



Longfield Solar Farm

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1. Executive Summary

AECOM has been commissioned to undertake a Flood Risk Assessment (FRA) for Longfield Solar Farm, hereafter referred to as 'the Scheme' (centred on approximate National Grid Reference (NGR); TL 74179 14620 as an appendix to the Environmental Statement (ES)).

The Order limits cover an area of approximately 453 hectares, comprising arable fields interspersed with tree shelter belts (linear), small woodland and copse, agricultural fields, farm access tracks and farm buildings. The Order limits and the Scheme is described in further detail in **Chapter 2: The Scheme** in the ES [EN010118.APP/6.1].

The Scheme includes:

- Solar PV Arrays Works Area;
- Battery Energy Storage System (BESS) Compound;
- The Longfield Substation;
- The Bulls Lodge Substation Extension; and
- The Grid Connection Route.

This FRA has been prepared in accordance with the requirements of the Overarching National Policy Statement for Energy (EN-1) and the draft NPS-EN-1 2021, the National Policy Statement for Renewable Energy Infrastructure (EN-3) [and the draft NPS-EN3 \(2021\)](#), and the National Planning Policy Framework, 2019 (NPPF). The proposed use of the Scheme would be classed as 'Essential Infrastructure'.

The vast majority of the Order limits lies within Flood Zone 1. The River Ter Main River passes through part of the northern part of the Order limits and a tributary of the River Chelmer, the Boreham Brook Tributary crosses the Order limits in the south west corner. This river is partially a Main River and an Ordinary Watercourse upstream in the tributary.

The flood risk summary table below indicates the overall flood risk across the Scheme; the report assesses the Scheme in more detail relative to each flood risk area.

Flood Risk Summary

Table 1: Flood Risk Summary

Flood Risk Source	Pre-Scheme Risk	Post Scheme Risk	Comments
Fluvial	Low (Majority) Medium – high (North West side)	Low (Majority) Medium – high (North West side)	The vast majority of the Order limits is in Flood Zone 1, but certain areas lie in Flood Zone 2, 3a and 3b, adjacent to the River Ter and Boreham Brook. No development will occur in Flood Zone 3. Long term post Scheme flood risk remains the same, as pre -Scheme.

Flood Risk Source	Pre-Scheme Risk	Post Scheme Risk	Comments
Tidal	Very Low	Very Low	Not in a tidal area (therefore scoped out of report herein). Long term post Scheme flood risk remains the same as pre-Scheme.
Pluvial (Surface Water)	Very Low	Very Low	<p>Surface water risk varies throughout the Order limits, indicating patches of the Site which are susceptible to surface water flooding; these are primarily field ditches / small tributaries of the River Ter. However, flooding is very localised and generally shallow (very low risk).</p> <p>According to the Chelmsford Surface Water Management Plan (2014), the south western area of the Site that crosses the Boreham Brook, is not within a Critical Drainage Area.</p> <p>Long term post Scheme flood risk remains the same, as pre -Scheme.</p>
Groundwater	Low (East side) - Medium (North West side) High (far eastern boundary adjacent to Ringers Farm)	Low (East side) - Medium (North West side) High (far eastern boundary adjacent to Ringers Farm)	<p>Generally, the Order limits is at low risk of groundwater flooding (<50% risk); a very small part of the Order limits extends near to an area at high risk, near the River Ter catchment in the east, with a risk >75% of groundwater flooding.</p> <p>Groundwater flood risk within the Order limits is considered to be low.</p> <p>Further ground investigation to confirm groundwater levels should be undertaken following receipt of the DCO to inform a detailed drainage strategy for the Order limits.</p> <p>Long term post Scheme flood risk remains the same, as pre -Scheme.</p>
Sewers	Low	Low	<p>There are no noted significant public sewer networks in the Order limits. The Braintree Strategic Flood Risk Assessment (SFRA) indicated no cases of sewer flooding within the surrounding areas, such as Terling, Boreham and Hatfield Peverell.</p> <p>Long term post Scheme flood risk remains the same, as pre -Scheme.</p>
Artificial Sources	Very Low	Very Low	<p>There are no identified sources that pose a risk to the Order limits.</p> <p>Long term post Scheme flood risk remains the same, as pre-Scheme.</p>

There appear to be no formal surface or foul water drainage networks present in the Order limits; geological and topographical conditions suggest that the surface water runoff runs off to the adjacent watercourses or ponds, as well as potentially utilising some infiltration to ground at natural low spots.

The outline drainage strategy for the Scheme will be secured under the DCO within section 4 of **Appendix 9C: Longfield SuDS Strategy [EN010118/APP/6.2]** and section 3 of **Appendix 9D: Bulls Lodge Substation Extension: Drainage Strategy [EN010118/APP/6.2]**.

The full drainage strategy will be designed to ensure there will be no increase in the risk of flooding within or outside of the Order limits. Surface water runoff from the Scheme will be captured by infiltration SuDS techniques: swales and basins to mimic existing drainage conditions and accommodate the 1 in 100-year return period storm event plus a 20% increase allowance for climate change.

When considered within the context of national, regional and local planning policy in respect of development and flood risk, the assessment concludes that the site of the Scheme remains safe from this perspective, does not increase flood risk elsewhere and fulfils the Government's wider criteria for sustainable development.

On this basis, it is concluded that flood risk considerations should not prevent the granting of development consent.

2. Introduction

Introduction

AECOM has been commissioned to undertake an FRA for Longfield Solar Farm, hereafter referred to as the 'Scheme' (approximate centre TL761135), approximate postcode: CM3 2RA.

The Order limits covers an area of approximately 453 hectares, comprising arable fields interspersed with tree shelter belts (linear), small woodland and copses, agricultural fields, and farm access tracks and farm buildings. The Order limits is described in more detail in *Chapter 2: The Scheme* of the ES [EN010118/APP/6.1].

FRA Objectives

The minimum requirements for FRAs as outlined in the NPS EN-1 (paragraph 5.7.5) are to:

- Be proportionate to the risk and appropriate to the scale, nature, and location of the project;

- Consider the risk of flooding arising from the project in addition to the risk of flooding to the project;

- Take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made;

- Be undertaken by competent people, as early as possible in the process of preparing the proposal;

- Consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure;

- Consider the vulnerability of those using the site, including arrangements for safe access;

- Consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;

- Consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes;

- Include the assessment of the remaining (known as 'residual') risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project;

- Consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems;

Consider if there is a need to be safe and remain operational during a worst case flood event over the development's lifetime; and

Be supported by appropriate data and information, including historical information on previous events.

It should be noted that revised draft NPS EN-1 sets out an amended list of minimum requirements for FRAs. The draft NPS EN-1 has been considered within this report.

Although not specifically mentioned in the current NPS EN-3, the draft NPS EN-3 has been considered in this FRA, as within paragraph 2.50.7 it mentions the need to consider drainage in the FRA. This FRA is compliant with paragraph 2.50.7 of draft NPS EN-3, as it considers drainage for the Scheme, with reference to the Drainage SuDs Strategy and Drainage Strategy within the ES [Appendix 9C and 9D, EN010118/APP/6.2].

The principal objectives of the FRA taking into account the above are to:

Identify potential forms of flooding including rivers, watercourses, surface water flooding, groundwater flooding, flooding from sewer systems and other forms of flooding;

Establish the risk of flooding to the Scheme;

Determine the effects of the development on flooding elsewhere either through displacement of floodwaters or increased runoff; and

Suggest appropriate flood mitigation measures, including a strategy for disposal of surface water run-off following the principles of sustainable drainage systems (SuDS).

Scope of Work

In preparing this FRA, AECOM has:

Obtained relevant data and information from statutory and other authorities;

Considered the potential sources of flooding;

Assessed the risk of flooding to the Order limits;

Assessed the impact of off-site flooding (displaced water) on third parties;

Considered the impact of climate change; and

Considered likely mitigation requirements and any residual risk.

Site Description

The Order limits covers approximately 453ha and is approximately centred on National Grid Reference (NGR) TL 74179 14620 and located approximately 1.1km to the west of the village of Terling. The Order limits is located within the District Council administrative areas of Chelmsford and Braintree, in the county of Essex.

LIDAR and Ordnance Survey mapping have been interrogated to establish approximate ground levels across the Site.

The land immediately surrounding the Order limits comprises a number of villages, including:

- Fuller Street approximately 300m to the north;
- Gamble's Green and Terling, 500m and 1.1km to the east;
- Boreham, 500m to the south-west;
- Hatfield Peverel 1.5km to the south-east; and
- Chelmsford 5.7km to the south-west. Boreham Road runs north to south along the western edge of the Site, with the A12 abutting and bounding the southern edge of the Site boundary.

The northern part of the Order limits and surrounding area consists of undulating and relatively elevated landform, as part of the River Ter valley. The landform rises steeply northwards from the river and Terling Spring, between 35m Above Ordnance Datum (AOD) to 50m AOD along parts of Braintree Road. It culminates at a ridgeline at 70m AOD at Rank's Green, in the northern part of the study area. To the south of the River Ter, the landform also rises steeply, across Sandy Wood, to a ridgeline at 55m AOD.

To the west of the Order limits, the landscape consists of a varied pattern of landform, reflecting past sand and gravel extraction and engineered flat terrain across Boreham airfield, which is situated at 55m AOD approximately 800m to the west of the Order limits. From the airfield, the landform falls very gradually eastwards to the River Ter, which flows southwards between Terling and the northern part of Hatfield Peverel, at approximately 20m AOD.

The River Chelmer flows across the southern part of the study area, at approximately 15m AOD. There are several large-scale reservoirs and lakes adjacent to the river. From the river, the landform rises consistently northwards, to form a ridgeline around 40m AOD at Boreham, and southwards, across Little Baddow, to an elevated ridgeline at 100m AOD, approximately 3km from the CP Site Boundary.

Neither the Order limits nor the immediate surrounding area is covered by any statutory landscape designations.

Site Extent

Figure 1 overleaf presents the extents of the Order limits; it occupies approximately 453ha. Only the Flood Risk within the Order Limit extents is discussed within this FRA. The figure below has been extracted from **Chapter 9: Water Environment** and can be found in **Figure 9-2b: Fluvial Flood Zones including indicative Concept Design [EN010118/APP/6.3]**.

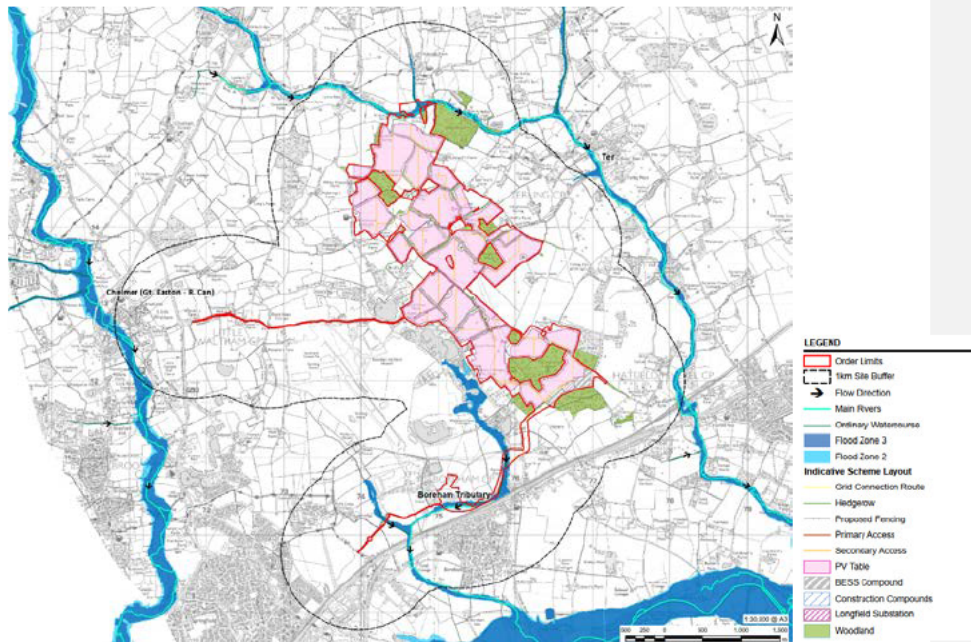


Figure 1: Fluvial Flood Zones including indicative concept design (Figure 9-2b [EN010118/APP/6.3])

Existing Land Use

The Order limits has been set to only occupy natural landscape, avoiding existing developments and buildings It is estimated to be less than 1% impermeable area); therefore, the site is considered 100% permeable].

The Order limits consist of agricultural fields with some small parcels of pasture, interspersed with individual trees, hedgerows, tree belts (linear), small woodland blocks and farm access tracks. The hedgerows within the Order limits range between lengths of dense tall vegetation (shrub and tree species) and thin lines of vegetation with sporadic trees present, although the former is a dominant feature. The arable fields are of small to moderate size, some of which are of irregular shape.

Table 2 below provides the existing site permeable and impermeable areas:

Table 2: Contributing Areas

	Total Area (ha)	Permeable Area (ha)	Impermeable Area (ha)	Percentage Impermeable
Extent of Order limits	453	453	Considered 0 ha (<1%)	0%

Development Proposals

The Scheme comprises the installation of solar PV Panels and on-site energy storage facilities. It would allow for the storage of electricity to the National Grid as described within **Chapter 2: The Scheme** of this ES [EN010118/APP/6.1]. The Scheme is also described in **Schedule 1** to the DCO, where the “authorised development” is divided into works packages, which comprise:

- Solar PV Array Works Area and The Solar Farm Site (Work No. 1): up to 279.5ha;
- Battery Energy Storage System (BESS) Compound (Work No. 2): up to 5.2ha;
- Longfield Substation (Work No. 3): up to 1.7ha;
- Grid Connection Route (Work No. 4A): up to 30.4ha;
- Bulls Lodge Substation Extension Site (Work No. 5): up to 4.4ha;
- Ancillary Infrastructure which could be located across the Scheme (Work No. 6 and generally listed at the end of Schedule 1 of the draft DCO);
- Temporary Construction Laydown Areas (Work No. 7A, up to 6.9ha) and the Bulls Lodge Substation Extension (Work No. 7B, up to 6.4ha);
- Ancillary Building (Work No. 8): up to 0.6ha;
- Site Access Works (Work No. 9, up to 6.5ha); and
- Habitat Management Areas (Work No. 10): a minimum of 41.1ha.

During the construction phase, one or more temporary construction compound(s) will be required as well as temporary roadways to facilitate access to all land within the Order limits. These will not necessarily constitute the permanent access tracks, as these are yet to be agreed but will lie within the Order limits boundary.

Please refer to **Annex A** for the Scheme layout.

Consultees

The following stakeholders have been consulted. Comments from stakeholders has been incorporated within this report:

Lead Local Flood Authority – Chelmsford City Council and Braintree District Council; and
The Environment Agency.

3. Existing Legislation and Policy

National Policy

Overarching National Policy Statement (NPS) for Energy (EN-1), including overview of the Draft NPS (EN-1)

The Overarching National Policy Statement for Energy (NPS) (EN-1) sets out the Government's policy for the development of nationally significant infrastructure projects which must be authorised by a DCO.

Paragraph 2.2.1 states the objectives of this Flood Risk Assessment which are in line with paragraph 5.7.5 of NPS EN-1.

Paragraph 5.7.7 recommends that applicants should arrange pre-application discussions with the EA, and, where relevant, other bodies such as Internal Drainage Boards and sewerage undertakers to identify the likelihood and possible extent and nature of the flood risk, help scope the FRA, identify the information that will be required, and address concerns, where proposed development is affected by flood risk or is likely to increase flood risk elsewhere.

NPS EN-1 states at paragraph 5.7.12 that the Infrastructure Planning Commission (IPC) (now, for the purposes of this application, the appointed Examining Authority with the Secretary of State for Business Energy and Industrial Strategy being the decision-maker) should not recommend consent development in Flood Zone 2 in England unless it is satisfied that the Sequential Test requirements have been met and that it should not consent development in Flood Zone 3 unless it is satisfied that the Sequential and Exception Test requirements have been met. For the Sequential Test, it states at paragraph 5.7.13 the following:

Preference should be given to locating projects in Flood Zone 1 in England or Zone A in Wales. If there is no reasonably available site in Flood Zone 1 or Zone A, then projects can be located in Flood Zone 2 or Zone B. If there is no reasonably available site in Flood Zones 1 or 2 or Zones A and B, then nationally significant energy infrastructure projects can be located in Flood Zone 3 or Zone C subject to the Exception Test.

The overarching objectives of the NPS are addressed within this FRA, however, with regard to the Exception Test, the NPS requires the following at paragraph 5.7.14 to 5.7.17:

If, following application of the sequential test, it is not possible, consistent with wider sustainability objectives, for the project to be located in zones of lower probability of flooding than Flood Zone 3 or Zone C, the Exception Test can be applied. The test provides a method of managing flood risk while still allowing necessary development to occur.

The Exception Test is only appropriate for use where the sequential test alone cannot deliver an acceptable site, taking into account the need for energy infrastructure to remain operational during floods. It may also be appropriate to use it where, as a result of the alternative site(s) at lower risk of flooding being subject to national designations such as landscape, heritage and nature conservation designations, for example Areas of Outstanding Natural Beauty (AONBs), Sites of Special Scientific Interest (SSSIs) and World Heritage Sites (WHS) it would not be appropriate to require the development to be located on the alternative site(s).

All three elements of the test will have to be passed for development to be consented. For the Exception Test to be passed:

It must be demonstrated that the project provides wider sustainability benefits to the community that outweigh flood risk;

The project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land subject to any exceptions set out in the technology-specific NPSs; and

An FRA must demonstrate that the project will be safe, without increasing flood risk elsewhere subject to the exception below and, where possible, will reduce flood risk overall.

Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, the IPC [now Secretary of State] may grant consent if it is satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, nationally significant energy infrastructure as set out in Part 3 above. In any such case the IPC [now Secretary of State] should make clear how, in reaching its decision, it has weighed up the increased flood risk against the benefits of the project, taking account of the nature and degree of the risk, the future impacts on climate change, and advice provided by the EA and other relevant bodies.

Paragraph 5.7.23 of NPS EN-1 also requires a sequential approach to be applied to the layout and design of projects with more vulnerable uses being located on parts of the site at lower probability and residual risk of flooding by using Sustainable Urban Drainage Systems (SuDS).

Paragraph 5.7.24 and 5.7.25 require “Essential energy infrastructure which has to be located in flood risk areas should be designed to remain operational when floods occur” and that “the receipt of and response to warnings of floods is an essential element in the management of the residual risk of flooding”.

Paragraph 5.7.19 explains the range of sustainable approaches to surface water drainage management and paragraph 5.7.21 requires “surface water drainage arrangements for any project to be such that the volumes and peak flow rates of surface water leaving the site are no greater than the rates prior to the proposed project, unless specific off-site arrangements are made and result in the same net effect”.

Paragraph 5.7.22 also states that it “may be necessary to provide surface water storage and infiltration to limit and reduce both the peak rate of discharge from the site

and the total volume discharged from the site. There may be circumstances where it is appropriate for infiltration facilities or attenuation storage to be provided outside the project site, if necessary, through the use of a planning obligation”.

National Policy Statement for Renewable Energy (Draft EN-3)

The current NPS EN-3 does not mention a need for an FRA or implications for drainage. However, paragraph 2.50.7 of draft NPS EN-3 notes that an FRA may be required and will need to consider the impacts of drainage, noting:

“This will need to consider the impact of drainage. As solar PV panels will drain to the existing ground, the impact will not in general be significant. Where access tracks need to be provided, permeable tracks should be used, and localised Sustainable Drainage Systems (SuDS), such as swales and infiltration trenches, should be used to control any run-off where recommended. Given the temporary nature of solar PV farms, sites should be configured or selected to avoid the need to impact on existing drainage systems and watercourses. Culverting existing watercourses/drainage ditches should be avoided. Where culverting for access is unavoidable, it should be demonstrated that no reasonable alternatives exist and where necessary it will only be in place temporarily for the construction period.”

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National Policy Statement for Electricity Networks Infrastructure (EN-5)

National Policy Statement for Electricity Networks Infrastructure (EN-5) (NPS EN-5) principally concerns high voltage transmission systems and distribution systems in addition to associated infrastructure.

Paragraph 2.4.1 of NPS EN-5 explains that as climate change is likely to increase risks to the resilience of electrical infrastructure it requires applicants to “set out to what extent the proposed development is expected to be vulnerable, and, as appropriate, how it would be resilient to flooding, particularly for substations that are vital for the electricity transmission and distribution network”. Applicants should, in particular, set out to what extent the proposed development is expected to be vulnerable, and, as appropriate, how it has been designed to be resilient to:

Flooding, particularly for substations that are vital to the network; and especially in light of changes to groundwater levels resulting from climate change;

The effects of wind and storms on overhead lines;

Higher average temperatures leading to increased transmission losses;

Earth movement or subsidence caused by flooding or drought (for underground cables); and

Coastal erosion – for the landfall of offshore transmission cables and their associated substations in the inshore and coastal locations respectively.

National Planning Policy Framework (NPPF)

The NPPF was first published in March 2012, superseding national planning policy statements and guidance. The NPPF was revised in July 2021 and this FRA complies

with the revised version of the NPPF. Flood Risk and Coastal Change Planning Practice Guidance (PPG) was also published in 2014 to provide guidance to support the implementation of the NPPF policies.

Section 14 of the NPPF entitled Meeting the Challenge of Climate Change, Flooding and Coastal Change (paragraphs. 152-173) sets out the requirements to assess flood risk and climate change for developments. Paragraph 169 expects “*major developments to incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate.*”

The assessment of flood risk is based on the definitions in **Table 3** below, extracted from the PPG:

Table 3: Flood Zones – Table 1 of the PPG 2014

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as ‘clear’ on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. 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)

Annex 3: Flood risk vulnerability classification of the NPPF, classifies the Flood Risk Vulnerability of various land uses in **Table 4** below. The More Vulnerable classification encompasses usages such as hospitals and buildings used for dwellings. Less Vulnerable applies to buildings used for general industry, storage and distribution.

Table 4: Flood Risk Vulnerability Classification – Annex 3 of NPPF 2021 Table 2 of the PPG 2014

Development Type	Classifications
Essential infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.

Development Type	Classifications
	<p>Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.</p> <p>Wind turbines.</p> <p>Solar farms.</p>
Highly vulnerable	<p>Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.</p> <p>Emergency dispersal points.</p> <p>Basement dwellings.</p> <p>Caravans, mobile homes and park homes intended for permanent residential use.</p> <p>Installations requiring hazardous substances consent (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure")</p>
More vulnerable	<p>Hospitals.</p> <p>Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.</p> <p>Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.</p> <p>Non-residential uses for health services, nurseries and educational establishments.</p> <p>Landfill and sites used for waste management facilities for hazardous waste.</p> <p>Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan</p>
Less vulnerable	<p>Police, ambulance and fire stations which are not required to be operational during flooding.</p> <p>Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure.</p>

Development Type	Classifications
	Land and buildings used for agriculture and forestry. Waste treatment (except landfill and hazardous waste facilities). Minerals working and processing (except for sand and gravel working). Water treatment works which do not need to remain operational during times of flood. Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place). Car parks. Solar Farms
Water-compatible development	Flood control infrastructure. Water transmission infrastructure and pumping stations. Sewage transmission infrastructure and pumping stations. Sand and gravel working. Docks, marinas and wharves. Navigation facilities. Ministry of Defence installations. Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. Water-based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

The Scheme is classified as Essential Infrastructure. The overall aim is to steer new development to the lowest flood zone, i.e. Flood Zone 1 (Sequential Test). Where there are no reasonably available sites within Flood Zone 1, Flood Zones 2 and 3 may be considered, subject to passing the Exception Test, as required and set out in Table 5 below.

The Sequential Test and Exception Test


The NPPF sets out the details of the Sequential Test, which is a risk-based test that should be applied at all stages of development. The aim of the test is to steer new

development to areas with the lowest probability of flooding (Zone 1). This is applied by local authorities by means of a SFRA.

If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the NPPF requires the Exception Test to be applied to certain forms of new development. The Exception Test considers the vulnerability of the new development to flood risk. The need for the Exception Test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in national planning guidance (paragraph 163 of the NPPF).

Table 5: Flood Risk Vulnerability and Flood Zone Compatibility - Table 3 of the PPG 2021424

	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	*	Exception Test Required	✓	✓
Zone 3b functional floodplain	Exception Test Required	*	*	*	✓

- ✓ Development is appropriate
- * Development should not be permitted
-  Flood Zones the Scheme Sits Within for the Vulnerability classification applied.

The NPPF states in paragraph 164 that for the Exception Test to be passed it should be demonstrated that:

The development would provide wider sustainability benefits to the community that outweigh the 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.

Both elements of the Exception Test should be satisfied for development to be allocated or permitted.

NPS EN-1 was published in July 2011, prior to the first release of the NPPF in 2012. With regard to the Exception Test the NPPF, which was subsequently updated in 2021, only requires two of the three requirements referred to in NPS EN-1. The requirement for projects to be located on developable or previously developed land should no alternative site on previously developed land be available is not referred to in the NPPF. Whilst NPS EN-1 relates specifically to nationally significant energy infrastructure projects, planning policy relating to development and flood risk listed in NPPF provides more up to date government policy.

The draft NPS EN-1, published in September 2021 has been reviewed for this FRA, and does not change the approach to the assessment. It should be noted that the text of this draft is closely aligned to the NPPF (see paragraph 3.4.3 above) and requires the following two limbs to be passed:

- the project provides wider sustainability benefits to the community that outweigh flood risk; and
- the project reduces flood risk overall, where possible.

Local Planning Policy

The Order limits are located within the administrative areas of Chelmsford City Council (CCC) and Braintree District Council (BDC). The Lead Local Flood Authority is Essex County Council (ECC). ECC will consider the FRA (through consultation with the Environment Agency as necessary) as the Order limits is predominantly located in Flood Zone 1.

The following key planning documents and salient policies have been considered to inform this FRA:

ECC SuDS Guidance:

- Sustainable Drainage Systems: Design Guide (2020); and
- Preliminary Flood Risk Assessment (2011, Amended 2017)

Chelmsford City Council:

- The Chelmsford Local Plan (2013-2036);
- The Plan includes the follow planning policies which are relevant to flood risk, drainage and surface water:
 - S2: Addressing Climate change and Flood Risk;
 - DM18: Flooding/SuDS; and
 - DM19: Renewable and Low Carbon energy.
- Chelmsford Surface Water Management Plan (SWMP) (2014); and
- Chelmsford City Strategic Flood Risk Assessment (SFRA) (2018)

Braintree District Council:

- Braintree District Council SFRA, 2016
- Mid Essex SFRA (Covering Braintree) (2007)

**Braintree District Council Draft Local Plan (2017) – (Section 1 –
Adopted February 2021) and Publication Draft Local Plan (2017):**

SP1: Presumption in Favour of Sustainable Development;

LPP 67: Natural Environment and Green Infrastructure;

**LPP 70: Protection, Enhancement and Management of
Biodiversity**

**LPP 73: Protecting and Enhancing Natural Resources,
Minimising Pollution and Safeguarding from Hazards**

LPP 76: Renewable Energy Schemes;

LPP 78: Flooding Risk and Surface Water Drainage;

LPP 79: Surface Water Management Plan; and

LPP 80: Sustainable Urban Drainage Systems.

Braintree and Witham Surface Water Management Plan (SWMP) (2016).

4. Supporting Information

Contributing Areas

Within hydrology, it is generally understood that permeable surfaces absorb rainfall whilst impermeable surfaces repel rainfall leading to surface water runoff. For a site, the total impermeable area is often referred to as the site's Contributing Area. The Contributing Area is used as part of the calculation to determine the volume of surface water runoff generated within the site. Developing greenfield sites (typically entirely permeable land) often increases the site's Contributing Area as natural permeable surfaces are sealed by impermeable surfaces. For the Scheme, some existing permeable surfaces will be replaced by proposed impermeable surfaces; these areas are located at the Bulls Lodge Substation Extension, the BESS Compound and the Ancillary Building. A comparison of the proposed and existing site has been undertaken to demonstrate how the Scheme would affect the Order limits Contributing Area.

Table 6 below presents this comparison:

Table 6: Contributing Areas

	Total Area (ha)	Pre-Development Contributing Area (ha)	Post-Development Contributing Area (ha)	Pre-Development PIMP*	Post-Development PIMP
Order limits	453	0	2.4	0%	0.5%**

*- Percentage Impermeable Area (PIMP) – percentage of an area that is impermeable

**- Assumed Battery and Substation Areas 100% P MP. Photovoltaic (PV) panel areas assumed to have 0% PIMP

Flood Risk Mapping

Table 7 summarises the pre-Scheme flood risk across the Order limits (the Order limits has been marked indicatively in Table 7 maps, purely to represent perspective of the site and surroundings to the SFRA mapping. Refer to *Figure 2-1: Environmental Constraints [EN010118/APP/6.3]* for the precise extent of the Order limits):

Table 7: Flood Risk Mapping

Flood Risk Source	Flood Risk Level	Comments
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Fluvial	Low (Majority) Medium – high (North West side)	Source: EA Flood Zone Dataset The vast majority of the Order limits lies in Flood Zone 1. However, Flood Zones 3 are shown to encroach into the Order limits to the north, in proximity of the River Ter (Classified as Main River by the EA), and towards south-west, where a tributary of the River Chelmer, the Boreham Brook, flows, as a culverted watercourse, in a north-south direction (Classified as Main River by the EA when it flows as an open channel, south of Brick House Farm and the A12). Source: Online Flood Map for Planning, accessed 2021.
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SFRA mapping corroborates the EA mapping above. The Braintree SFRA Indicates climate change flood extents which, as modelling has not been undertaken to date, uses Flood Zone 2 as a proxy for Flood Zone 3a including climate change, i.e. 70% climate change (River Thames Basin). Refer to Figure 2 and 3 below for EA mapping and Braintree SFRA climate change flood risk mapping.

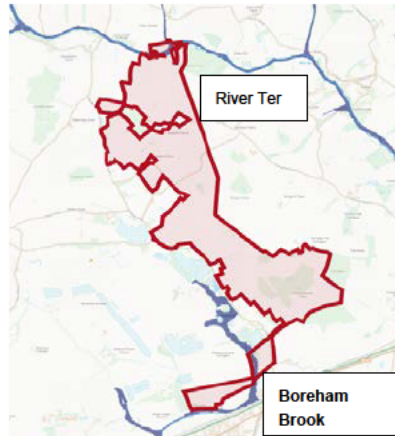


Figure 2 : BDC 2016 Flood Zone Mapping Flood Zone 2 and 3a including Climate Change

The mapping within the Chelmsford City Council SFRA was not available for the Boreham Brook; however, assuming Flood Zone 2 as the climate change Flood Zone 3a extent, flood risk is still confined to within the watercourse boundary. The south west part of the site that crosses the Brook is proposed as a buried cable route, so there will be no change in flood risk in this

location, to or for the Scheme. Refer Figure 3 and Figure 4 below.

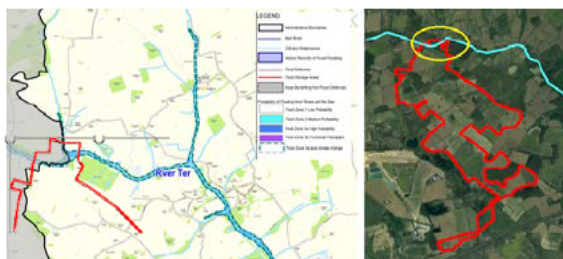


Figure 4 : BDC 2016 Flood Zone Mapping Flood Zone 2/3 and Flood Zone 3a including Climate Change

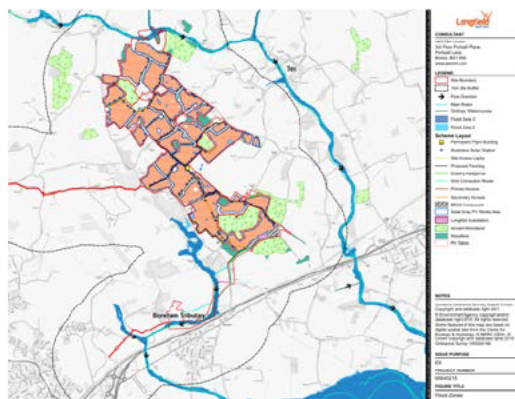


Figure 3 : SFRA Fluvial Flood Zone Mapping 65% Climate Change - Fluvial Modelling Report

Tidal	Very Low	Not in a Tidal area
Pluvial (Surface Water)	Very Low	<p>Source: GOV.uk Flood Risk from Surface Water; Gov.uk Online mapping (23/01/2021), BDC SFRA and CCC SWMP</p> <p>All reference sources indicate that patches of the Order limits are susceptible to surface water flooding; however, flooding is generally very localised and generally shallow (low risk). Some larger patches are located within the north-eastern portion of the Order limits which are at a high risk. Several field ditches displayed within the Order limits are also shown to be susceptible to surface water flooding. However, the majority of the Order limits is at very low risk of surface water flooding.</p> <p>The Chelmsford SWMP confirms the Order limits does not fall within a Critical Drainage Area (CDA). All reference sources indicate that patches of the Order limits are susceptible to</p>

surface water flooding; however, flooding is generally very localised and generally shallow (low risk). Some larger patches are located within the north-eastern portion of the Order limits which are at a high risk. Several field ditches displayed within the Order limits are also shown to be susceptible to surface water flooding. However, the majority of the Order limits is at very low risk of surface water flooding.

The Chelmsford SWMP confirms the Order limits does not fall within a Critical Drainage Area (CDA).

Pluvial Modelling Undertaken in November 2021 (Refer to paragraphs 5.1.16 to 5.1.21 below for further detail.

The revised modelling provides predicted surface water depths and extents across the DCO Boundary and surrounding areas for the 1 in 100-year storm event + 20% climate change. The mapping output from the modelling offers an opportunity to assess the risk of flooding from surface water sources more accurately specifically for the Order limits and surrounding area and therefore supersedes the mapping available from the Local Council's SFRA's and Environment Agency's Online Flood Maps for Planning

The model results show a reduction over the estimated flood risk indicated in SFRA and online mapping. The post development scenario also maintains a low pluvial risk across the site and off site.

Groundwater Low (East side) - Medium (North West side)

 High (far eastern boundary adjacent to Ringers Farm)

Figure 6 of the BDC SFRA Update produced in 2016 shows areas susceptible to groundwater flooding, indicating the probability of flooding from groundwater per 1km square grid. The map covers the majority of the Order limits area, but also indicates in shaded squares, the risk outside of the borough boundary, which includes the Chelmsford City Council administrative area of the Order limits. The probability of flooding is shown as generally less than 25%, increasing to values between 25%-50% in proximity of the River Ter. A higher risk area of >75% lies encroaches into the east boundary of the Order limits as shown in Figure 5 below adjacent to Ringers Farm)

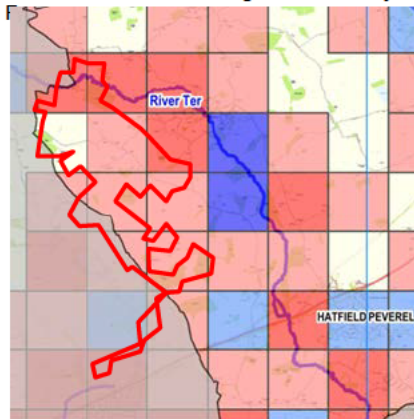


Figure 5: BDC SFRA Figure 6: Groundwater Flood Risk Map

Sewers Low

Source: BDC SFRA
 Figure 5.1 and 5.2 of the BDC SFRA Update from 2017 shows no external or internal sewer flood incidents recorded at this location. Refer to Figure 6 below.



Figure 6: BDC Figure 5.1 and Figure 5.2 Sewer Flood History Map (no flooding recorded)

Artificial Sources	Very Low (residual)	The Order limits is not within or near any registered reservoirs (assumed with volumes >10,000m ³) or other artificial sources. The Order limits is at very low risk of flooding from artificial sources.
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Watercourse

Watercourses are designated as main rivers or ordinary watercourses, main rivers are identified on the Statutory Main river Map and are maintained by the Environment Agency whereas, ordinary Watercourses are maintained by the Lead Local Flood Authority.

The following watercourses lie within the Order limits:

Main River:

The River Ter runs across the very north of the Order limits flowing eastwards.

The Boreham Brook is designated as main river where it passes near Boreham in the far west of the Order limits, before it enters the River Chelmer further south.

Ordinary Watercourse:

The Boreham Brook is designated as an ordinary watercourse throughout all of the Order limits excluding in the above-mentioned section where it is designated as main river.

A series of field ditches, noted as ordinary watercourses, drain east to the River Ter.

Geology and Hydrogeology

A desk top assessment has been completed to determine bedrock and superficial geology within the Order limits Boundary. These maps indicate the Order limits is underlain by the London Clay Formation comprising clay, silt and sand, atop superficial deposits of Lowestoft Formation (diamicton), Brickearth (clay, silt and sand), glaciofluvial deposits (sand and gravel), alluvium (clay, silt, sand and gravel), and head deposits (clay, silt and sand).

The EA's Online Interactive Maps for Groundwater shows the entire Order limits to be at medium to low risk of groundwater pollution.

5. Assessment of Flood Risk

Flood Risk from all Sources

This section assesses the flood risk from the following sources against the Order limits parameter plans within Appendix A for the with-Scheme scenario:

- Fluvial (Rivers and the Sea);
- Surface Water;
- Sewers;
- Groundwater; and
- Artificial waterbodies.

The methodology used to assess the flood risk is detailed below:

Low: where little risk is identified or any theoretical risk identified is classified as low within Local Authority SFRA and/or EA flood risk mapping extents, with very low probability of flooding occurring;

Medium: where risk is identified within Local Authority SFRA and/or EA flood risk mapping extents indicating a medium probability, but manageable flood risk with little to no mitigation required; and

High: where modelled levels within Local Authority SFRA and/or EA flood risk mapping extents show risk to the Scheme as a high probability of flood risk and where mitigation needs to be considered and residual risks controlled.

Through the sequential process and design iterations, all Ancillary Buildings and BESS Compound will be located outside of Flood Zones 2 and 3 (River Ter flood risk area), i.e., in Flood Zone 1. The Boreham Brook will not alter in flood risk as the location will be used for cable routes/access with no above ground installations. Infrastructure shown to be at flood risk is to be mitigated as discussed below (Mitigation discussed in **Appendix 9C: Longfield SuDS Strategy [EN010118/APP/6.2]**).

Flood Risk mapping and EA flood risk guidance is presented in **Annex B: Flood Risk Mapping [EN010118/APP/6.2]**.

Climate Change

As of July 2021, the climate change allowances have changed, and now propose peak river flow allowances based on Water Framework Directive catchment areas. The Environment Agency Website 'Climate change allowances for peak river flow in England' has been consulted to check and confirm the revised climate change allowances for the catchment areas that cover the Order limits.

Climate change allowance relate to predicted percentage increase in peak river flows that the Scheme design must be considerate of.

The current allowance for design purposes for the Order limits is now the Higher Central allowance of 38% (for Essential Infrastructure), instead of 65%. The Mid Essex and Chelmsford SFRA use Flood Zone 2 as a proxy for the 65% climate change event in lieu of detailed hydraulic modelling. The Order limits PV panel areas are located outside of the Flood Zone 2 boundary, i.e. the PV panels are within Flood Zone 1.

Previously the H++ Scenario would be applied to Infrastructure projects of this scale. The H++ scenario provides an estimate of sea level rise and river flood flow change beyond the likely range but within physical plausibility. It is useful for contingency planning to understand what might be required if climate change were to happen much more rapidly than expected.

H++ still applies to sea level rise, although no longer for river flows. This specific area of the UK is not considered to be impacted by coastal sea level rise, so H++ is not discussed further in this report. As the H++ Scenario no longer applies to river flows, the 38% value is the required design allowance.

Figure 7 below is extracted from the EA online climate change allowance website:

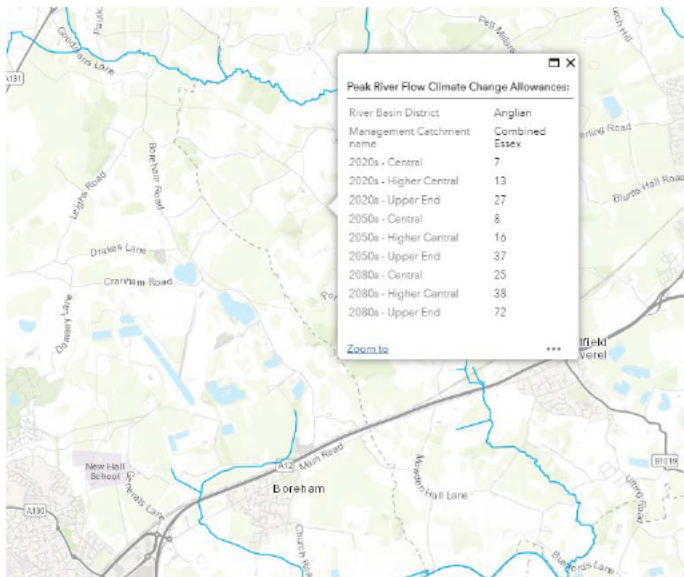


Figure 7: EA Online Climate Change Allowances – Reviewed October 2021
Anglian River Basin: Combined Essex Management Catchment

A ground level assessment was carried out, using available LiDAR data from Defra online, and overlaying of the EA long term fluvial flood risk maps on a 3D surface to determine the approximate level difference between both the Flood Zone 3 and Flood Zone 2 extents, where the Order limits is in proximity to Flood Zones 2 and 3.

Two areas were considered in this review that fit this criterion; all other areas of the Order limits are not in the vicinity of Flood Zones, except for the cable route, which is

not considered to impact long term flood risk as the cables are fully buried below existing ground level. The two areas reviewed were:

Area 1: The north of the site adjacent to the River Ter, where the DCO boundary is within Flood Zone 2 and 3 (but not PV Panels) – Shown on **Figure 8** below.

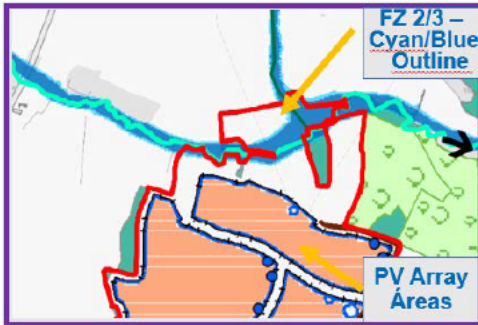


Figure 8: Flood Zones 2 and 3 – River Ter

Area 2: The mid-west of the Site near to the Flood Zone 2 boundary. Shown on **Figure 9** below.

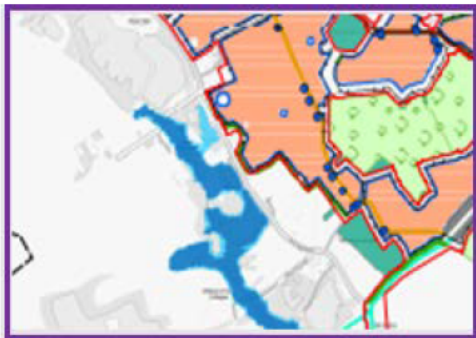


Figure 9: Flood Zones 2 and 3 – Boreham Brook

For Area 1, the Flood Zone 2 boundary, at its highest point in the Order limits is approximately 34.00m AOD. The nearest point of the Potential Developable Areas (PDAs) is approximately 38.00m AOD; a level difference of 4m. Due to the catchment characteristics and free flow downstream, it is highly unlikely that fluvial flood risk will rise by 4m in this location.

The distance from the Scheme at Area 1 to the Flood Zone 2 extent (at its shortest distance) is approximately 61m, representing a ground slope of 1 in 15.

For Area 2, the Flood Zone 2 Boundary, at its highest point in the Order limits is shown to be approximately 45.00m AOD. The nearest point of the PV Panel area is

approximately 46.50m AOD. A level difference of 1.5m. The level difference is relatively small; however, the topography indicates the Flood Zone 2 extent would not increase in depth as it is located in small “valley”. Flood Zone 2 extents in proximity to the Boreham Brook are approximately 43.00m AOD. It is considered the mapping for the “spur” of Flood Zone 2 in Figure 9 presents an unrealistic spike in flood level here of 45.00m AOD, and fluvial levels would reasonably be in the region of 43.00m AOD, a level difference of 3.5m.

The distance from the Scheme at Area 2 to the Flood Zone 2 extent (at its shortest distance) is approximately 47m, representing a ground slope of 1 in 13.

The online and SFRA mapping reviewed has not been provided using detail hydraulic modelling. However, with the assessment above, it is considered that fluvial modelling of both the River Ter and Boreham Brook is not required for the Order limits, as it is reasonable to assume fluvial flood levels would not reflect an increase in flood level, in the order of magnitude that the PV Panels sit above the estimated Flood Zone 2 levels. Additionally both the SFRAs indicate Flood Zone 2 as a proxy for the 65% climate change extent, with the revised climate change allowances now only requiring 38% for design purposes; the fluvial design extent level would be less, providing a greater depth difference to the PV Panels.

Surface Water Modelling

Surface water modelling undertaken by ARCUS, November 2021 appended to this FRA assessment in **Annex D**, supports and is considered to supersede the local authority and the Environment Agency broadscale mapping available online. Refer to Appendix D for Arcus Pluvial Modelling report and associated revised mapping.

The modelling provides predicted surface water depths and extents across the Order limits and surrounding areas for the 1 in 100-year storm event + 20% climate change. The mapping output from the modelling offers an opportunity to assess the risk of flooding from surface water sources more accurately specifically for the Order limits and surrounding area and therefore supersedes the mapping available from the Local Council’s SFRAs and Environment Agency’s Online Flood Maps for Planning.

The modelling was undertaken through an iterative process using the “worst-case scenario” rainfall data for three modelling scenarios: “Baseline”, “Refined Baseline” and “Operational Phase”. The “Refined Baseline Scenario” is a revised output of the “Baseline Scenario” modelling which identifies the existing surface water flow characteristics across the Order limits and any areas of potential surface water flood risk at or emanating from the Order limits by using additional data for the catchment (refer to ARCUS Surface Water Modelling Technical Note for further details on the modelling methodology). The Operational Phase Scenario identifies the potential surface water impact of the proposed infrastructure associated with the Scheme and quantifies the potential betterment of mitigation measures proposed within the report.

The surface water modelling results for each of the scenarios are as follows:

The “Baseline Scenario” modelling indicates the existing maximum surface water flood depths are located in an isolated area within the Order limits with a depth of approximately 0.9m. However, significant areas of the model extent have less than 0.1m depth of surface water flood levels. There are also areas within the Order limits

associated with existing surface water features (i.e. ponds, open land drains) demonstrating depths significantly greater than 0.9 m, however this is due to the depression in topography associated with these types of features.

The "Refined Baseline Scenario" modelling indicates the maximum surface water flood depths within the Order limits decreased from the "Baseline Scenario" to approximately 0.88 m.

The "Operational Phase Scenario" modelled the maximum surface water flooding depth as approximately 0.6m.

A comparison of the scenarios modelled indicates that post-construction, with the proposed surface water management measures (refer to **Appendix 9C: Longfield SuDS Strategy [EN010118/APP/6.2]** and **Appendix 9D: Bulls Lodge Substation Extension: Drainage Strategy [EN010118/APP/6.2]**, the risk of surface water flooding on or off the Order limits.

The residual risk of flooding from surface water therefore remains low.

Table 8 below summarises the flood risk as a result of the Scheme.

Table 8: Flood Risk Assessment

Flood Risk Source	Flood Risk Level	Comments
Fluvial	Low (Majority) Medium – High (Proximity to the River Ter / Boreham Brook)	<p>The Scheme is predominantly in Flood Zone 1 with very small areas at the northern boundary (River Ter) and the south-west corner of the Order limits (at the Boreham Brook). In areas of flood risk (Flood Zone 2 and 3) The Scheme layout in Appendix A indicates no development, PV panels or associated infrastructure will be located within flood risk areas; flood risk is not increased by the Scheme or elsewhere.</p> <p>Climate change has been assessed in sections 5.1.5 to 5.1.15 for the Order limits, in particular to the areas of PV panels in proximity to Flood Zones 2 and 3. For this stage of the design, it is not considered necessary to undertake hydraulic modelling as the built development areas are outside of the SFRA mapped extents and EA long term flood risk extents and are considered to be sufficiently above the predicted flood extents.</p> <p>It is considered fluvial flood risk will not increase as a result of development.</p>
Tidal	Very Low	Not in a Tidal area
Pluvial (Surface Water)	Very Low	<p>Solar Farm Site: The PV Panels will not increase peak surface water runoff. Swales will be implemented to reduce peak rates exiting the Order limits during storm events.</p> <p>BESS Compound: Surface water runoff will be attenuated, and the outfall flows restricted to limit peak surface water flows exiting the facility to the existing greenfield rate for up to and including the 1 in 100 year (+20%) event. Fire water runoff will be stored in an additional 4000m3 attenuation tank, which can be isolated to ensure no pollution discharges to the hydrological network. Pollution risk from site compound areas will be managed within the Construction Environmental Management Plan (CEMP), included in the ES.</p> <p>Ancillary Building: A filter drain is proposed to intercept and store surface water runoff, allowing it to slowly percolate into the underlying strata as per the existing conditions.</p> <p>Bulls Lodge Substation Extension: A hybrid system utilising infiltration and attenuation will limit peak surface water flows exiting the Extension to the existing greenfield rate for up to and including the 1 in 100 year (+20%) event.</p> <p>The risk of surface water flooding will not increase as a result of the Scheme.</p>
Groundwater	Low (East side) -	The overall probability of flooding is shown as generally less than 25%, increasing to values between 25%-50% in proximity of the River Ter. A higher risk area of >75% lies encroaches into the east boundary of the Order limits as shown in Figure 4 adjacent to Ringers Farm

Flood Risk Source	Flood Risk Level	Comments
	Medium (North West side)	Shallow Infiltration SuDS are currently proposed for the development, subject to further ground investigation, groundwater monitoring and infiltration testing. SuDS will be designed to ensure no increase in flood risk to the site or elsewhere.
	High (far eastern boundary adjacent to Ringers Farm)	The risk will not increase as a result of the Scheme.
Sewers	Low	It is not envisaged that the construction of the PV Panels and infrastructure will increase the risk existing sewers flooding risk. An Ancillary Building will be constructed as part of the Scheme. Wastewater emanating from this facility the BESS Compound will be contained within cesspits (or similar self-contained arrangement) to be emptied at regular intervals. The Bulls Lodge Substation Extension proposes to utilise the existing welfare facilities onsite. The risk will not increase as a result of the Scheme, it will remain Low
Artificial Sources	Very Low (residual)	It is not envisaged this risk will increase to the existing with the construction of the Solar PV Arrays. The risk will not increase as a result of the Scheme, it will remain Very Low.

Flood Risk Summary

The following Flood Risk conclusions are presented in **Table 9** below.

Table 9: Flood Risk Summary

Flood Risk Source	Pre-Scheme Risk	Post Scheme Risk	Comments
Fluvial	Low (majority) Medium – High in proximity to watercourse	Low (majority), Medium – High in proximity to watercourse	The majority of the Order limits is in Flood Zone 1, but certain areas lie in Flood Zone 2, 3a, 3b. No built development or ground level raising will occur in Flood Zone 3a or 3b. It is considered fluvial flood risk will not increase as a result of development.
Tidal	Very Low	Very Low	Not in a tidal area
Pluvial (Surface Water)	Very Low	Very Low	Surface water risk varies throughout the Order limits indicating patches of the Order limits which are susceptible to surface water flooding. However, flooding is localised and generally shallow (very low risk).

Groundwater	Low (East side) - Medium (North West side) - High (far eastern boundary adjacent to Ringers Farm)	Low (East side) - Medium (North West side) - High (far eastern boundary adjacent to Ringers Farm)	Groundwater flood risk varies across the Order limits. Shallow Infiltration SuDS are currently proposed for the development, subject to further ground investigation, groundwater monitoring and infiltration testing. Infiltration techniques must ensure mitigation measures are put in effect to protect groundwater interaction where a risk is identified following ground investigation.
Sewers	Low	Low	The risk of sewer flooding in the vicinity of the Order limits is deemed to remain low.
Artificial Sources	Very Low (residual)	Very Low (residual)	Statutory Reservoirs (large, raised reservoirs with volumes above ground of 25,000m ³ or over) are regularly inspected and maintained as set out in the Reservoirs Act 1975. On that basis they are deemed to pose a low (residual) risk. Other artificial sources such as canals and waterways are considered to be regularly maintained and therefore only deemed to pose a low (residual) risk to the proposed development

The Sequential Test

The Scheme satisfies the requirements and purpose of the Sequential and Exception Tests as set out by both NPS EN-1 and the NPPF.

Paragraph 5.7.13 of NPS EN-1 states a preference should be given to locating projects in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, then projects can be located in Flood Zone 2. If there is no reasonably available site in Flood Zones 1 or 2, then energy NSIPs can be located in Flood Zone 3, subject to the Exception Test.

Similarly, within the NPPF the overall aim of the Sequential Test is to steer new development to the lowest flood zone, i.e. Flood Zone 1. Flood Zones 2 and 3 may be considered, subject to passing the Exception Test depending on the type of development proposed. The development type for the Solar Farm infrastructure, the Grid Connection Route and the Bulls Lodge Substation Extension is 'Essential Infrastructure', which is defined in Annex 3 of the NPPF. The biodiversity enhancement areas that form part of the Scheme, including that adjacent to the River Ter is classified by NPPF Annex 3 as 'Water-Compatible' development ('nature conservation and biodiversity'). In accordance with national planning policy, the Secretary of State will need to be satisfied that the Scheme passes the Sequential Test and Exception Test, as small areas of the Scheme, comprising parts of the Order limits to be used for biodiversity enhancement and for the Grid Connection Route, are in Flood Zones 2 and 3.

In terms of the solar farm infrastructure, principally comprising the Solar PV Panels, BESS Compound and Longfield Substation, all of this is located within Flood Zone 1, and, therefore, in compliance with the Sequential Test.

The Grid Connection Route is required to link the Longfield Substation within the Solar Farm Site to the Bulls Lodge Substation Site. The Boreham Tributary and its associated flood plain is located between these two locations. There is no practical alternative to the Grid Connection Route crossing the Boreham Tributary (i.e. Flood Zones 2 and 3). The Grid Connection Route therefore passes the Sequential Test.

Regarding water compatible development; the biodiversity enhancement areas adjacent to the River Ter is partly within Flood Zone 2 and 3. This is defined as a water compatible use; therefore, in compliance with the requirements of the Sequential Test.

Overall, each of the component areas of the Scheme is in accordance with the purpose and requirements of the Sequential Test, taking account of the flood risk vulnerability classification.

The Exception Test

The requirements of the Exception Test are set out in paragraph 3.4.3 above; the two elements to be passed are reproduced below:

The development would provide wider sustainability benefits to the community that outweigh the 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.

NPS EN-1, which was published in 2011 (with a draft consultation revision in 2021) also includes the requirement that 'the project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land subject to any exceptions set out in the technology-specific NPSs'. It has been considered there are no suitable alternative sites located on pre-developed land, that offer the size and nature of the topography to facilitate a scheme of this size.

The majority of the Order limits lie within Flood Zone 1 and so do not require the Exception Test to be passed. The Exception Test is therefore applied because parts of the Grid Connection Route and a part of the Order limits to be used for biodiversity enhancement lie within Flood Zone 3a.

The national need and benefits for the Scheme is set out in the **Statement of Need [EN010118/APP/7.1]** and the **Planning Statement [EN010118/APP/7.2]** which accompany the DCO Application. These documents explain why the large scale nature of the Scheme is urgently needed nationally and the wider sustainability benefits of renewable energy production. The Planning Statement also explains the local benefits provided by the Scheme which include the delivery of significant biodiversity net gain and increased public local access.

The biodiversity net gain that will be provided within flood risk areas, will exceed the minimum 10% net gain required on the Scheme (as discussed within **Chapter 8: Ecology** of the ES [EN010118/APP/6.1]); therefore, providing greater environmental benefits to the area. The proposals do not increase flood risk to the Scheme or

elsewhere as there will be no ground raising involved with these proposals, or increased pathways for surface water runoff to enter the watercourse.

Overall, the Scheme's wider sustainability benefits outweigh the low flood risk which is identified by this FRA to and from the Scheme. Measures set out in section 7 will ensure the Scheme is safe for its lifetime and that there will be no increases in flooding elsewhere

With regard to meeting the Exception Test requirements of the NPPF, and the first and third requirements of the Exception Test set out in NPS EN-1, the assessment of the flood risk from the Scheme presented in section 5.1 demonstrates that there is no increase in flooding elsewhere once the Scheme is operational and during its construction stage

All above ground, built development has been relocated outside of Flood Zones 2 and 3 (including climate change allowance) through embedded design mitigation, with biodiversity and ecological enhancement areas located within Flood Zone 2 and 3 extents. Cable routes passing through Flood Zones 2 and 3 will be buried and have no long term flood risk impact, with no flood risk increased elsewhere as a result.

Additionally, surface water drainage will reduce flood risk elsewhere from the Scheme, reducing peak runoff rates into watercourses

The Scheme is considered to be in compliance with the Exception Test.

Finished Floor Levels

The main development areas of the Order limits are all within Flood Zone 1. All access points, floor levels and electrical/switchgear apparatus will be set a minimum of 300mm above existing ground level, as per the online Environment Agency Standing Advice, to provide flood resilience.

10. Drainage Strategy Assessment

Arcus SuDS Strategy

The following section provides a summary of the Outline Drainage Strategy for The Scheme prepared by ARCUS in **Appendix 9C: Longfield SuDS Strategy [EN010118/APP/6.2]**.

The **Appendix 9c: Longfield SuDs Strategy** assesses the “the Scheme infrastructure” in separate sections; “Solar Farm (the Solar Development)”, “Ancillary Building” and “Battery Energy Storage System (BESS) Compound”.

Existing Surface Water Drainage

The Order limits is within the Anglian River Basin District, Essex Combined Management Catchment and the Chelmer Operational Catchment and within the Boreham and Ter tributaries. The Order limits is not shown to be located within the operational boundary of an Internal Drainage Board (IDB). There are various undesignated waterbodies within the Order limits which comprise drainage channels and ponds, some of which are connected to the wider hydrological network associated with the River Ter and Boreham Tributary.

There are various ponds across the Order limits located within low lying areas and these are assessed to provide storage capacity through the flow of surface water flow towards low lying areas.

There is a collection of former gravel quarry pits approximately 250 m immediately west of the Order limits adjacent to Witham Road.

An irrigation reservoir is located approximately 650m north east of the Order limits north of the River Ter.

The Cranfield Soil and Agrifood Institute Soilsmap map indicates soils at the Order limits are categorised as ‘freely draining slightly acid sandy soils’, ‘Slightly acid loamy and clayey soils with impeded drainage’ and ‘Lime-rich loamy and clayey soils with impeded drainage’. Infiltration Testing was undertaken by Rogers Geotechnical Services in July 2021 at the proposed BESS Compound area. The report from this testing determined that the underlying strata is not suitable for soakaways.

Existing Foul Water Drainage

It is currently believed that there is no formal foul drainage network across the Order limits. Asset records have not yet been obtained from utility providers (Anglian Water) to confirm there are no sewer routes across the fields between local settlements.

Proposed Surface Water Drainage Strategy for areas of the Scheme proposed to have PV Arrays installed

An Outline Drainage Strategy has been prepared for the Scheme (excluding the Bulls Lodge Substation Extension site area) within **Appendix 9C: Longfield SuDS Strategy [EN010118/APP/6.2]** as part of the DCO application, in compliance with national and local planning policy and guidance.

The SuDS measures outlined in the report have been designed to ensure that greenfield runoff rates are maintained during the construction and operational phases of the Scheme.

Installation of the PV arrays does not involve the introduction of hardstanding at ground level meaning there is not expected to be a decrease in permeable area across the Solar Development as a result of the Scheme.

The PV Arrays are to be installed with regular rainwater gaps to prevent water being concentrated along a single drip line, in addition to this Rural Sustainable Drainage System measures are proposed to limit possible channelisation from surface water runoff from the PV panels by promoting interception and infiltration in the areas surrounding and between the PV Arrays throughout the Solar Development.

To intercept extreme surface water runoff, swales are proposed within low lying areas and parallel to the Order limit's contours. With the negligible increase in surface water runoff associated with the Solar Development, the proposed swales will provide additional surface water storage capacity relative to the pre-Scheme scenario and do not form part of the formal SuDS network.

To limit the potential flows of surface water within the proposed swales check dams will be implemented within the swales throughout the operational phase of the Scheme, limiting the potential of surface water to settle in low lying extents of the swales.

Proposed Surface Water Drainage Strategy for the Ancillary Building

An Ancillary Building is located within the Order limits which measures 540 m² and will comprise a warehouse building, office, kitchen and toilets.

Surface water runoff associated with this part of the Scheme is proposed to be intercepted by a shallow filter drain located between the building and proposed Primary Access Track.

Due to the limited infiltration capacity on the Site, surface water will not disperse into soils at a significant rate. As such the implemented feature will be designed with no calculated outflow or discharge and will slowly percolate to the underlying strata as per the natural percolation of the soils with no overtopping during the 1:100 year (+20%) event, preventing any increase in surface water runoff as a result of this part of the Scheme.

In such an eventuality there would be significant surface water depths at the surrounding Ancillary Building site and catchment. Surface water emanating from the filter drain would disperse as per existing flow routes within the wider Site and would flow away from the Ancillary Building.

Proposed Surface Water Drainage Strategy for BESS Compound

The area designated for the BESS Compound (6.86 ha) will have an increase in impermeable area, of 1.94ha as a result of the Scheme.

The increased surface water runoff associated with the BESS Compound is proposed to be "attenuated within the unbound free-draining subbase beneath the aggregate

chippings and an attenuation pond which will discharge to the existing open land drain to the east through an excavated surface water pipe.”

The subbase will be served by a network of drains which will migrate surface water to two outfalls located at topographic low points within the BESS Compound. The two outfalls are located at the location of existing surface water flow routes which will lead to the attenuation pond to the east.

Surface water flows will be limited to the 1:1-year rate of 2.4 l/s up to and including the 1:100-year (+20% CC) through the use of a flow restriction device placed on the outfall of the pipes from the subbase and attenuation pond receiving land drain.

To provide additional ecological benefits the attenuation pond will incorporate embankments with native planting to be implemented on the wider banks of the pond.

During an exceedance event, surface water flow routes will disperse as per the current pre-Scheme scenario within the Order limits.

Fire Water Control / Discharge for BESS Compound

As part of the operation of the Order limits, the risk of fire within the battery storage containers must be considered. Consultations with ECC Fire and Rescue (F&R) department have outlined that the BESS Compound has a fire risk which must be assessed in relation to the potential contaminants within any fire suppressing water runoff.

The BESS units will be underlain by a concrete base and any immediate runoff from the infrastructure during a fire event which would require direct firefighting would then runoff the concrete base and be intercepted by the drainage system. The limited infiltration capacity of the underlying grounds confirmed via localised infiltration testing would prevent any potentially contaminated water from percolating into the underlying ground.

During a fire event whereby, fires are to be managed onsite, 4,000 kilolitres of suppressant water will be released as per agreement with ECC F&R. Due to the potential contaminants within any firewater runoff, a separation and storage mechanism will be required within the drainage system.

A sub-surface attenuation tank with 4,000m³ of storage is proposed to capture the 4,000 kilolitres of fire suppressant water during a large fire event, enabling contaminated water to be isolated from entering the surrounding hydrological network before it is tested and disposed of offsite.

To enable any contaminants to be extracted from the system it is proposed that the drains will have the ability to be bunged and a penstock to be implemented at the downstream extremity of pipe 1.013 to isolate the network. The penstock will then enable potential contaminated suppression waters to be isolated and stored within a sub-surface attenuation tank prior to extraction in order to be suitably tested and disposed of offsite without entering the surrounding hydrological network.

The bung and penstock system is designed to intercept and isolate potentially contaminated runoff from the wider SuDS system for all fire events and thus prevent contaminated runoff entering the wider hydrological network.

The bung equipment required to manage suppression water is to be covered further in an Emergency Response Plan and ancillary emergency equipment will be kept onsite (e.g. drain bungs, extra fire hose). The Emergency Response Plan will outline the emergency measures in place and the procedures implemented to mitigate potential impacts of the infrastructure on surrounding receptors during emergency situations. The Emergency Response Plan will be produced in accordance with principles agreed with ECC F&R with engagement and communication ongoing from an early stage in the concept stage and through to the design and construction phase.

Following a fire event, the drainage network will undergo an assessment to confirm the absence of any contaminants prior to the penstock being released. The designated Development operator will be responsible for conducting a controlled flushing of the drainage network prior to the release of the penstock and bung tools.

Proposed Foul Water Drainage Strategy

During the construction of the Scheme, it is proposed that foul water will be disposed of via 'Port-a-loo' type facilities and disposed of via a licenced waste carrier.

During the operational phase of the Scheme, the Battery Energy Storage System (BESS) Compound and the Ancillary Building will contain welfare facilities for the staff when in use. It is proposed that foul water will be collected in cesspits within the confines of these areas and will be managed, inspected and drained by a licensed courier who will also dispose of the waste off site.

The Ancillary Building and BESS Compound are located approximately 550 m and 750 m from the nearest potential foul sewer, assumed to be on Waltham Road. Therefore connection to a foul sewer will not be feasible for either proposal.

Bulls Lodge Substation Extension Drainage Strategy

The following section provides a summary of the Proposed Surface Water Strategy Prepared by Mott MacDonald in **Appendix 9D: Bulls Lodge Substation Extension: Drainage Strategy [EN010118/APP/6.2]**.

Appendix 9D: Bulls Lodge Substation Extension: Drainage Strategy [EN010118/APP/6.2] summarises the proposed drainage strategy and outlines measures taken to reduce the impact of the Bulls Lodge Substation Extension by utilising sustainable drainage systems.

The proposed substation expansion is to be constructed on a currently undeveloped greenfield site (1.525 ha) adjacent to the existing Bulls Lodge Substation. The construction of Ancillary Buildings, Primary Access Tracks and associated parking areas delivers 0.360 ha of impermeable area post-development across the site (23.6%).

Existing and Proposed Surface Water Strategy

The strategy proposes to compensate for the increase in impermeable area constructed on the site through the use of a hybrid attenuation and infiltration SuDS system; limiting the surface water discharge rate to the 1 in 1 year greenfield runoff rate (1.9l/s) for surface water run off events up to and including the 1 in 100 year + 20% climate change event.

The strategy proposes to limit the surface water discharge rate using 1160m³ of attenuation volume provided in the subbase of the gravel Access Tracks.

The strategy also accounts for proposed ground level changes across the site through the use of land drains located on the north and western boundary of the site. The rate/volume of flow from the land drainage are to be determined during detailed hydraulic modelling.

The controlled site runoff and land drains are proposed discharge via a gravity pipe network, south to Boreham Brook and outfall at a new headwall structure.

Proposed Foul Water Drainage Strategy

There are no proposed foul water drainage plans for the Bulls Lodge Substation Extension as the development proposal does not include plans for welfare facilities as it will not be a manned facility. Personnel visiting the site will use the existing welfare facilities in the existing Bulls Lodge Substation.

11. Residual Risks and Mitigation

Residual Risks to Site

By passing the Exception Test, any residual risks relating to fluvial flooding around the PV sites have been demonstrated to be sufficiently mitigated. Residual risks are considered to be very low.

The residual risk for fire water entering groundwater or watercourses remains. However, the fire management plan measures that are captured with the Drainage Strategy Report (*Appendix 9C: Longfield SuDS Strategy [EN010118/APP/6.2]*) ensure the risk is mitigated as far as reasonably practicable.

Resilience and Resistance Measures

The proposed Solar Stations have all been located in Flood Zone 1. However, to account for residual extreme surface water flooding events, finished floor levels, and electrical components should be set 300mm above existing ground levels.

Safe Access

Through the sequential process and design iterations there are no buildings located within the floodplain. All compounds for site staff and battery storage units have been located out of Flood Zones 2 and 3, i.e. within Flood Zone 1, and it is envisaged access to the PV Panels would not be sought during flooding conditions.

Safe access and escape for flood risk during construction will be addressed within the Construction Environment Management Plan, ensuring access to and from the site is safely maintained in areas at risk of flooding.

12. Conclusions and Recommendations

This Flood Risk Assessment has been prepared to support the Application.

The following conclusions from the FRA are presented in **Table 10** below:

Table 10: Flood Risk Summary

Flood Risk Source	Pre-Scheme Risk	Post Scheme Risk	Comments
Fluvial	Low (majority), Medium – High in proximity to watercourse	Low (majority), Medium – High in proximity to watercourse	The majority of the Order limits is in Flood Zone 1, but certain areas lie in Flood Zone 2, 3a, 3b. No development will occur in Flood Zone 3b.
Tidal	Very Low	Very Low	Not in a tidal area
Pluvial (Surface Water)	Very Low	Very Low	Surface water risk varies throughout the Order limits indicating patches of the Site which are susceptible to surface water flooding. However, flooding is localised and generally shallow (low risk).
Groundwater	Low (East side) - Medium (North West side) High (far eastern boundary adjacent to Ringers Farm)	Low (East side) - Medium (North West side) High (far eastern boundary adjacent to Ringers Farm)	Groundwater flood risk is low across the Order limits, less than 50% probability. Shallow Infiltration SuDS are currently proposed for the development, subject to further ground investigation, groundwater monitoring and infiltration testing. Infiltration techniques must ensure mitigation measures are put in effect to protect groundwater interaction where a risk is identified following ground investigation.
Sewers	Low	Low	There is no history of sewer flooding within or around the Order limits. Operational use of the Order limits is not considered to increase the risk of sewer flooding.
Artificial Sources	Very Low (residual)	Very Low (residual)	Statutory Reservoirs (large raised reservoirs with volumes above ground of 25,000m ³ or over) are regularly inspected and maintained as set out in the Reservoirs Act 1975. On that basis they are deemed to pose a low (residual) risk.

The Scheme is classed as 'Essential Infrastructure' and therefore not suitable within Flood Zone 3a and 3b without passing the Exception Test. All new built development is set within Flood Zone 1, incorporating the estimated climate change fluvial flood

extents (based on the SFRA maps). The Order limits passes the Sequential Test in terms of flood risk. Consequently, the Exception Test is not considered necessary.

The Outline Drainage strategy (**Appendix 9C: Longfield SuDS Strategy [EN010118/APP/6.2]**) proposes to use SuDS techniques and perimeter swales to mimic existing drainage conditions and accommodate the 1 in 100-year return period storm event plus a 20% increase allowance for climate change. Additional surface water runoff volume generated from impermeable areas of the Scheme will be attenuated and discharged from at controlled rates, ensuring there is no increase in flood risk off site.

Exceedance flows from the Order limits will not increase the existing flood risk on or off site as a result of the Scheme.