Luton Rising
Our airport.
Our community.
Our planet.

November 2023

London Luton Airport Expansion

Planning Inspectorate Scheme Ref: TR020001

Volume 5 Environmental Statement and Related Documents

5.07 Appendix 20.1 Flood Risk Assessment

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The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

London Luton Airport Expansion Development Consent Order 202x

5.07 ENVIRONMENTAL STATEMENT APPENDIX 20.1 FLOOD RISK ASSESSMENT

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Contents

1 INTRODUCTION

1.1 Report context

1.1.1 This Flood Risk Assessment (FRA) is part of the suite of documents prepared for Luton Rising (the Applicant) to support an application for development consent for the proposed expansion of London Luton Airport (the Proposed Development). Specifically, this FRA is a technical appendix supporting **Chapter 20** Water Resources and Flood Risk of the Environmental Statement (ES) **[TR020001/APP/5.01]**.

1.1.2 This FRA has been prepared with reference to the National Planning Policy Framework (NPPF) (Ref 1), the NPPF Flood Risk and Coastal Change web-based Guidance (Ref 2) and follows the methodology prescribed in CIRIA document C624: Development and Flood Risk, Guidance for the Construction Industry (Ref 3).

1.2 Proposed Development

1.2.1 The Proposed Development builds on the current operational airport with the construction of a new passenger terminal and additional aircraft stands to the north east of the runway. This would take the overall passenger capacity from 18 mppa to 32 mppa.

1.2.2 In addition to the above, and to support the initial increase in demand, the existing infrastructure and supporting facilities would be improved in line with the assessment phases related to incremental growth in capacity of the airport:

a. Assessment Phase 1 – to achieve a capacity of 21.5 mppa at the existing terminal (referred to as Terminal 1);

b. Assessment Phase 2a – to achieve a capacity of 27 mppa with the new terminal opening in 2037 (referred to as Terminal 2); and

c. Assessment Phase 2b – progressive expansion of Terminal 2 to achieve a capacity of 32 mppa by 2043.

1.2.3 An overview of the Proposed Development and the site and surroundings in which it is proposed is provided in **Chapter 2** of the ES **[TR020001/APP/5.01]**. A detailed description of the Proposed Development is provided in **Chapter 4** of the ES **[TR020001/APP/5.01]**. A summary of those elements of the Proposed Development relevant to this FRA includes:

a. Extension and remodelling of the existing passenger terminal (Terminal 1) to increase the capacity;

b. new passenger terminal building and boarding piers (Terminal 2);

c. earthworks to create an extension to the current airfield platform, the vast majority of material for these earthworks would be generated on site;

d. airside facilities including new taxiways and aprons, together with relocated engine run-up bay and fire training facility;

e. landside facilities, including buildings which support the operational, logistics, energy and servicing needs of the airport;

f. enhancement of the existing surface access network, including a new dual carriageway road (Airport Access Road (AAR)) accessed via a new junction on the existing New Airport Way (A1081) to the new passenger terminal along with the provision of forecourt and car parking facilities;

g. extension of the Luton Direct Air to Rail Transit (Luton DART) with a station serving the new passenger terminal;

h. landscape and ecological improvements, including the replacement of existing open space; and

i. Further infrastructure enhancements and initiatives to support the target of achieving zero emission ground operations by 2040[1], with interventions to support carbon neutrality being delivered sooner including facilities for greater public transport usage, improved thermal efficiency, electric vehicle charging, on-site energy generation and storage, new aircraft fuel pipeline connection and storage facilities and sustainable surface and foul water management installations.

1.2.4 Note also, that the expansion of the operational airport within the Main Application Site (as defined in **Chapter 2** of the ES **[TR020001/APP/5.01]**) is limited in all directions, other than to the east of the existing airport, due to existing development and the outcomes of the identification and appraisal of alternative design options. Therefore, it is appropriate to consider only the development to the east of the existing airport, within the Main Application Site, the 'Expansion Area' for the purpose of this FRA.

1.3 Local stakeholders and operating authorities

1.3.1 With regards to development planning, flood risk and water related issues, there are a number of key local stakeholders and/or operating authorities associated with the Proposed Development. These include:

a. The Environment Agency (EA). The EA have wide ranging powers for main rivers and groundwater bodies under the Water Resources Act (1991) (Ref 4) and the Environment Act (1995) (Ref 5). Under the Flood and Water Management Act (FWMA) (2010) (Ref 6) they have a responsibility to produce a national strategy towards managing flood risk and are a statutory planning consultee for development and flood risk issues.

b. Lead Local Flood Authorities (LLFA). Under the FWMA, the LLFA have responsibility for local flood risk. This includes ordinary watercourses, groundwater and surface water (including the implementation of sustainable drainage (SUDs) techniques). The Main Application Site and the Off-site Highway Interventions (as defined in **Chapter 2** of the ES **[TR020001/APP/5.01]**) extend across the boundaries of three LLFA's,

[1] This is a Government target, for which the precise definition will be subject to further consultation following the Jet Zero Strategy, and which will require further mitigations beyond those secured under the Development Consent Order.

Luton Borough Council (LBC), Central Bedfordshire Council (CBC) and Hertfordshire County Council (HCC).

c. The Planning Inspectorate. The nature and scale of the Proposed Development means that the application will be reviewed by the Planning Inspectorate and recommendations made to the Secretary of State as to whether to grant permission for the Proposed Development by way of a Development Consent Order (DCO). This will include ensuring the Proposed Development is safe in terms of flood risk, does not increase flood risk elsewhere and would seek to implement SUDs, in conjunction with the LLFA.

d. Thames Water (TW). TW is the public sewerage undertaker under The Water Industry Act 1991 (Ref 7). They operate and maintain significant infrastructure in proximity to the Main Application Site as well as in proximity of the Off-site Highway Interventions.

e. Affinity Water. They are the primary supplier of public potable water with powers under The Water Industry Act 1991 (Ref 7) to the Proposed Development. They operate and maintain significant infrastructure in proximity to the Main Application Site as well as in proximity of the Off-site Highway Interventions.

f. Veolia Water act on behalf of London Luton Airport Operations Limited (LLAOL) to operate and maintain the existing water related infrastructure within the existing airport. This includes the private surface and foul water systems that connect into the public sewerage network and private water supply network that takes potable water from the public system. the private surface and foul water systems that connect into the public sewerage network and private water supply network that takes potable water from the public system.

1.4 Data sources

1.4.1 The key data sources used to compile this FRA are listed below:

a. EA indicative flood mapping (Flood Map for planning) (Ref 8), Risk of Flooding from Rivers and Sea dataset, and Risk of Flooding from Surface Water (RoFSW) as indicated on the Long term flood risk information page on the gov.uk website (Ref 9).

b. Information on the existing airport drainage and water supply infrastructure, owned by the Applicant and operated by Veolia Water on behalf of London Luton Airport Operations Limited (LLAOL), the current operator of the airport. This includes an ‘Asset Management Plan Report’ authored by Mott MacDonald in 2008 (Ref 10) and data available in the Drainage Design Statement (DDS), provided in **Appendix 20.4** of the ES **[TR020001/APP/5.02]**, regarding baseline and the proposed surface water management design.

c. Information on existing public drainage (surface water and foul) infrastructure owned and operated by TW (Ref 11).

d. Information on existing public water supply distribution infrastructure owned and operated by Affinity Water (Ref 12).

e. Strategic Flood Risk Assessments (SFRA), Preliminary Flood Risk Assessments (PFRA) and Local Flood Risk Management Strategy documents for the three local authorities with LLFA responsibilities (LBC, CBC and HCC). These are listed below:

   i. LBC (2015). Local Flood Risk Management Strategy (Ref 13);
   ii. Capita Symonds (2013). Luton Level 1 SFRA update (Ref 14) (update to original SFRA published in 2008);
   iii. Capita Symonds (2011). Luton Borough Council Preliminary Flood Risk Assessment (Ref 15);
   iv. HCC (2018) LFRMS 2 A Strategy for the Management of Local Sources of Flood Risk (update to original LFRMS published in 2011) (Ref 16).
   v. HCC (2018). Hertfordshire Minerals Local Plan Review. Updated Level 1 Strategic Flood Risk Assessment (SFRA) (Ref 17) (update from original SFRA published in 2015);
   vi. HCC (2011). Hertfordshire County Council. Preliminary Flood Risk Assessment (Ref 18);
   vii. HCC (2017); Hertfordshire County Council. Preliminary Flood Risk Assessment Addendum (Ref 19);
   viii. JBA (2017). Central Bedfordshire Council. Level 1 Strategic Flood Risk Assessment (Ref 20);
   ix. CBC (2014). Local Flood Risk Management Strategy for Central Bedfordshire (Ref 21);
   x. Bedford Group of Drainage Boards (2011). Upper River Great Ouse. Tri Lead Local Flood Authority. Preliminary Flood Risk Assessment For Bedford Borough Council, Central Bedfordshire Council and Milton Keynes Council (Ref 22); and
   xi. CBC (2017) Central Bedfordshire Council. Preliminary Flood Risk Assessment Addendum (Ref 23); and
   xii. DBC (2007) Strategic Flood Risk Assessment (Ref 24).

1.4.2 This FRA was also informed by a site walkover undertaken on the 10 April 2018 which provided an overview of the topography of the site and key operational assets in the existing airport. Additional ground investigation and ecological surveys of the Main Application Site have taken place up to summer 2022, and there has been no indication from these surveys that conditions have since changed in any way that could affect flood risk.

2 FLOOD RISK PLANNING AND LEGISLATIVE CONTEXT

2.1 Airports National Planning Statement

2.1.1 The Airports National Policy Statement (ANPS) (Ref 25) does not have effect in relation to an application for development consent for an airport development not comprised of an application relating to the Heathrow Northwest Runway. Nevertheless, as set out within paragraph 1.41 of the ANPS, the Secretary of State considers that the contents of the ANPS will be both important and relevant considerations in the determination of such an application, particularly where it relates to London or the south east of England. In particular, the ANPS makes clear that, alongside the provision of a new Northwest Runway at Heathrow, the government supports other airports making best use of their existing runways as set out in Beyond the Horizon: Making best use of existing runways (MBU) (Ref. 26), which is the specific policy context for this application.

2.1.2 In addition, whilst the ANPS does not have effect in relation to the Proposed Development, it sets out a number of principles for environmental impact assessment and compliance and these will be an important and relevant consideration in the determination of the application for development consent. The relevant provisions of the ANPS considered in this FRA include:

a. paragraphs 5.152-5.157 set out the approach to flood risk assessment that are relevant for airport development; and

b. paragraphs 5.158 to 5.165 and 5.178-5.181 outline the requirements to mitigate the impact of flooding including the use of sustainable drainage systems (including infiltration devices, rainwater recycling, ponds) with the aim to ensure that surface runoff does not increase in comparison to the baseline and the requirement to apply the sequential approach.

2.2 National Planning Policy Framework

2.2.1 The National Planning Policy Framework (NPPF) (Ref 1) introduced in 2012 and revised in 2021, is the overarching planning framework guiding the development process at a national level across England. Although paragraph 5 makes clear that it does not contain specific policies for nationally significant infrastructure projects, such as the Proposed Development, it will be an important and relevant consideration. In terms of flood risk the aim is to ensure that flood risk is considered at all stages in the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. It does this by formulating a risk-based approach towards flooding, to be adopted at all levels of planning. It is supported by web based technical guidance (Ref 2).

2.2.2 The NPPF requires that the "sequential test" is applied during the planning process. The sequential test aims to ensure that preference for developable land is given to land that has the lowest risk of flooding, based on the data available. The starting point for the sequential test is the system of 'flood zoning'.

2.2.3 The flood zoning system adopted in England is described in **Table 2.1** below, as described in NPPF technical guidance (Ref 2). It describes the flood risk of an area by rivers and in coastal areas, estuaries and the sea. This information is generated by the EA and Local Planning Authority (LPA) and used to support land use planning decisions. It is shown on the EA's Flood Map for planning (Ref 8) and is also found in LPA's SFRAs.

Table 2.1: Flood zoning system used across England as defined in NPPF (Ref 1).

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 (0.1%) annual exceedance probability (AEP) 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 (1%) and 1 in 1,000 (0.1%) AEP of river flooding; or land having between a 1 in 200 (0.5%) and 1 in 1,000 (1%) AEP of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High Probability	Land having a 1 in 100 (1%) or greater AEP of river flooding; or Land having a 1 in 200 (0.5%) or greater AEP of sea flooding (Land shown in dark blue on the Flood Map).
Zone 3b Functional Floodplain	This zone comprises land where water needs to flow or be stored in times of flood. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map).

2.2.4 The sequential test requires that development only be considered within Flood Zone 2, if there are no appropriate development sites in Flood Zone 1. Development in Flood Zone 3 should only be considered if development is not possible in Flood Zone 2, assuming development in Flood Zone 1 has also been ruled out. This process should be undertaken by the LPA on behalf of the Secretary of State, to identify areas appropriate for development and the approach should be adopted by developers on a site-specific basis.

2.2.5 The NPPF also encourages those involved in development to consider the flood vulnerability of a proposed development to the impact of flooding. The vulnerability of different types of development is listed in the online guidance. This is relevant for considering what type of development is appropriate for a site (based on its Flood Zone) and also how a development site should be laid out if there are different Flood Zones encountered within a site. The compatibility of development in terms of its vulnerability and flood zoning is described in **Table 2.2** below which is based on Table 3 in NPPF technical guidance (Ref 2).

Table 2.2: Flood risk vulnerability and compatibility

Flood zone	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	✓	Exception test required	✓	✓
Flood Zone 3a	Exception test required	✓	×	Exception test required	✓
Flood Zone 3b "Functional Floodplain"	Exception test required	✓	×	×	×

Key:

✓ Development is appropriate,

× Development should not be permitted

2.2.6 This illustrates how higher vulnerability land uses should be directed to lower flood risk sites and vice versa.

2.2.7 Should the sequential approach show that it is not possible for a development to be located in Zones of lower flood risk, it may be possible, using the exception test, to demonstrate that development is still feasible by adopting flood risk management measures. However, these measures should not increase flood risk elsewhere. The exception test requires the demonstration of the following:

a. the development provides wide sustainability benefits that outweigh the flood risk; and

b. a FRA must be provided.

2.2.8 A FRA is required for any development irrespective of Flood Zone, for all development in excess of 1 hectare (ha). This is due to the potential flood risk caused by increases in surface water discharges.

2.2.9 A NPPF and ANPS compliant FRA should be undertaken to consider the following:

a. the risk posed by all potential sources of flooding while also considering the impact of climate change (in most cases the risk should be less than 1% in any given year);

b. the development will not increase flood risk elsewhere from any potential source, with climate change considered once more;

c. the development is designed to be safe with flood protection considered where necessary as well as a design that considers emergency access and egress arrangements;

d. the development process should seek to reduce overall flood risk, wherever practicable;

e. management and funding arrangements to ensure the site can be developed and occupied safely throughout its proposed lifetime; and

f. sustainable drainage systems are incorporated into the development, unless there is clear evidence that this would be inappropriate.

2.2.10 The implementation of sustainable drainage and the requirement for flood risk reduction were specifically reinforced in the July 2018 issue of the NPPF, and the subsequent update in July 2021 (Ref 1).

2.3 Flood and Water Management Act 2010

2.3.1 The FWMA (Ref 6) is a direct result of the recommendations made by Sir Michael Pitt, taken from the Pitt Report (Ref. 27) on the severe flooding experienced across the country in 2007, and which was given Royal Assent in April 2010. It provides for better, more comprehensive management of flood risk for people, homes and businesses, helps safeguard community groups from unaffordable rises in surface water drainage charges and protects water supplies to the consumer. It set out a legislative framework that compliments the NPPF (Ref 1). The principles of the FWMA (Ref 6) have been applied to this FRA.

3 FLOOD RISK ASSESSMENT METHODOLOGY

3.1.1 The methodology adopted for this FRA is outlined below and is compliant with NPPF (Ref 1) and the ANPS (Ref 25).

3.1.2 In the first instance, the Proposed Development has been evaluated in terms of the sequential test (as reported in **Section 6**). This determines the suitability of the Proposed Development considering existing flood risk and the vulnerability of the Proposed Development. This initial test was based on the EA's Flood Map for planning (Ref 8) and the RoFSW data set (Ref 9). Where there were existing flood risk considerations the 'exception test' has been addressed by examining the sustainability benefits of the Proposed Development and **Section 6.1** signposts to the sections of the FRA which ensure that the Proposed Development is safe and that it does not increase flood risk elsewhere.

3.1.3 Following the sequential and exception test stage of the assessment, the baseline conditions of the Main Application Site, Off-site Highway Interventions and Off-site Car Park locations (as defined in **Chapter 2** of this ES **[TR020001/APP/5.01]** and shown in **Figure 2.2 [TR020001/APP/5.03]**) was compiled, as reported in **Section 5**. This describes the existing surface and groundwater features, locates existing water related infrastructure and identifies the key flood risk considerations affecting the Main Application Site and the off-site works locations.

3.1.4 Once the baseline was fully compiled, the assessment (**Section 7**) identifies potential flood risk considerations relating to the Proposed Development.

3.1.5 The assessment (**Section 7**) examines the Main Application Site, the Off-site Highway Interventions and the Off-site Car Parks separately. The Off-site Highway Interventions and Off-site Car Parks are not covered in detail by the DDS in **Appendix 20.4** of the ES **[TR20001/APP/5.02]**. Off-site Highway Interventions and Off-site Car Parks have different drainage design requirements which will be developed during detailed design to contemporary standards as required in this assessment and the design principles set out in the Design Principles [**TR020001/APP/7.09**] which is a live document through the examination process. However, this FRA is holistic in its coverage of the Proposed Development, and accounts for the Main Application Site, Off-site Highway Interventions, and Off-site Car Parks.

3.1.6 Potential flood risk receptors are identified in **Section 5** and any potential impacts on flood risk are identified in **Section 7**. The assessment tables contained in **Chapter 20** Water Resources and Flood Risk of the ES (**[TR020001/APP/5.01]**) have been used to define if flood risk impacts are identified as significant or not. These tables are based on the Design Manual for Roads and Bridges (DMRB) LA113 assessment methodology (Ref 28), although as outlined in **Chapter 20** Water Resources and Flood Risk of this ES (**[TR020001/APP/5.01]**) they have been slightly adapted for consistency across assessments and agreed through EIA Scoping and discussions with relevant stakeholders.

3.1.7 The assessment of flood risk has considered the potential impacts of the Proposed Development, for construction and operation, as described in

Chapter 4 of the ES (**[TR020001/APP/5.01]**). The assessment of construction related flood risk impacts is based on the implementation of measures described in the Code of Construction Practice (CoCP) provided as **Appendix 4.2** of the ES (**[TR020001/APP/5.02]**) as outlined in **Section 7**.

3.2 Assumptions and Limitations

3.2.1 It is understood that phasing of the Proposed Development is to be undertaken cognisant of the requirement for the drainage systems to be operational throughout construction. No decommissioning of existing drainage infrastructure is to be undertaken without an appropriate alternative in place (such as the new infiltration tanks being in place, prior to decommissioning of the existing central soakaway).

3.2.2 The baseline conditions have been derived from both desk-based assessment and the site walkover, and data updated based upon findings from direct observations and sampling. This has included information obtained from walkover surveys, intrusive ground investigations and groundwater monitoring.

3.2.3 This document includes the information reasonably required to assess flood risk. The assessments are based on conservative inputs derived from available field or desk study data and published research literature relevant to the study area.

3.2.4 The findings presented in this document are based upon the data available at the time of writing. Any data collected following the granting of development consent would be used to refine conceptual models to support the detailed design phase and would form part of the ongoing dialogue with the EA, LLFAs and other stakeholders.

3.2.5 Any third-party information, including the readily available data sources and input from external consultations has been assumed to be accurate at the time of writing.

3.2.6 The Off-site Highway Interventions and Off-site Car Parks are not covered in detail by the DDS in **Appendix 20.4** of the ES **[TR20001/APP/5.02]**. Off-site Highway Interventions and Off-site Car Parks have different drainage design requirements which will be developed during detailed design to contemporary standards as required in this assessment and the design principles set out within the Design Principles [**TR020001/APP/7.09**] which is a live document through the examination process. However, this FRA is holistic in its coverage of the Proposed Development, and accounts for the Main Application Site, Off-site Highway Interventions, and Off-site Car Parks.

3.2.7 The FRA has been undertaken using the study area defined in **Chapter 20** Water Resources and Flood Risk of this ES **[TR20001/APP/5.01]**.

4 ENGAGEMENT

4.1.1 Throughout the pre-application process, input has been sought from the following key stakeholders:

a. the LLFAs responsible for the areas affected by the Proposed Development (CBC, LBC and HCC);

b. the EA with respect to their role in setting a national flood risk strategy and also in respect to their roles to control discharges to controlled waters;

c. Veolia Water, who act on behalf of LLAOL to operate and maintain the existing water related infrastructure within the existing airport;

d. TW as the local sewerage undertaker; and

e. Affinity Water as the local public water supply undertaker.

4.1.2 A series of meetings were held with these key stakeholders in order to keep them up to date on the progress of the Proposed Development and the key design features with the potential to affect flood risk. The main focus of these meetings was the drainage strategy for the Proposed Development, which is included as **Appendix 20.4** of the ES **[TR020001/APP/5.02].**

4.1.3 A summary record of this engagement is provided in **Section 20.4** of **Chapter 20** of the ES **[TR020001/APP/5.01].**

5 BASELINE CONDITIONS

5.1 Site description

Main Application Site

5.1.1 A detailed description of the Application Site, including the Main Application Site, Off-site Highway Interventions and Off-site Car Parks, and the surrounding area is provided in **Chapter 2** of the ES **[TR020001/APP/5.01]**. These development areas are shown in **Figure 2.2** of this ES **[TR020001/APP/5.03]**.

5.1.2 In addition to the existing airport infrastructure, land use within the Main Application Site comprises Wigmore Valley Park, which is characterised by areas of scrub, rough grassland and wooded areas. This is located over a historic landfill site. To the east of the park the land is used for arable farming. The Main Application Site extends beyond Winch Hill Road, to the east.

5.1.3 The Main Application Site includes the AAR that connects to New Airport Way and Percival Way. The majority of the western half of the alignment is proposed to occupy a corridor of undeveloped land between Vauxhall Way and Percival Way. The alignment arcs around to the north east through existing industrial and commercial properties associated with airport operations and connects into Percival Way.

Off-site Highway Interventions and Off-site Car Parks

5.1.4 The Off-site Highway Interventions are located at existing highway junctions that have been determined to be affected by the changes in traffic flow caused by the increase in passenger numbers at the airport and require work to mitigate this impact on the network. Outline designs for these works have been developed as part of the Proposed Development and are described in **Chapter 4** of the ES **[TR020001/APP/5.01]** and the DDS provided as **Appendix 20.4** of the ES **[TR020001/APP/5.02].** There are also two Off-site Car Parks (P1 and P2), located to the south west of the Main Application Site.

5.2 Existing surface water features and flood risk

Main Application Site

Existing surface water features

5.2.1 The Main Application Site covers a large geographical area, however, as a result of the underlying geological strata the Main Application Site is devoid of natural permanent surface water features such as rivers or streams. Although, there are a number of surface water features in and around the Main Application Site associated with surface water management of the existing airport and the surrounding residential development. These are described in more detail in **Table 5.1** and **Table 5.2**.

5.2.2 The Main Application Site is situated on an elevated escarpment area that forms part of a scarp slope of the Chilterns Hills, and contributes to two river valleys, the River Lee and the River Mimram. The existing airport sits on a plateau between these two river valleys at an elevation of approximately 160m Above Ordnance Datum (AOD).

5.2.3 The east of the Main Application Site is located within the head of the River Mimram valley. The land here dips to the south east with elevations ranging between approximately 160m and 115m AOD.

5.2.4 The nearest watercourses are outside of the Main Application Site and are described below.

5.2.5 The River Lee is an EA designated main river, located approximately 450m to the south west of the Main Application Site. It is a major tributary of the River Thames and generally flows within an open channel in a south easterly direction. It is a groundwater fed river, although over time urbanisation has changed the characteristics of its inflow with a far higher proportion now being surface water runoff.

5.2.6 Hydraulic control structures have been installed on the River Lee in the vicinity of the southern access road to Luton Hoo Estate (not publicly accessible). These control structures were installed in the 18th Century as part of the estates landscaping designed by Capability Brown in order to create two online lakes. These lakes are still present today and are known as Luton Hoo Lakes, although they are essentially over-widened sections of the River Lee.

5.2.7 The River Mimram is an EA designated main river, located approximately 3.5km to the east of the Main Application Site. The Mimram is a chalk stream, a watercourse type with a very specific ecological and habitat response that is in decline across Southern England. It is fed by the local groundwater catchment, part of which underlays the Main Application Site.

Flood risk and surface water catchments

5.2.8 The Main Application Site is located on an elevated plateau above the River Lee and River Mimram floodplain. The Main Application Site is located within Flood Zone 1, and as such is at low risk of flooding from the River Lee and River Mimram (See **Figure 20.1** of this ES **[TR020001/APP/5.03]**).

5.2.9 The surface water catchments within the existing airport and across the Main Application Site have been identified based on the Asset Management Plan report produced by Mott McDonald (Ref 10). The drainage catchments are shown in **Figure 20.6 [TR020001/APP/5.03]**.

5.2.10 The catchment names, area in ha, nature of the catchment and receptors are described in **Table 5.1**.

Table 5.1: Existing surface water catchment and details

Catchment name	Receptor	Developed area (ha)	Undeveloped area (ha)
Existing airport			
Central soakaway (SW1) and undeveloped area (SW22)	Central soakaway, although a first flush system is in place for part of the catchment that is designed to direct the initial pulse of a rainfall event (assumed containing polluting material from the airside area) to the public foul water system which subsequently flows to East Hyde treatment works.	65.62	18.00
Airport Way (SW2)	Pipe network collecting surface water from existing terminal building, internal road and other buildings on the western side of the existing airport. First flush system in place for part of the catchment that is designed to direct first flush to public foul water system and onto East Hyde treatment works. At higher flows, surface water discharges to public surface water system which	40.9	N/A

Catchment name	Receptor	Developed area (ha)	Undeveloped area (ha)
	subsequently flows to the River Lee at Luton Hoo Lakes.		
Northern soakaway (SW3)	Pipe network collecting surface water from a section of the existing long stay and other car parking to the north of the existing airport. Discharges to the surface water drainage system which ultimate discharges to the northern soakaway. Although first flush system is provided for part of the catchment to direct potentially contaminated surface water to the public foul water drainage system.	18.68	0.7
Runway West (SW4)	Contributes to Airport Way catchment (public drainage system owned and operated by TW which ultimately flows to the River Lee).	5.33	N/A
North East Balancing Pond (SW5)	Contributes to North East Balancing Pond.	2.86	N/A
Eaton Green Road (Kerry Ingredients) (SW6)	Public surface water drainage system owned and operated by TW. Ultimately flows to the River Lee at Luton Hoo Park via a 1,500mm diameter sewer.	4.05	N/A
Eaton Green Road (GKN) (SW7)	Public drainage system owned and	5.29	N/A

Catchment name	Receptor	Developed area (ha)	Undeveloped area (ha)
	operated by TW. Ultimately flows to the River Lee at Luton Hoo Park via a 1,500mm diameter sewer.		
Frank Lester Way (SW8)	Public surface water drainage system owned and operated by TW. Ultimately flows to the River Lee at Luton Hoo Park via a 1,500mm diameter sewer.	1.55	N/A
President Way (SW9)	Direct to a small local soakaway.	0.42	N/A
Medium Stay car park (SW11)	Direct to Medium Stay Car Park soakaway.	9.76	N/A
Catchment SW12	Direct to local soakaway	1.27	N/A
Catchment SW13	Direct to foul	0.39	N/A
Catchment SW14	Direct to local soakaway	0.75	N/A
North west of existing runway (SW16)	Infiltrates in dispersed natural way (no formal structures).	0.96	12.4
South of western end of runway (SW17)	Flows in a southerly direction and infiltrates in dispersed natural way (no formal structures).	N/A	10.9
South of runway (SW18)	Flows in a southerly direction and infiltrates in dispersed natural way (no formal structures).	N/A	24.0
To the south of eastern end of runway end (SW19)	South East soakaway	N/A	5.9
Land to the east of runway (SW20)	Flows in an easterly direction and infiltrates in a	N/A	3.84

Catchment name	Receptor	Developed area (ha)	Undeveloped area (ha)
	dispersed natural way (no formal structures).		
North of eastern end of runway (SW21)	Flows in an easterly direction and infiltrates in a dispersed natural way (no formal structures).	N/A	12.76
Expansion Area			
North west of existing Wigmore Park (NW WP)	North towards existing pond off Eaton Green Road.	N/A	12.87
North east Wigmore Park (NE WP)	Flow eastwards to Mimram catchment.	N/A	39.6
Mid Wigmore Park (M WP)	Flows eastwards to Mimram catchment.	N/A	48.54
Southern rural (S WP)	Flows eastwards to Mimram catchment.	N/A	23.35

5.2.11 The EA's RoFSW mapping (see **Figure 20.1 [TR020001/APP/5.03]**) shows numerous areas of the Main Application Site potentially at risk from surface water flooding (overland flow), particularly to the east of the existing terminal building within the existing aircraft stands.

5.2.12 There are also overland flow paths along the AAR and then onto Airport Way and two flow paths within the proposed Expansion Area that indicate a significant flow of water south eastwards towards Kimpton.

5.2.13 Isolated spots of low lying land such as the existing soakaways are also identified by this data set across the Main Application Site.

Off-site Highway Interventions and Off-site Car Parks

5.2.14 The Flood Map for planning (Ref 8) indicates that none of the works associated with the Off-site Highway Interventions and Off-site Car Parks are within Flood Zones 2 and/or 3. However, it is acknowledged that the following locations are within close proximity to the River Lee:

a. Windmill Road/Manor Road;

b. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory; and

c. A1081 New Airport Way/B653/Gipsy Lane.

5.2.15 The Off-site Highway Interventions affected by surface water flooding, based on the RoFSW mapping (Ref 9) are shown in **Figure 20.1 [TR020001/APP/5.03]** and listed in **Paragraph 6.1.9**.

5.2.16 The Off-site Car Park P1 is also located within an area of elevated surface water flood risk.

5.2.17 It should also be noted that Wigmore Lane and Vauxhall Way have been identified as Critical Drainage Areas (CDA) by LBC in their SWMP (Ref 29). These are areas where the LLFA has identified a significant surface water flooding and drainage issue.

5.3 Existing water infrastructure

Main Application Site

Foul Drainage

5.3.1 Foul water at the Main Application Site is currently discharged to the public foul water network owned and operated by TW. This is via the airport's own private sewerage system operated by Veolia Water. The plan drawing of this network is available in the DDS in **Appendix 20.4** of the ES **[TR020001/APP/5.02]**.

Surface Water Drainage

5.3.2 The surface water generated by the existing airport is currently captured by a pipe network owned by the Applicant and operated by LLAOL. Parts of the network were designed with a first flush system which directs the first pulse of a rainfall event (assumed to contain the majority of any polluting matter) to the public foul sewerage system and onto East Hyde treatment works, which is operated and maintained by TW. As flows from across the existing airport increase the water is then directed towards one of the existing soakaways located on site or the public surface water drainage network operated and maintained by TW that ultimately discharges into the River Lee or to ground. Whether the water is discharged to the existing soakaways or the public surface water drainage network is dependent on the catchment.

5.3.3 The pipe network, the linkages to the public drainage systems and the existing soakaway features are described in detail in **Table 5.2** in association with the catchments identified in **Figure 20.6** of the ES **[TR020001/APP/5.03].** The plan drawing of this network is available in the DDS in **Appendix 20.4** of the ES **[TR020001/APP/5.02]**.

5.3.4 Effluent from the existing fire training ground is currently stored and tankered off site.

Table 5.2: Infrastructure associated with surface water catchments

Catchment name	Infrastructure and receptor
Central soakaway (SW1)	Pipe network collects surface water runoff from existing stands and taxi ways in the central area of the existing airport and the majority of the existing runway. Part of this pipe network is served by a first flush system. This means that surface water is directed to the public foul water drainage system and onto East Hyde treatment works until the rate of discharge causes water to overtop a spillway that allows water to flow to the existing central soakaway (infiltration basin). The idea being that the majority of contaminants are contained within the initial volume of runoff (first flush). As flow increases not only is the amount of potentially polluting matter present reduced but also the amount of dilution is far greater. This means the majority of higher flows are directed to the central soakaway.
Airport Way (SW2)	Pipe network collecting surface water from existing terminal building, internal road and other buildings on the western side of the existing airport. Part of the network is served by another first flush system that is designed to direct the first flush of a rainfall event to the public foul water system and onto East Hyde treatment works while higher flows. At higher flows the water discharges to the surface water network which ultimately discharges to the River Lee at Luton Hoo Lakes.
Northern soakaway (SW3)	Pipe network collecting surface water from a section of the existing long stay and other car parking to the north of the existing airport. Discharges to the existing northern soakaway. As with other catchments, part of the network is served by a first flush system which directs potentially contaminated surface water to the public foul water system and onto East Hyde treatment works. This means the majority of higher flows are directed to the northern soakaway.
Runway West (SW4)	Pipe network that collects the western extent of the existing runway and half of the southern edge of the runway and directs water to the public surface water sewerage system which ultimately discharges to the River Lee.
North East Balancing Pond (SW5)	Pipe network that collects the eastern extent of the existing runway and half of the southern edge of the runway and directs water to an existing balancing pond (north east balancing pond).
Eaton Green Road (GKN and Kerry Ingredients) (SW 6 and 7)	Consists of two small catchments served by pipe networks discharging to the public surface water drainage system that which ultimately discharges to the River Lee.
Frank Lester Way (SW8)	Served by pipe networks discharging to the public surface water drainage system which ultimately discharges to the River Lee.

Catchment name	Infrastructure and receptor
President Way (SW9)	Served by pipe networks discharging to the public surface water drainage system which ultimately discharges to the River Lee.
Existing Medium stay car park (SW11)	Pipe network to existing soakaway.
Catchment SW12	Direct to existing soakaway.
Catchment SW13	Direct to foul.
Catchment SW14	Direct to existing soakaway.
North west of existing runway (SW16)	No formal pipe network.
South of western end of runway (SW17)	No formal pipe network.
South of runway (SW18)	No formal pipe network.
To the south of eastern end of runway end (SW19)	No formal pipe network.
Land to the east of runway (SW20)	No formal pipe network.
North of eastern end of runway (SW21)	No formal pipe network.
Undeveloped area (SW22)	No formal pipe network.

Water Supply

5.3.5 Within the Main Application Site there is a private network of water supply assets operated by Veolia Water on behalf of LLAOL.

Off-site Highway Interventions and Off-site Car Parks

Drainage Infrastructure

5.3.6 Existing foul, combined and surface water drainage infrastructure has been identified in the vicinity of the following roads affected by the Off-site Highway Interventions and those situated within the Main Application Site:

a. Airport Way;
b. Airport Approach Road;
c. Percival Way;
d. Eaton Green Road;
e. Frank Lester Way;
f. President Way;

g. Lalleford Road;
h. Chertsey Close;
i. Layham Drive;
j. Keeble Close;
k. Nayland Close; and
l. Wigmore Lane.

5.3.7 Existing drainage infrastructure data collated does not currently cover the full extent of the Off-site Car Parks, and existing drainage infrastructure should be anticipated to be present in any location beneath the sites until further surveying confirms the existing drainage layout.

5.3.8 Further information would be obtained to inform the detailed design prior to commencement of construction of the relevant works. This information would be used to ensure that existing assets are not damaged and inform surface water drainage improvements required as a result of the Proposed Development, as required by the design principles outlined in the Design Principles [**TR020001/APP/7.09**] which is a live document through the examination process**.**

Water supply

5.3.9 Existing water supply infrastructure has been identified within the following roads, which are in proximity of the Off-site Highways Interventions locations:

a. Airport Way;
b. Vauxhall Way;
c. Eaton Green Road; and
d. Frank Lester Way.

5.3.10 All of these are less than 150mm small diameter distribution pipes.

5.3.11 Existing water supply infrastructure data collated does not currently cover the full extent of the Off-site Car Parks, and existing water supply infrastructure should be anticipated until further surveying confirms the location of water supply infrastructure or that no pipelines are present.

5.3.12 Further information would be obtained to inform the detailed design prior to the commencement of construction of the relevant works and would be used to ensure that existing assets are not damaged.

5.4 Geology and hydrogeology

Main Application Site

Geological features

5.4.1 The Main Application Site is underlain by chalk deposits, mostly by the Lewes Nodular Formation and the Seaford Chalk Formation. The existing dry valleys within the Main Application Site, as represented by the surface water flow paths,

are shown in **Figure 20.1 [TR020001/APP/5.03]**. The River Lee valley is indicated to be underlain by the Holywell Nodular Chalk Formation and the New Pit Chalk Formation.

5.4.2 The bedrock deposits are then overlain by the Clay with Flints Formation, although this is missing from the dry valleys, and the River Lee deposit. The bottom of these valleys are filled with head deposits.

5.4.3 These geological formations contain two groundwater bodies located beneath the Main Application Site; an extensive chalk bedrock aquifer and a smaller superficial aquifer associated with head deposits in the upper reaches of the River Mimram catchment.

5.4.4 The chalk is a soft white carbonate rock traversed by flint and marl layers and is designated by the EA as a 'Principal Aquifer'. A Principal Aquifer is defined as layers of rock or drift deposits that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

Hydrogeology

5.4.5 The regional groundwater flow direction within the chalk is to the south east in the dip direction of the chalk. However, the rivers described above have a marked influence on groundwater flow, with the groundwater in the River Lee catchment flowing in a westerly direction and groundwater in the River Mimram catchment flowing to the south east, although the River Mimram groundwater catchment is locally affected by potable water abstractions located near Kings Walden which results in an easterly flow of groundwater.

5.4.6 The groundwater divide between the River Lee and River Mimram groundwater catchments is located underneath the existing airport, just to the west of the existing Long Stay Car Park area.

5.4.7 As part of the design work, it has been necessary to undertake a detailed Hydrogeological Characterisation Report, provided as **Appendix 20.3** of the ES **[TR020001/APP/5.02]**. This has involved determining the local groundwater levels within the chalk aquifer under the Main Application Site from observed data, using on-site and off-site borehole data. This information has been used in combination with information extracted from the EA's groundwater model (Ref 30). This information has established maximum baseline groundwater levels of 134m AOD at the western extent of the proposed Expansion Area within the Main Application Site (in the centre of the groundwater divide) lowering to 112m AOD at the eastern extent in the dry valleys.

5.4.8 The Hydrogeological Characterisation Report provided as **Appendix 20.3** of the ES **[TR020001/APP/5.02]** also analyses the permeability characteristics of the chalk underlying the Main Application Site. Analysis within this FRA has been used to determine an appropriate permeability to use for design purposes is 2.37×10^{-5}m/s. The equates to an infiltration rate of 0.085m/hr.

Groundwater flooding

5.4.9 Groundwater flooding is caused when groundwater levels increase to such an extent that the water reaches the surface. This can be caused by changes in the groundwater regime related to increases in rainfall, reductions in groundwater abstraction and changes to flow paths. It is ultimately controlled by the interaction of rock with water bearing potential and the ground surface. Although this mechanism can activate overland flow paths in areas where the water bearing strata is not represented at the surface.

5.4.10 Information on the current status of groundwater flood risk has been obtained by reviewing the existing flood risk reports outlined in **Paragraph 1.4.1**.

5.4.11 The LBC LFRMS (Ref 13) presents groundwater flood risk by using the susceptibility to groundwater flooding data set as developed by the British Geological Survey (BGS). This data set categorises areas of land the following way:

a. Limited potential for groundwater flooding to occur (green).
b. Potential for groundwater flooding of property situated below ground level to occur (amber).
c. Potential for groundwater flooding to occur at surface (red).

5.4.12 This demonstrates that the majority of Luton Borough, including the Main Application Site has ‘Limited potential for groundwater flooding to occur’.

5.4.13 CBC’s PFRA (Ref 23) presents the susceptibility to groundwater flooding data for the Central Bedfordshire area. However, the data is presented in terms of the percentage of the land area that is susceptible to groundwater flooding, in an Ordnance Survey 1:50,000 scale map grid square. In terms of areas in the vicinity of the Main Application Site, the data identifies the River Lee corridor to the south east of the airport as having between 25% and 50% of the area susceptible to groundwater flooding with the grid square centred around New Mill End having between 50% and 75% of the area susceptible.

5.4.14 HCC’s PFRA (Ref 18) and LFRMS (Ref 16) also presents the susceptibility to groundwater flooding data in the same manner as CBC and identifies the grid square to the east of Winch Hill Road as having between 25% and 50% of the area susceptible to groundwater flooding.

5.4.15 Furthermore, the HCC PFRA (Ref 18) outlines historical cases of groundwater flooding. These were especially prevalent in the winter of 2000/2001, when groundwater levels were exceptional and peaked at record measured levels. Much of the emergence was in dry river valleys and mostly affected areas of agricultural land, although a number of roads were also affected. Measures also had to be put in place to manage the impact on two settlements in particular, Kimpton in North Hertfordshire and an area to the north east of St Albans between Sandridge and Jersey Farm.

5.4.16 The event in Kimpton is of relevance to the Proposed Development as the Main Application Site lies within the groundwater catchment of the River Mimram.

Therefore, additional information on groundwater flood risk is provided in this FRA.

5.4.17 In the winter of 2000/2001 in Kimpton, the River Kym, the line of which had been historically dry, re-emerged and followed its historical route which is thought to be along a line which now includes two of the roads in the village. The water had to be routed by various means through the village to join the River Mimram further down the valley. In an account of the event, there is a note that the river also reappeared for a short while in 1947, this instance was associated with the sudden thaw that caused extensive flooding across the country during the winter so may have been related to overland flow rather than groundwater emergence.

Off-site Highway Interventions and Off-site Car Parks

5.4.18 The majority of the Off-site Highways Interventions and Off-site Car Parks locations are underlain by the Lewes Nodular Chalk with Clay with Flints superficial deposits. However, the following locations are underlain by the deposits that characterise the River Lee Valley and the dry valleys i.e. Holywell Nodular Chalk Formation and the New Pit Chalk Formation bedrock overlain by head deposits:

a. Windmill Road/Kimpton Road;
b. A1081 New Airport Way/B653/Gipsy Lane;
c. Wigmore Lane/Crawley Green Road;
d. Eaton Green Road/Wigmore Lane;
e. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory;
f. A1081 New Airport Way/A505 Kimpton Road/Vauxhall Way;
g. Off-site Car Parks (P1 and P2); and
h. A505 Moormead Hill/B655 Pirton Rd/Upper Tilehouse Street (Located in Hitchin).

5.4.19 This places them in the same hydrogeological regime as the Main Application Site in terms of aquifer status and relative groundwater flow direction.

5.4.20 However, the geological and hydrogeological characteristics of the other two interventions located in Hitchin are outlined below:

a. A602 Park Way/A505 Upper Tilehouse Street – The bedrock at this location is the Holywell Nodular Chalk Formation and the New Pit Chalk Formation. These chalk formations are overlain by glaciofluvial deposits. The chalk formations are still part of the Principal Aquifer, while the superficial deposits are not encountered in the Main Application Site nor the offsite works. These superficial deposits are designated a Secondary A aquifer.
b. A602 Park Way/Stevenage Road – The bedrock at this location is the Gault Formation. This is comprised of mudstone units and is indicated to

be unproductive strata. This is overlain by the glaciofluvial deposits, which are part of the Secondary A aquifer.

5.4.21 Detailed analysis has not been undertaken to determine groundwater levels for the Off-site Highway Interventions due to their localised nature and minor scale. This data is not required to complete the assessment nor does its absence compromise the validity of the assessment.

6 THE SEQUENTIAL AND EXCEPTION TESTS

6.1 The sequential test

6.1.1 The sequential test aims to steer development to the areas of lowest flood risk.

Main Application Site

6.1.2 The EA's Flood Map for planning (Ref 8), shown in **Figure 20.1** of the ES **[TR020001/APP/5.03]** indicates the Main Application Site is wholly within Flood Zone 1. This demonstrates that the Main Application site is at low risk of fluvial flooding and as such is appropriate for development.

6.1.3 It is acknowledged that there are areas of potential surface water flooding across the Main Application Site, based on the RoFSW mapping data set (Ref 9) (see **Figure 20.3 [TR020001/APP/5.03]**).

6.1.4 The dataset identifies existing surface water flow paths and/or areas of existing low lying land where water accumulates in the event of a high intensity or prolonged rainfall event. It should be noted that the data set is based on a low resolution ground model and does not take account of any existing or natural drainage features that could convey water away and so is not a wholly accurate representation of how rainfall behaves once it reaches the surface. However, it does provide an indication of where surface water issues may arise.

6.1.5 The data set (Ref 9) (see **Figure 20.3 [TR020001/APP/5.03]**) identifies four main areas of flood risk across the Main Application Site:

a. an area of elevated surface water flooding along Airport Approach Road;
b. an area of elevated flood risk within the existing airport stands, associated taxiways and within the land north of the existing airport;
c. multiple surface water spots identifying discrete locations of low lying land; and
d. two significant flow paths flowing in an easterly direction.

6.1.6 In terms of the vulnerability of the Proposed Development to flooding, overall the airport is considered Essential Infrastructure as defined in **Table 2.2** and in the NPPF (Ref 1). When the individual components of the Proposed Development are considered, only the existing Terminal 1 building and proposed Terminal 2 (Terminal 2 building, aircraft stands, taxiways, buildings, facilities associated with aircraft maintenance, the Wastewater Treatment Plant (WTP), the Fuel Storage Facility and the fire training ground) would fall into this category. The Airport Access Road is identified as more vulnerable. The car parks and other elements of the Proposed Development located to the north of the Terminal 2 correspond to less vulnerable development.

6.1.7 As a result, it is considered appropriate that the elements of the Proposed Development within the Main Application Site advances to the exception test to examine the contribution of the Proposed Development to sustainable development and flood risk safety.

Off-site Highway Interventions and Off-site Car Parks

6.1.8 The EA's Flood Map for Planning (Ref 8) (see **Figure 20.1 [TR020001/APP/5.03]**) indicates that neither the proposed Off-site Highway Interventions, nor the Off-site Car Parks, are within Flood Zones 2 or 3. As such, there is no requirement to apply the sequential test, as development is deemed appropriate at all these locations. It is acknowledged that the following locations are within close proximity to the River Lee, however, this does not affect the sequential test criteria:

a. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory; and
b. A1081 New Airport Way/B653/Gipsy Lane.

6.1.9 It is also acknowledged that the following Off-site Highway Interventions are indicated to be affected by surface water flooding, based on the RoFSW mapping (Ref 9) (See **Figure 20.1 [TR020001/APP/5.03]**), however this does not affect the sequential test criteria:

a. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory;
b. A1081 New Airport Way/B653/Gipsy Lane;
c. Hitchin Road/Ramridge Road;
d. Proposed airport access road (Airport Access Road)/A1081 Airport Way /Percival Way;
e. M1 Junction 10;
f. Wigmore Lane/Crawley Green Road;
g. Eaton Green Road/Wigmore Lane;
h. Eaton Green Road/Frank Lester Way;
i. A1081 New Airport Way/A505 Kimpton Road/Vauxhall Way;
j. Eaton Green Road/Lalleford Road;
k. A505 Moormead Hill/B655 Pirton Rd/Upper Tilehouse Street; and
l. A602 Park Way/Stevenage Road.

6.1.10 As the Off-Site Highway Interventions are located within the existing highway network, it is not possible to move existing highway junctions to a lower flood risk location. In terms of flood risk vulnerability, the Off-site Highway Interventions are considered less vulnerable. Therefore, it is considered appropriate to undertake the proposed works at the locations listed above without considering the exception test. However, as these Off-site Highway Interventions are an important component of an essential infrastructure development the exception test has been considered (as outlined in **Section 6.2**).

6.1.11 There are also two off-site car parks (P1 and P2), located to the south west of the Main Application site. Neither are located in Flood Zones 2 or 3 and so are

not in a location affected by fluvial flooding. However, P1 is located within an area of elevated surface water flood risk as shown in **Figure 20.1 [TR020001/APP/5.03]**.

6.1.12 The location of P1 and P2 has been based on proximity to the Main Application Site and the fact they are currently or have previously been used for car parking. In terms of flood risk vulnerability, car parks are considered less vulnerable. Therefore, in accordance with the NPPF and ANPS, it is considered appropriate to consider placement of P1 in this location provided that surface water management ensures the car park is protected from flooding and does not increase flood risk elsewhere. The full exception test has not been considered for the Off-site Car Parks because the proposed surface water management strategy is anticipated to comprehensively mitigate flood risk to acceptably low levels.

6.2 The exception test

6.2.1 To satisfy the exception test, evidence has to be provided of how the Proposed Development would provide wider sustainability benefits to the community that outweigh the flood risk and that the Proposed Development would be safe for its lifetime.

Main Application Site

6.2.2 The Proposed Development has looked to provide a sustainable development. A key example of this is the holistic approach to water management, with measures in place to maximise the reuse of rain and wastewater, reduce consumption of potable water at the airport, and improve the treatment of surface water runoff from the airport. This would result in benefits to the groundwater environment and River Mimram and provide wider sustainability benefits.

6.2.3 The existing surface water flow paths and catchments and potential changes as a result of the Proposed Development have been taken into consideration in developing the surface water drainage design. This ensures that the existing water balance to the existing surface water receptors is maintained. In addition, the surface water management system has been designed to be able to collect and convey high volumes of surface water to safeguard against flooding of the airport facilities within the Proposed Development.

6.2.4 Further details of the proposed surface water management design are provided in the DDS provided as **Appendix 20.4** of the ES **[TR020001/APP/5.02]**.

Off-site Highway Interventions and Off-site Car Parks

6.2.5 The proposed Off-site Highway Interventions would help provide the following wider sustainability benefits, which includes taking account of flood risk:

a. Reduce impact of the Proposed Development on traffic congestion across the local road network.

b. The detailed design of these locations will be specified following submission of the application for development consent and would

incorporate measures to manage surface water drainage in accordance with the design principles outlined in the Design Principles [**TR020001/APP/7.09**] which is a live document through the examination process. This would ensure that local flood risk to existing receptors is not increased.

c. Improvements to the local surface water management provision could be included as part of the works, to alleviate existing surface water flooding issues, where technically feasible.

d. Water quality has been assessed (**Section 20.9** of **Chapter 20** of the ES **[TR020001/APP/5.01]**), and measures incorporated into the surface water management design to treat potentially polluted surface water discharges, where technically feasible.

7 FLOOD RISK ASSESSMENT

7.1.1 The assessment of flood risk has considered the potential impacts of the Proposed Development during construction and operation as outlined in **Chapter 4** of the ES **[TR020001/APP/5.01]**.

7.1.2 All potential construction related flood risk impacts are addressed by the measures described in the CoCP provided as **Appendix 4.2** of the ES **[TR020001/APP/5.02]** and therefore further assessment is not required in the FRA.

7.2 Fluvial flood risk

7.2.1 Flooding from rivers, streams and other natural inland watercourses is usually caused by prolonged or intense rainfall generating high rates of surface water runoff throughout the catchment. This overwhelms the capacity of the fluvial system as a flood flow and as a result, flood flow spills into available floodplain storage areas.

Main Application Site

7.2.2 The Main Application Site is at low risk of fluvial flooding (see **Section 4.1**). Therefore, no further assessment or engineering design for any of the assessment phases was required and the impacts of fluvial flooding on the Main Application Site is not considered further in this FRA.

Off-site Highway Interventions and Off-site Car Parks

7.2.3 The following works are in close proximity to the River Lee:

a. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory; and

b. A1081 New Airport Way/B653/Gipsy Lane

7.2.4 The works proposed in this area are limited in scope and scale and would not affect the existing channel or any existing floodplain storage. Therefore, no likely significant effects were identified, and these works are not considered any further in terms of their impact on fluvial flooding in this FRA.

7.2.5 Further engagement with the EA may be required prior to construction during the detailed design stage when further engineering information is generated and appropriate flood risk activity environmental permits would be sought if required for Work No. 6e(b) and 6e(i) (as defined in **Chapter 4** of the ES **[TR020001/APP/5.01]**) over the River Lee.

7.3 Surface water flood risk

7.3.1 Surface water or pluvial flood risk is associated with overland flow routes. This is a description for water flowing over the surface of the ground, which has yet to enter a natural drainage channel, an artificial drainage system or the natural substrate. It is the result of very intense short lived rainfall events prolonged periods of wet weather when drainage systems are at capacity or the ground is

already saturated. This can result in the inundation of low-lying areas. It is also related to sewer flooding, excessive groundwater and infrastructure failure.

Main Application Site

7.3.2 The key flood risk consideration of the Proposed Development is related to the management of surface water throughout the assessment Phases, as defined in **Chapter 5** of the ES **[TR020001/APP/5.01]**, and how this could affect the airport and adjacent areas.

7.3.3 It should also be noted that the risk of surface water flooding is increased during construction. However, the lead contractor would employ methods and procedures to mitigate flooding while works are being undertaken. These are outlined in the CoCP provided as **Appendix 4.2** of the ES **[TR020001/APP/5.02]**

Assessment Phase 1

7.3.4 At assessment Phase 1, changes to the existing drainage network are required to facilitate the construction of proposed design features. These are described and shown on plans in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**), and any resulting flood risk issues identified.

7.3.5 In its current configuration the northern section of the existing long stay car park is assumed to discharge to the northern soakaway, the rest of this car park discharges to the central soakaway. As part of assessment Phase 1, this area is to be repurposed but would remain as hardstanding. However, this area would continue to discharge to the northern soakaway. The remaining section of the long stay car park would become Car Park P5 and would continue to discharge to the central soakaway. This reduces the area contributing to the central soakaway by 64,400 m^3.

7.3.6 The majority of the area proposed for the additional aircraft stands (see DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02]** for further details and figures), located south of the existing stands, is currently part of catchment SW1 and as such discharges to the existing central soakaway. The DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) indicates that water from the proposed stands will continue to discharge to the central soakaway during general operations. Quality monitoring will be undertaken of the discharge from the stands utilised for de-icing operations, with any de-icer contaminated water diverted to a holding tank. Contaminated water would be discharged into the TW foul water main at a rate of 2l/s. It is understood that TW has agreed that their sewerage network has sufficient capacity for this additional inflow. On this basis the network has capacity to operate without increasing flood risk.

7.3.7 As outlined in the DDS and associated figures (**Appendix 20.4** of this ES **[TR020001/APP/5.02])** additional hardstanding is created by the formation of car park located to the east of the existing airport footprint and would be situated on top of the existing landfill in Wigmore Valley Park. It is proposed to discharge the surface water from this car park to the existing TW soakaway asset located outside the existing airport boundary (not the northern soakaway operated by LLAOL), to the north of the airport, which then infiltrates surface

water to the underlying aquifer and feeds the River Mimram groundwater catchment. This arrangement maintains the existing water balance and ensures no flood risk considerations are caused at assessment Phase 1 in association with the Car Park.

7.3.8 The drainage design proposals for the new aircraft stands located south of the long stay car park are to direct surface water from this area to the existing central soakaway. On the whole, this area is currently undeveloped and not served by formal drainage, therefore in its current configuration surface water falling on this area would likely infiltrate naturally to the underlying aquifer.

7.3.9 Therefore, the utilisation of the central soakaway as the receptor for surface water from this area would maintain the overall water balance as water would not be transferred from one catchment (groundwater or surface water) to another. In addition, the strategy outlined in the DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02])** reduces the overall catchment contributing to the central soakaway. This takes account of the resizing of the existing long stay car park and incorporation of the area of land proposed for the new aircraft stands south of the long stay car park. As a result, there are no flood risk considerations associated with this element of the design.

Assessment Phase 2a

7.3.10 At assessment Phase 2a the proposed surface and foul water management system would be implemented which would include a WTP and two infiltration tanks. For the preferred option, both tanks would accept untreated surface water. For the reserve option, the large tank would be used for ‘untreated’ surface water and the smaller tank for treated effluent (foul water and contaminated surface water).

7.3.11 During normal operation, surface water collected would be diverted to the large untreated infiltration tank (Tank 2). A real time water quality monitoring network would be installed and if this system identifies potentially polluting matter the surface water would be diverted to a large attenuation tank and then onto either the WTP for treatment or to the preferred Thames Water network option (where it would be treated). If discharged to the Thames Water network, active monitoring and discharge control will be implemented to ensure no discharge to the Thames Water foul network of attenuated contaminated surface water from Tank 1 during high flow conditions, i.e. when identified existing Combined Sewer Overflow’s (CSO´s) on the drainage route are in operation, to avoid changes to existing fluvial flood risk. For the reserve option, after treatment the treated water would be discharged to the smaller infiltration tank (Tank 3) as treated effluent. Details of the system and plan drawings are available in the DDS provided as **Appendix 20.4** of the ES **[TR020001/APP/5.02]**.

7.3.12 Surface water generated by the existing airport stands to the north and west of T1 (which represents the Airport Way catchment) would continue to flow to the public sewerage network, operated and maintained by TW. This ensures that there are no flood risk considerations associated with the existing Airport Way catchment as a result of the Proposed Development.

7.3.13 In terms of flood risk the key changes implemented by the proposed drainage strategy are:

a. Following the construction of the WTP and the infiltration tanks, the existing surface water catchments that currently discharge to the existing central soakaway (i.e. SW1 and SW22) would be diverted to the new untreated infiltration tank (or when contaminants are detected, to a storage tank prior to the WTP and once treated to the smaller treated effluent infiltration tank).

b. Surface water generated by the hardstanding associated with Terminal 2 and Car Park P6 to the north of the terminal building would be directed to the 'untreated infiltration' tank. Surface water generated by the area proposed for Terminal 2 currently discharges to the existing northern soakaway. The area proposed for Car Park P6, above the landfill in Wigmore Park, currently drains to the north east and so contributes to the River Mimram catchment (ground and surface water).

c. Surface water generated by the proposed aircraft stands to the south of Terminal 2 and the new taxiways would also be collected and sent to the new infiltration tank (or when contaminants are detected, to a storage tank prior to the WTP and once treated to the smaller treated effluent infiltration tank). As outlined for assessment Phase 1, the majority of this area is currently undeveloped and not served by formal drainage, therefore in its current configuration surface water falling on this area would likely infiltrate naturally to the underlying aquifer within the Mimram groundwater catchment.

d. Surface water generated by Car Parks P7 and P8 would also be directed to the untreated infiltration tank, however, these areas would be connected to the water quality monitoring system and so surface water would be directed to a storage tank prior to the WTP and subsequently (once treated) to the smaller infiltration tank during times when contaminants are detected. This area is currently undeveloped and so currently surface water would infiltrate naturally to the underlying aquifer within the Mimram groundwater catchment.

e. The south west end of the existing runway (SW4) currently discharges to the public surface water sewerage system operated and maintained by TW and then discharges towards the off-site sewer system in New Airport Way. Surface water generated by this area would be directed to the WTP and onto the smaller infiltration tank at times when the water quality monitoring system identifies contaminants at trigger levels. If contaminants are not detected, surface water would continue to discharge to Airport Way and onto the public surface water sewerage system operated and maintained by TW.

7.3.14 The strategy for the Main Application Site replaces the central soakaway with the two infiltration tanks located further to the east (the large untreated tank, Tank 2, and the smaller infiltration tank for either treated effluent or clean water, Tank 3). The strategy also reduces surface water inputs to the northern

soakaway by directing the water from the location of Terminal 2 to the untreated tank.

7.3.15 As both the proposed infiltration tanks, and the existing soakaways, are all located within the Mimram groundwater catchment, and a portion of rainfall will be captured for reuse, the proposals are not significantly changing the overall surface or groundwater catchment balance. Therefore, there are no off-site surface water flood risk considerations as a result of the assessment Phase 2a proposals and so no flood risk impacts or effects have been identified in this assessment phase.

7.3.16 The proposed drainage strategy outlined in the DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02]** has been designed so that the infrastructure provided is able to collect and convey the 1% AEP rainfall event, with a 40% uplift in rainfall intensity to account for predicted changes in rainfall pattern caused by climate change, from each area of hardstanding to the infiltration tanks (this event is referred to as the 1% AEP + Climate Change (CC) in all other instances in this FRA). This would prevent uncontrolled flows of surface water across the Proposed Development within the Main Application Site and would protect the more vulnerable facilities from inundation. This would ensure that there would not be any surface water flood risk impacts or effects in the Main Application Site as a result of the Proposed Development.

7.3.17 The proposed water quality monitoring system would divert surface water to a large storage tank located adjacent to the WTP. This would occur when concentrations of specific pollutants exceed trigger levels. The water in the tank would then be gradually released to the WTP and the treated effluent would flow to the smaller treated effluent infiltration tank. The storage available has been sized based on a 1% AEP + CC with a two-hour duration. This provides the airport with a high degree of resilience against inundation, even when polluting matter is detected and requires treatment. This seeks to ensure that there would not be any surface water flooding impacts and effects even when the treatment of surface water quality is considered.

7.3.18 The addition of surface water catchment SW4 to the proposed WTP and onto the treated effluent infiltration tank has the potential to transfer surface water from a surface water catchment to a groundwater catchment. However, as this transfer would only occur during contamination events, the frequency and duration of these changes is not considered to represent a flood risk consideration that requires further assessment or mitigation.

7.3.19 A potential groundwater flood risk consideration has been identified resulting from these proposals due to local groundwater mounding within the untreated infiltration basin and the potential impact to the areas local to the infiltration basin and downstream receptors. This is discussed further in **Section 7.5**.

Assessment Phase 2b

7.3.20 The changes from assessment Phase 2a to Phase 2b involve an increase in the scale of development in the Expansion Area. This involves additional aircraft stands, additional car parking and the reconfiguration of the area north of Terminal 2 to incorporate Green Horizons Park (not part of the Proposed

Development) and Car Park P6. All these changes increase the area contributing surface water to the untreated infiltration tank (or alternatively the Thames Water network or the WTP and the smaller treated effluent infiltration tank during times when contaminants are detected).

7.3.21 As outlined for assessment Phase 2a, the proposed infiltration tanks are all located within the same catchment (Mimram groundwater catchment). In addition, the proposed on-site drainage infrastructure is able to collect and convey the 1% AEP + CC, from each area of hardstanding to the infiltration tanks. This would prevent uncontrolled flows of surface water across the airport and would protect the more vulnerable facilities from inundation. This design also provides a high degree of resilience against inundation, even when polluting matter is detected and requires treatment. This seeks to ensure that there would not be any surface water flood risk impacts or effects.

7.3.22 The potential impacts on the groundwater regime, as with assessment Phase 2a, are explored in **Section 7.5**.

Off-site Highway Interventions and Off-site Car Parks

7.3.23 Drainage strategies for the Off-site Highway Interventions and Off-site Car Parks are to be further developed in advance of construction where additional hardstanding is required to ensure appropriate management of surface water flood risk.

7.3.24 The drainage strategies would be developed in accordance with contemporary standards of sustainable drainage design to ensure no increase in surface water runoff up to the for the 1% AEP + CC storm event, as required by the design principles captured in the Design Principles [**TR020001/APP/7.09**] which is a live document through the examination process. In addition, existing surface water flooding issues would also be taken into consideration. This would be undertaken in consultation with the LLFA and ES.

7.3.25 The RoFSW data set has identified that the following locations have existing surface water flooding issues and would be of specific relevance to Off-site Highway Interventions along Wigmore Lane and Vauxhall Way, which are CDA locations as identified by LBC in their SWMP. The existing flood risk issues at these locations may require the additional of specific drainage management measures into the drainage strategies for the relevant Off-site Highway Interventions:

a. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory;
b. Hitchin Road/Ramridge Road;
c. A1081 New Airport Way/B653/Gipsy Lane;
d. Proposed airport access road (Airport Access Road)/A1081 Airport Way /Percival Way;
e. M1 Junction 10;
f. Wigmore Lane/Crawley Green Road;

g. Eaton Green Road/Wigmore Lane;
h. Eaton Green Road/Frank Lester Way;
i. A1081 New Airport Way/A505 Kimpton Road/Vauxhall Way;
j. Eaton Green Road/Lalleford Road;
k. A505 Moormead Hill/B655 Pirton Rd/Upper Tilehouse Street; and
l. A602 Park Way/Stevenage Road.

7.4 Infrastructure failure

7.4.1 Flooding can occur as a result of failure of infrastructure design to retain or transmit water. Retaining features can include formal features such as dams or flood defences but can also include features such as embankments, which in some locations can hold back flood waters. Flooding can also occur in the event of water supply and sewerage infrastructure failure.

Main Application Site

7.4.2 In the event of a mains water supply or drainage infrastructure failure on the Main Application Site, water emerging from a damaged pipe or sewer will generally reflect the flow paths and areas of accumulation identified in the RoFSW data set, as shown on **Figure 20.3 [TR020001/APP/5.03].**

7.4.3 In the event of failure of the existing on-site sewerage or water supply networks the RoFSW data set indicates that water may accumulate around Terminal 1. The risk of failure and the impact of failure caused by this source of flooding is not changed by the Proposed Development.

7.4.4 The RoSWF data set also indicates that in the event of failure of existing airport water supply or sewerage infrastructure, water may flow east and naturally accumulate in the Expansion Area of the Proposed Development. At assessment Phase 1 this would affect the adjacent agricultural field, in assessment Phase 2 this would affect the construction area that would later become the Car Park P7, the WTP, the infiltration tank, the fuel storage facility and other ancillary services. The WTP and the fuel storage facility are considered essential infrastructure that could be disrupted by flooding. Therefore, the proposed drainage infrastructure in this area has to consider this type of asset failure and would be constructed to safeguard the operability of essential infrastructure up to and including the design standard (1% AEP +CC). Therefore, there are no residual flood risk considerations associated with this source of flooding during operation.

7.4.5 It should be noted that the risk of failure is increased during construction. The lead contractor would employ methods and procedures to safe guard the integrity of buried and other utility assets and would also have procedures in place to mitigate flooding in the event of a failure while works are being undertaken. These are outlined in the CoCP provided as **Appendix 4.2** of the ES **[TR020001/APP/5.02]**.

7.4.6 Exceedance events may also result in localised flooding downstream (to the east) of the central soakaway basin and related embankment, which is not

reflected on the RoSWF data set. Flooding of the central soakaway and overtopping of/and or failure or the related embankment is not considered to result in additional flood risk to the existing airport, but would be a risk to the construction works downgradient to the east. This risk could be increased if the integrity of the embankment is compromised by construction works.

7.4.7 To mitigate the risks from flooding of the central soakaway, the lead contractor is to employ methods and procedures to safe guard the construction works and workers from a flood event. These are outlined in the CoCP provided as **Appendix 4.2** of the ES **[TR020001/APP/5.02]**.

Off-site Highway Interventions and Off-site Car Parks

7.4.8 In the event of main water supply or sewer failure in proximity to the proposed Off-site Highway Interventions and/or Off-site Car Parks, water emerging from a damaged pipe or sewer will generally reflect the flow paths and areas of accumulation identified in the RoFSW data set. This means the flow and accumulation of water is most likely to be experienced at the following locations:

a. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory;
b. Hitchin Road/Ramridge Road;
c. A1081 New Airport Way/B653/Gipsy Lane;
d. Proposed airport access road (Airport Access Road)/A1081 Airport Way /Percival Way;
e. M1 Junction 10;
f. Wigmore Lane/Crawley Green Road;
g. Eaton Green Road/Wigmore Lane;
h. Eaton Green Road/Frank Lester Way;
i. A1081 New Airport Way/A505 Kimpton Road/Vauxhall Way;
j. Eaton Green Road/Lalleford Road;
k. A505 Moormead Hill/B655 Pirton Rd/Upper Tilehouse Street; and
l. A602 Park Way/Stevenage Road.

7.4.9 In accordance with the design principles identified within the Design Principles [**TR020001/APP/7.09**] which is a live document through the examination process, this would also be taken into consideration during the detailed design stage after DCO is granted and prior to construction at these locations to ensure that surface water drainage provision takes this source of flooding and potential for failure into account.

7.5 Groundwater flood risk

Main Application Site

Assessment Phase 1

7.5.1 There are no groundwater flood risk impacts or effects caused by assessment Phase 1 of the Proposed Development.

Assessment Phase 2a and 2b

7.5.2 The proposed drainage strategy (DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02])** for assessment Phases 2a and 2b diverts surface water from a large area of land to the untreated infiltration tank (assuming contaminated material is not detected by the proposed water quality monitoring system) and so diverts a large volume and rate of water to a new infiltration tank. The tank has been designed to be able to store up to 75,000m^3, with the maximum discharge rate reaching the infiltration tank calculated for the 1% AEP + CC condition. This has been calculated using the IH124 method for small catchments (Ref 31) and assumes a combined total for all the catchments contributing to the untreated infiltration basin, which represents a reasonable worst case assumption.

7.5.3 Groundwater analysis and modelling has been undertaken (see the Hydrogeological Characterisation Report provided in **Appendix 20.3** of the ES **[TR020001/APP/5.02]**) to determine the local impact of groundwater mounding at the two proposed new infiltration tanks.

7.5.4 This indicates that groundwater mounding would occur but overtopping of the tank would only occur during extreme rainfall conditions that lasted more than half a day. This is considered to give the Main Application Site a high level of resilience against extreme rainfall during extreme groundwater conditions. This analysis does not take account of any of the on-site storage such as the pipe network and the attenuation tanks, which increases the resilience of the system.

7.5.5 Overtopping of the attenuation tank would potentially cause overland flow to be generated and localised pooling in the agricultural field downstream of potentially in excess of 50mm. However, this is considered a very low risk event, outside the normal design event parameters and as such would not be reported in terms of an impact and effect but is presented as a demonstration of the resilience of the system being proposed.

7.5.6 Another groundwater risk that has been considered is the dispersal of the groundwater mound, generated during this scenario, and its impact downstream.

7.5.7 Assuming the dispersal of the groundwater mound downgradient is gradual and reflective of the calculated permeabilities (see the Hydrogeological Characterisation Report provided in **Appendix 20.3** of the ES **[TR020001/APP/5.02]**), the risk of the mound being responsible for elevating groundwater levels in locations such as Kimpton is considered very low. This is

based on the time it would take for the water to reach the downstream location, with the chalk attenuating the groundwater flow downstream.

7.5.8 However, the risk of the Main Application Site affecting conditions at Kimpton could increase if there is an accelerated dispersal rate. This could occur if a fracture flow pathway becomes active. There is no indication that this pathway exists at the Main Application Site, based on the historical groundwater levels monitored around the area in response to peak groundwater levels at the airport.

Off-site Highway Interventions and Off-site Car Parks

7.5.9 No groundwater flood risk issues have been identified with any of the Off-site Highway Interventions or Off-site Car Parks.

8 SUMMARY AND CONCLUSIONS

8.1.1 This FRA has assessed flood risk from all sources of flooding (fluvial; surface water; infrastructure; groundwater) for the Main Application Site, the Off-site Highway Interventions, and the Off-site Car Parks across all assessment phases of the Proposed Development.

8.1.2 This has determined that the Main Application Site is not affected by fluvial flooding.

8.1.3 Detailed assessment of the Off-site Highway Interventions and Off-site Car Parks is not required in terms of fluvial flood risk, although the intervention at Windmill Road/St Mary's Road/Crawley Green Road Gyratory is located in close proximity to the River Lee and so this would be considered at the construction stage in accordance with the CoCP (**Appendix 4.2** of the ES **[TR020001/APP/5.02]**) in terms of flood risk activity environmental permitting.

8.1.4 There are no surface water (pluvial) flooding considerations for the works, at any assessment phase, within the Main Application Site. This is because there are no cross catchment transfers of surface water and the proposed drainage strategy (DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02]**), designed to accommodate the 1% AEP + CC storm event, would safeguard existing and proposed buildings and infrastructure.

8.1.5 A surface water management strategy has been designed for the proposed AAR that is able to accommodate a 1 in a 100-year return period storm event plus a 40% uplift for climate change, as outlined in the DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02].**

8.1.6 Surface water management strategies (surface and foul water drainage plans) for the other Off-site Highway Interventions and Off site Car Parks would be developed at detailed design in accordance with the design principles outlined in the Design Principles [**TR020001/APP/7.09**] which is a live document through the examination process**.**

8.1.7 The drainage strategies to be undertaken in detailed design for the Off-site Highway Interventions and Off-site Car Parks would be developed in accordance with contemporary standards of sustainable drainage design to ensure no increase in surface water runoff for a 1% AEP + CC storm event. In addition, existing surface water flooding issues and failure potential would also be taken into consideration. This would be undertaken in consultation with the relevant local authority, taking account of existing surface water flooding issues. The implementation of the above measures for the AAR and Off-site works would safeguard existing and proposed buildings and infrastructure.

8.1.8 The impact of failure of existing infrastructure for the Main Application Site has been considered. The design principals outlined in the proposed DDS in **Appendix 20.4** of the ES **[TR20001/APP/5.02]**, provide a resilient system that takes account of infrastructure failure.

8.1.9 The proposed drainage strategy (DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02]**) for assessment Phases 2a and 2b diverts a large

volume and rate of surface water to a proposed untreated infiltration tank. Groundwater analysis has been undertaken to determine the local impact of groundwater mounding (see the Hydrogeological Characterisation report provided in **Appendix 20.3** of the ES **[TR020001/APP/5.02]**).

8.1.10 This indicates that groundwater mounding would occur but overtopping of the tank would only occur after more than half a day of extreme rainfall conditions. This is considered to give the airport a high level of resilience against extreme rainfall during extreme groundwater conditions.

8.1.11 Assuming the dispersal of the groundwater mound downgradient is gradual and reflective of the calculated permeabilities (as supported by the mounding assessment and baseline monitoring of groundwater levels), the risk of the mound being responsible for elevating groundwater levels in locations such as Kimpton is considered very low. This is based on the time it would take for the water to reach the downstream location, with the chalk attenuating the groundwater flow downstream.

8.1.12 Overall, this assessment concludes that with the implementation of mitigation outlined in this FRA, the CoCP (**Appendix 4.2** of the ES **[TR020001/APP/5.02]**) and DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02])** there would be no significant impacts on flood risk to the Proposed Development at any part of the Application Site in any of the three assessment phases. The assessment in **Section 7** also demonstrates no impacts on flood risk to third party land as a result of the Proposed Development.

GLOSSARY AND ABBREVIATIONS

Term	Definition
AAR	Airport Access Road
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
AWB	Artificial Water Bodies
BGS	British Geological Society
CBC	Central Bedfordshire Council
central soakaway	Existing infiltration drainage feature located within the Main Application site
CoCP	Code of Construction Practice
CSO	Combined Sewer Overflow
DBC	Dacorum Borough Council
DCO	Development Consent Order
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
ES	Environmental Statement
EU	European Union
Expansion Area	The area of Proposed Development to the east of the existing airport within the Main Application Site where works are proposed to take place.
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act
HCC	Hertfordshire County Council
HEWRAT	Highways England Water Risk Assessment Tool
HWMB	Heavily Modified Water Bodies
LBC	Luton Borough Council
Luton Rising	A trading name for London Luton Airport Limited
LLAOL	London Luton Airport Operation Limited
LLFA	Lead Local Flood Authority
NHDC	North Hertfordshire District Council
northern soakaway	Existing infiltration drainage feature located within the Main Application site
NPPF	National Planning Policy Framework
PEIR	Preliminary Environmental Information Report
PFRA	Preliminary Flood Risk Assessment

Term	Definition
RBD	River Basin District
RBMP	River Basin Management Plan
ROFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
STW	Sewage Treatment Works
SuDS	Sustainable Urban Drainage Systems
SWMP	Surface Water Management Plan
WFD	Water Framework Directive
WTP	Water Treatment Plant

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