrate where flood water will flow and pond when excess water that cannot be contained occurs. The routes should direct towards the highways and public open space, avoiding any risk to people and property.[20]

4.1.20 Where possible, developers should consider site wide approaches to attenuate surface water. The development of both the loop road and the commercial area within Phase 1 are examples of where there are opportunities to include more significant attenuation features. This should include green infrastructure such as basins and raingardens. On an individual site level, attenuation/flows should be controlled through green features such as permeable paving, raingardens and rainwater butts for each property.

Mitigate Flood Risk

4.1.21 Typical measures to mitigate and manage the risk of flooding, and thereby demonstrate the safety of development, comprise resistance and resilience measures including the raising of finished floor levels.

4.1.22 Finished floor levels should be a minimum elevation of the design flood level plus a freeboard. The Environment Agency *'recommend floor levels are set at least 600 millimetres (mm) above the estimated flood level. You will also need to use flood resistant materials up to at least 600mm above the estimated flood level.*

[19] Essex County Council (2020) *The Sustainable Drainage Systems Design Guide For Essex – Attenuation Storage* https://www.essexdesignguide.co.uk/suds/rates-and-storage/attenuation-storage/

[20] Essex County Council (2020) *The Sustainable Drainage Systems Design Guide For Essex – Exceedance Routes* *https://www.essexdesignguide.co.uk/suds/rates-and-storage/exceedance-routes/*

4.1.23 *You may be able to reduce this to 300mm if there is a high level of certainty about your estimated flood level. If there is a particularly high level of uncertainty it may need to be increased.'*[21]

4.1.24 Within the NPPF and PPG, '*a design flood is a flood event of a given annual flood probability, which is generally taken as:*

- *river flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year); or*
- *surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), plus an appropriate allowance for climate change.*'

4.1.25 The loop road will be designed in the areas that have the lowest risk of flooding, adopting a sequential approach (Ref 4). The loop road should be designed to accommodate for flood risk up to the 3.33% AEP rainfall event, ensuring drainage is sufficient. Flood risk should not be increased elsewhere up to the 1% AEP with a 45% climate change allowance.[22] As the loop road is at risk of flooding during the 1% AEP including climate change rainfall event, where possible highway levels may be raised at an appropriate freeboard level above the design flood level to allow access during significant flood events. Careful consideration should be taken when determining the highway levels to determine the effects of flood routing as water may be displaced to other areas and therefore increase flood risk elsewhere.

Manage Residual Risk

4.1.26 An Emergency Plan should be prepared for the plotlands to determine the best course of action in the event of flooding from surface water and local watercourses.

4.1.27 In the event of flooding blocking access for the loop road to and from Pound Lane, an emergency access route should be developed in the north of the plotlands to provide access to Burnt Mills Road (Ref 5). The public bridleway along the western boundary can also serve as an emergency access route. Installing a removable bollard can be helpful in ensuring emergency access while also preventing the village from becoming a shortcut for through traffic. Although this route will provide access which is drier than that along Pound Lane, there is still a risk of flooding predicted along this route during high probability rainfall events and therefore further investigation should be undertaken to determine a safe (dry) access/egress route.

4.1.28 Local Resilience Forums (LRFs) are multi-agency partnerships made up of representatives from local public services, including the emergency services,

[21] Environment Agency (2024) *Preparing a flood risk assessment: standing advice* https://www.gov.uk/guidance/flood-risk-assessment-standing-advice
[22] Essex County Council (2023) *The Sustainable Drainage Systems Design Guide For Essex – Climate Change* https://www.essexdesignguide.co.uk/suds/rates-and-storage/climate-change/

local authorities, the NHS, the Environment Agency and others.[23] The LRF applicable to North Benfleet is the Essex Resilience Forum[24] where information can be found on local Accident & Emergency departments, Environment Agency flood warnings and how to prepare yourself for a range of risks, both floods related and otherwise.

[23] Cabinet Office (2024) *Local resilience forums: contact details* https://www.gov.uk/guidance/local-resilience-forums-contact-details
[24] Essex Resilience Forum (2024) http://www.essexprepared.co.uk/

5. Summary and Recommendations

Summary

5.1.1 This report identifies relevant national and local policy and guidance in relation to flood risk and planning within North Benfleet.

5.1.2 An overview of flood risk from all sources within North Benfleet is provided. This highlights that some areas of the site are at a high risk of flooding from fluvial sources (rivers) and surface water.

5.1.3 The North Benfleet site has a similar flood risk to the majority of the proposed alternative sites detailed in Appendix A. As the development will enhance and integrate into an existing neighbourhood rather than other greenfield sites proposed, this site should be considered for development.

Recommendations

5.1.4 Section 4 of this report provides a number of recommendations for how development could be brought forward on the plotlands. These include:

- A sequential approach should be taken to planning whereby development should be steered towards areas within Flood Zone 1, and away from those areas in Flood Zone 3 associated with the North Benfleet Brook.
- De-culverting of watercourses/ditches.
- Ensuring that the watercourses and ditches within the NDO are suitably maintained.
- Floodplain storage should be maintained. Any loss of storage must be compensated for, with storage provided on a ‘level for level’ and ‘volume for volume’ basis.
- Existing surface water storage features (e.g. topographic depressions or ponds) should be retained or re-provided within the site.
- On an individual site basis, each development should incorporate green solutions to attenuate surface water and/or control flows such as permeable paving, raingardens and rainwater butts.
- Developers should prioritise site wide attenuation features.
- Detailed direct rainfall hydraulic modelling may be required to better understand the flood risk within the NDO area.
- The Where Water Goes4 study should be reviewed to determine whether any of strategies proposed are appropriate to consider alongside any NDO development.
- An emergency access route should be provided from the loop road onto Burnt Mills Road.

Appendix A Alternative Sites

Appendix A Table 1 Alternative Site Information



Appendix A Figure 1 Alternative Site Locations

Site Reference	Site Location	Local Plan Notes	Area (ha)	% of site at risk from SW Flooding (1% AEP)	SW Flood Risk	% of site in Flood Zone 2	Fluvial Flood Risk	Reservoir Flood Risk
AS3	Land East of Bowers Gifford	Limited capacity to deliver new housing as constrained by areas at higher flood risk and priority habitat	166.2	6.6%	High risk associated with watercourses along east and west edges. High risk pockets of ponding in the centre of the site	5.1%	Flood Zone 3 along the western edge of the site	None
AS4	Land South of the A127	IIA found Minor negative (-) Greater or equal to 25% of site is within an area that in a location where the current baseline annual mean concentration of a pollutant exceeds the 2021 WHO guidelines.	67.5	4.1%	High risk flow path along west boundary and ponding along the northern boundary	0.0%	None	None
H8	Land West of Bowers Gifford	This location is adjacent to the urban area with good access to services. Significant negative (--) 1% or more of the site intersects with internationally or	142	2.5%	High risk flow path through the centre of the site and pockets of ponding in the northern part of the site	0.0%	None	None

		nationally designated site and/or more than 1% of the site intersects with a locally designated site, Priority Habitat or Ancient Woodland.						
H23	Bower's Gifford	This location is adjacent to the urban area with good access to services. The significantly of this site is on brownfield land and has no effects or minor effects on agricultural land and water bodies. Significant negative (--) 1% or more of the site intersects with internationally or nationally designated site and/or more than 1% of the site intersects with a locally designated site, Priority Habitat or Ancient Woodland.	123.3	16.0%	High risk flow paths through the centre and in the north of the site	10.7%	Flood zone 3 in north-eastern corner of the site	None
H10	Land North of A13	Potential for limited development infilling along London Road. Significant negative (--) 1% or more of the site intersects with internationally or nationally designated site	6.6	22.9%	High risk of surface water ponding along the southern boundary of the site	0.0%	None	None

		and/or more than 1% of the site intersects with a locally designated site, Priority Habitat or Ancient Woodland.						
H13	Land North of London Road Basildon	This location is adjacent to the urban area with good access to services. Limited capacity due to ecological constraints. Around half land would be green infrastructure. Significant negative (--) 1% or more of the site intersects with internationally or nationally designated site and/or more than 1% of the site intersects with a locally designated site, Priority Habitat or Ancient Woodland.	37.7	6.4%	Small pockets of surface water ponding throughout the site	0.0%	None	None
E1	Burnt Mills Extension	This location is a logical extension of the existing Burnt Mills employment area and has access to the A127 growth corridor. IIA found Significant positive (++) This site is 5ha or greater in size and/or 25% or more of the site is located within	54.7	6.8%	High risk surface water ponding in the north-eastern corner of the site	22.3%	Flood zone 3 along east boundary of the site	None

		one of the 20% most deprived areas nationally.						