12. Surface Water and Flood Risk

12.1 Introduction

12.1.1 This chapter of the Environmental Statement (ES) assesses the likely significant effects of the Proposed Development with reference to Surface Water And Flood Risk. The chapter should be read in conjunction with **Chapter 2: Description of the Proposed Development** and with reference to relevant parts of other chapters (**Chapter 11: Biodiversity** and **Chapter 13: Groundwater**) where common receptors have been considered and where there is an overlap or relationship between the assessment of effects.

12.1.2 In addition to the 196 hectares (ha) of the operational airport site owned by Bristol Airport Limited (BAL), an additional corridor of land along the A38 to the north-east of the airport is included within the application site. This is associated with proposed improvements to the A38 between Bristol Airport's northern access roundabout, Downside Road and West Lane. Where necessary to describe baseline, potential effects and mitigations, the A38 highway improvement area and the remainder of the application site will be differentiated.

12.1.3 This chapter is supported by a separate Flood Risk Assessment (FRA) (refer to **Appendix 12A**), which includes details of both the Bristol Airport's site Drainage Strategy and the A38 highway improvements Drainage Strategy.

12.2 Limitations of this assessment

12.2.1 No limitations have been identified that affect the robustness of the assessment of the likely significant effects of the Proposed Development with respect to Surface Water and Flood Risk.

12.3 Relevant legislation, planning policy and technical guidance

Legislative context

12.3.1 The following legislation is relevant to the assessment of the effects on Surface Water and Flood Risk receptors:

- The European Union (EU) *Water Framework Directive (WFD)*[1]: focuses on delivering an integrated approach to the protection and sustainable use of the water environment on a river basin scale;
- *Environmental Permitting (England and Wales) Regulations 2016 (Statutory Instrument (SI) 2016 No. 1154)*[2], as amended: of relevance to surface water and drainage design due to infiltration to ground. The regulations include requirements for the prevention of hazardous substances entering groundwater and the control of non-hazardous pollutants to avoid pollution of groundwater;

[1] The Water Framework Directive (Standards and Classification) Directions (England and Wales) (2015), [online]. Available at: http://www.legislation.gov.uk/uksi/2015/1623/pdfs/uksiod_20151623_en_auto.pdf [Checked 01/08/2018].
[2] The Environmental Permitting (England and Wales) Regulations 2016 together with subsequent amendments, [online]. Available at: https://www.legislation.gov.uk/uksi/2016/1154/pdfs/uksi_20161154_en.pdf [Checked 01/08/2018].

- *The Water Resources Act 1991*[3]: states that it is an offence to cause or knowingly permit polluting, noxious, poisonous or any solid waste matter to enter controlled waters. The Act was revised by the *Water Act (2003)*[4], which sets out regulatory controls for water abstraction, discharge to water bodies, water impoundment and protection of water resources;
- *The Land Drainage Act 1991*[5] and *1994*[6]: places responsibility for maintaining flows in watercourses on landowners and gives Local Authorities powers to serve a notice on landowners to ensure works are carried out to maintain flow of watercourses;
- *The Flood Risk Regulations*[7]: published in December 2009, these transpose the EU Floods Directive into UK law;
- *The Flood and Water Management Act, 2010*[8]: sets out the Government's proposals to improve flood risk management (building on the 2009 regulations), and also covers approaches to water quality and to ensure water supplies are more secure. The act also provided for the formation of Lead Local Flood Authorities (LLFAs) and aims to create a simpler and more effective means of managing the risk of flood and coastal erosion; and
- *The Town and Country Planning (Environmental Impact Assessment Regulations) 2017*:[9] outlines the Environmental Impact Assessment (EIA) process (hereafter referred to as the "EIA Regulations").

Planning policy context

12.3.2 There are a number of policies and guidance documents at the national and local level that are relevant to the surface water environment and FRA. In addition to policy referenced in **Chapter 5: Legislative and policy overview**, policy directly applicable to Surface Water and Flood Risk is listed in **Table 12.1**.

Table 12.1 Relevant policies relevant to Surface Water And Flood Risk

Policy reference	Implications
National Planning Policy Framework (NPPF) 2018[10]	
Paragraph 149	Requires that plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, water supply, biodiversity and landscapes.
Paragraphs 155-163	Provides the basis for the consideration of flood risk in determining planning applications and requires that development proposals ensure that flood risk is not increased elsewhere. This includes requiring development proposals in areas at risk of flooding to be accompanied by a flood risk assessment. These requirements will help form a framework for assessing the potential impacts.

[3] Water Resources Act 1991, [online]. Available at: https://www.legislation.gov.uk/ukpga/1991/57/contents [Checked 01/08/2018].
[4] Water Act 2003, [online]. Available at: https://www.legislation.gov.uk/ukpga/2003/37/contents [Checked 19/07/2018].
[5] Land Drainage Act 1991, [online]. Available at: https://www.legislation.gov.uk/ukpga/1991/59/contents [Checked 01/08/2018].
[6] Land Drainage Act 1994, [online]. Available at: https://www.legislation.gov.uk/ukpga/1994/25/contents [Checked 17/07/2018].
[7] The Flood Risk Regulations (2009). [online]. Available at: http://www.legislation.gov.uk/uksi/2009/3042/contents/made [Checked 01/08/2018].
[8] The Flood and Water Management Act 2010, [online]. Available at: https://www.legislation.gov.uk/ukpga/2010/29/contents [Checked 13/08/2018].
[9] The Town and Country Planning (Environment Impact Assessment) Regulations 2017, [online]. Available at: http://www.legislation.gov.uk/uksi/2017/571/pdfs/uksi_20170571_en.pdf [Checked 17/07/2018].
[10] Ministry of Housing, Communities and Local Government (2018). National Planning Policy Framework, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733637/National_Planning_Policy_Framework_web_accessible_version.pdf [Checked 01/08/2018].

Policy reference	Implications
Paragraph 165	Requires that major developments should incorporate sustainable drainage systems (SuDS) unless there is clear evidence that this would be inappropriate. These should take account of advice from the lead local flood authority, have proposed minimum operational standards and maintenance arrangements in place for the lifetime of the development and provide multifunctional benefits.
Paragraph 170	Requires development proposals to minimise impacts on and provide net gains in biodiversity. Proposals must prevent new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible help to improve local environmental conditions such as water quality, taking into account relevant information such as river basin management plans.
Paragraph 175	Identifies that when determining planning applications, local planning authorities should aim to conserve and enhance biodiversity, and where significant harm resulting from a development cannot be avoided, adequately mitigated, or as a last resort, compensated for, then planning permission should be refused.
National Planning Practice Guidance **(NPPG 2016)**[11] (Guidance documents have a range of published dates)	
Climate change (2014)	Sets the need to consider the potential vulnerability of a development to climate change risk over its whole lifetime, with the guidance to build in flexibility to allow future adaptation if it is needed.
Flood risk and coastal change (2014)	Sets out guidance regarding the need to assess, avoid, mitigate and manage flood risk. The guidance is that flood risk should be assessed through information contained in Strategic FRAs and through the undertaking of site-specific FRAs. Flood risk is to be avoided through applying a sequential approach to site selection which ensures that the development is as far is as reasonably possible, located where the risk of flooding from all sources is lowest. Flood risk is to be managed and mitigated in situations where development is in locations at risk of flooding and no alternative is available. Management and mitigation will occur through local planning authorities ensuring that development is appropriately flood resilient and resistant, safe for its users for the development's lifetime and will not increase flood risk overall. The guidance also states that local planning authorities and developers should seek flood risk management opportunities and reduce the causes and impact of flooding, for example through the use of sustainable urban drainage systems.
Natural Environment (2016)	Provides guidance on how biodiversity should be taken into account, protected, compensated and enhanced and how green infrastructure can be incorporated into developments.
Water supply, wastewater and water quality (2015)	Provides guidance on where water infrastructure considerations are to be taken into account in planning applications and how impacts on water quality should be assessed.
Flood risk assessments: climate change allowances (2017)	Current guidance on climate change allowances to use with regards to the peak river flow, peak rainfall intensity, and sea level rise. For peak river flow (by river basin district) and peak rainfall intensity (for all of England), three epochs are set out, 2015 to 2039, 2040 to 2069 and 2070 to 2115. Within each epoch the guidance details three allowances to anticipate for the total potential anticipated changes, these are for the Upper End, Higher Central and Central categories.
North Somerset Council Core Strategy January 2017[12]	
CS1 - Addressing climate change and carbon reduction	Indicates the need for developments to demonstrate water resource efficiency to reduce demand via efficient appliances or processes and the use of rainwater recycling.
CS2 - Delivering sustainable design and construction	Requires the application of best practice to incorporate SuDS to manage runoff from new development. These should be integrated in designs and be easily maintained.
CS3 - Environmental impacts and flood risk assessment	Requires potential adverse effects to be mitigated by control measures and mitigations - these may require planning conditions or obligations. A range of guidance is given on flood risk, however this focuses on potential development in Flood Zones 2 and 3.
CS4 - Nature conservation	Requires developments to maintain and enhance the biodiversity of North Somerset through incorporating, safeguarding and enhancing natural habitats and adding to them.

[11] Ministry of Housing, Communities and Local Government (2016). National Planning Practice Guidance, [online]. Available at: https://www.gov.uk/government/collections/planning-practice-guidance [Checked 27/07/18].
[12] North Somerset Council (2017). Core Strategy, [online]. Available at: https://www.n-somerset.gov.uk/wp-content/uploads/2015/11/Core-Strategy-adopted-version.pdf [Checked 16/04/18].

Policy reference	Implications
North Somerset Council Development Management Policies Sites and Policies Plan Part 1[13]	
DM1 – Flooding and drainage	Aims to discourage inappropriate development in flood risk areas and ensure that the impact of new development on flooding is fully taken into account. The vulnerability to flooding of a development must take into account all sources of flood risk and the impact of climate change. SuDS are expected for all major developments and open areas, including highways. Drainage systems must be designed to optimise drainage and reduce runoff, while protecting groundwater and surface water resources and quality.
North Somerset Strategic Flood Risk Assessment[14] ***(SFRA)***	
	Provides a baseline understanding of flood risk across North Somerset, before focussing on the level of current and future flood risk to potential future residential development areas across North Somerset. Winford to the east is highlighted as a settlement at risk from fluvial flooding. The document provides limited information relevant to Bristol Airport. SFRA Figure 3.2 highlights several historic surface water flood events along the A38 at Lulsgate Bottom, and along Downside Road.
The 2011 North Somerset Preliminary Flood Risk Assessment[15] ***(PFRA)***	
	Provides a baseline and 'with future climate change' understanding of flood risk from 'local' sources of flood risk (i.e. Ordinary Watercourses, surface water, groundwater) for which North Somerset Council (NSC) is responsible for managing (as the LLFA). The study assesses flood risk from these sources to all types of development across North Somerset. Winford is highlighted as a settlement at risk from surface water flooding. The document provides limited information relevant to the application site itself.
The 2015 North Somerset Local Flood Risk Management Strategy[16] ***(LFRMS)***	
	Builds on the PFRA to identify actions for key flooding hotspots where NSC as LLFA has responsibility. The study assesses flood risk management action required to alleviate flooding in the fifteen settlements judged to be most at risk of flooding. Claverham, situated immediately to the west of Brockley Combe is one of these, where flood risk is associated with surface water runoff from the hills east of Claverham, and groundwater emergence. The document does not cover the application site itself.

Technical guidance

12.3.3 A summary of technical guidance relevant to the Surface Water and Flood Risk assessment is given in **Table 12.2**.

[13] North Somerset Council (July 2016). Development Management Policies Sites and Policies Plan Part 1, [online]. Available at: http://www.n-somerset.gov.uk/wp-content/uploads/2015/11/Sites-and-Policies-Plan-Part-1-Development-Management-Policies-July-2016.pdf [Checked 07/08/18].

[14] North Somerset Council (2008). Strategic Flood Risk Assessment, [online]. Available at: https://www.n-somerset.gov.uk/my-services/planning-building-control/planningpolicy/supplementary-planning-advice/guidance/strategic-flood-risk-assessment/ [Checked 19/03/18].

[15] North Somerset Council (2011). Preliminary Flood Risk Assessment, [online]. Available at: https://www.n-somerset.gov.uk/wp-content/uploads/2017/04/North-Somerset-preliminary-flood-risk-assessment-report-2011.pdf [Checked 19/03/18].

[16] North Somerset Council (2011). Local Flood Risk Management Strategy, [online]. Available at: https://www.n-somerset.gov.uk/wp-content/uploads/2015/11/local-flood-risk-management-strategy.pdf [Checked 19/03/18].

Table 12.2 Technical guidance relevant to Surface Water And Flood Risk

Technical guidance	Relevance to this assessment
CIRIA (2001) C532: Control of water pollution from construction sites[17]	The guidance provides practical help for consultants and contractors on how to plan and manage construction projects to control water pollution.
CIRIA (2004) C624: Development and flood risk - guidance for the construction industry[18]	The document provides guidance on good practice in the assessment and management of flood risk as part of the development process.
CIRIA (2010) C688: Flood Resilience and resistance for critical infrastructure[19]	This document provides an overview of the regulatory framework for flood resilience and resistance in critical infrastructure and outlines the main issues now faced by organisations managing this infrastructure.
CIRIA (2006) C635: Designing for exceedance in urban drainage - good practice[20]	The guidance provides good practice advice to drainage engineers, regulators, planners and the construction industry on the design and management of urban sewerage and drainage systems to reduce the impacts from drainage exceedance.
CIRIA (2015) C741: Environmental good practice on site[21]	The guide is intended to be a reference and training aid which provides practical advice about managing construction on site to minimise environmental impacts.
CIRIA (2015) C753: The SuDS Manual[22]	The manual covers the planning, design, construction and maintenance of SuDS to assist with their effective implementation within both new and existing developments. Guidance is given on how to maximise amenity and biodiversity benefits while delivering the key objectives of managing flood risk and water quality.
Defra (2015) ***Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems***[23]	The document sets out non-statutory technical standards for sustainable drainage systems. It is intended to be used in conjunction with the NPPF and NPPG.
West of England Partnership (2015) ***West of England Sustainable Drainage Developer Guide***[24]	The guide signposts to existing policy and guidance to support the delivery of a sustainable approach to the drainage of new development in the West of England.

[17] CIRIA (2001). C532: Control of water pollution from construction sites, [online]. Available at: http://www.ciria.org/ProductExcerpts/C532.aspx [Checked 28/08/18].
[18] CIRIA (2004). C624: Development and flood risk – guidance for the construction industry, [online]. Available at: https://www.ciria.org/ItemDetail?iProductCode=C624 [Checked 28/08/18].
[19] CIRIA (2010). C688: Flood Resilience and resistance for critical infrastructure, [online]. Available at: https://www.ciria.org/Resources/Free_publications/Flood_resilience.aspx [Checked 28/08/18].
[20] CIRIA (2006). C635: Designing for exceedance in urban drainage - good practice, [online]. Available at: https://www.ciria.org/Resources/Free_publications/Designing_exceedance_drainage.aspx [Checked 28/08/18].
[21] CIRIA (2015). C741: Environmental good practice on site, [online]. Available at: https://www.ciria.org/ItemDetail?iProductCode=C741D [Checked 28/08/18].
[22] CIRIA (2015). C753: The SuDS Manual, [online]. Available at: https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx [Checked 28/08/18].
[23] Defra (2015). Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems, [online]. Available at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards [Checked 19/03/18].
[24] West of England Partnership (2015). West of England Sustainable Drainage Developer Guide, [online]. Available at: https://www.bristol.gov.uk/documents/20182/34524/West+of+England+sustainable+drainage+developer+guide+section+1/864fe0d2-45bf-4240-95e2-a9d1962a0df9 [Checked 18/07/18].

Technical guidance	Relevance to this assessment
(WRc) (2012) *Sewers for Adoption - A Design & Construction Guide for Developers: 7th Edition*[25]	The guidance is intended for use by developers when planning, designing and constructing conventional foul and surface water gravity sewers and lateral drains for developments.

12.4 Data gathering methodology

Study area

12.4.1 **Figure 12.1** shows the situation of the application site.

12.4.2 The study area for the Proposed Development for Surface Water and Flood Risk has been taken to be the hydrological 'Zone of Influence' (ZoI).

12.4.3 The hydrological ZoI has been defined as the WFD water body units in which the application site is situated (refer to **Figure 12.2** and **Figure 12.3**). This is on the basis that there are direct pathways from the application site into these catchments. The water body units provide a thorough definition of the potential ZoI linking sources within the development area, via flow pathways to potential receptors situated downstream and off-site.

12.4.4 As the application site is situated on a plateau and straddles the watershed, there are three relevant catchments:

- Winford Brook (source to confluence with the River Chew) - Water body (WB) ID: GB109053021900;
- Kenn (source to Kenn Moor SSSI) - WB ID: GB109052021670; and
- Kenn Moor SSSI - WB ID: GB109052021682.

12.4.5 It is the area of these three catchments that has been used as the study area for the desk study. This approach was presented in the Scoping Report (**Appendix 1A**) and at a meeting held with the EA and NSC on 10 May 2018. No objections to the approach were received.

Desk study

12.4.6 This chapter has utilised the sources of data set out in **Table 12.3,** alongside data received in response to the requests for data set out in **Table 12.4**.

Table 12.3 Sources of information

Topic	Aspect	Source of information
Topography and land-use	Ground elevation and gradient Land-use	Ordnance Survey (OS) 1:50,000, Landranger Sheet 182 Weston-super-Mare OS 1:50,000, Landranger Sheet 172 Bristol & Bath OS 1:25,000, Explorer Sheet 154 Bristol West & Portishead

[25] (WRc) (2012). Sewers for Adoption - A Design & Construction Guide for Developers: 7th Edition, [online]. Available at: http://sfa.wrcplc.co.uk/home.aspx [Checked 28/08/18].

		Bing Maps on-line maps and aerial photography[26]
Hydrology	River network	OS 1:50,000, Landranger Sheet 182 Weston-super-Mare OS 1:50,000, Landranger Sheet 172 Bristol & Bath OS 1:25,000, Explorer Sheet 154 Bristol West & Portishead Bing Maps on-line maps and aerial photography[26]. Department of Environment, Food and Rural Affairs (Defra) MAGIC database[27]
	Surface water quality (WFD information)	Environment Agency (EA) River Basin Management Plan (2016 cycle 2) information, via the Environment Agency Catchment Data Explorer[28]
	Surface water abstractions and discharges	Information has been obtained from the Envirocheck report (**Appendix 12B**) Licensed abstraction/discharge data obtained from the EA and Private water supply data obtained from NSC
	Flood risk	EA Flood Map for Planning[29] EA Flood Risk from Surface Water map[30] EA flood risk GIS data[31]
	Conservation sites	Defra MAGIC database[27]
Geology	Solid and drift geology	British Geological Survey (BGS) 1:50,000 Series Geology maps, Sheet 264, Bristol, Solid and Drift Edition (2004) BGS Geology of Britain Viewer[32]
Hydrogeology	Aquifer type	Defra MAGIC database[27]

[26] Bing Maps (2018). [online]. Available at: https://www.bing.com/maps [Checked 23/08/18].
[27] Defra (2018). Multi-Agency Geographic Information for the Countryside mapping, [online]. Available at: https://magic.defra.gov.uk/MagicMap.aspx [Checked 23/08/18].
[28] Environment Agency River Basin Management Plan (2016 cycle 2). Environment Agency Catchment Data Explorer, [online]. Available at http://environment.data.gov.uk/catchment-planning/ [Checked 23/08/18].
[29] Environment Agency (2018). Flood map for planning, [online]. Available at: https://flood-map-for-planning.service.gov.uk/ [Checked 23/08/18].
[30] Environment Agency (2018). Long term flood risk assessment for locations in England, [online]. Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/ [Checked 23/08/18].
[31] Environment Agency (2018). Spatial Data Catalogue, [online]. Available at: http://environment.data.gov.uk/ds/catalogue/#/catalogue [Checked 23/08/18].
[32] British Geological Survey (2018). Geology of Britain Viewer, [online]. Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html [Checked 23/08/18].

Table 12.4 Requested data

Organisation	Data requested	Date and details
BAL	Details of the existing surface water drainage network at Bristol Airport.	Included within the Drainage Strategy prepared for the Proposed Development within the boundary of Bristol Airport (refer to **Appendix 12A** - FRA and Appendix D therein)
EA	Surface water quality monitoring data within the three WFD catchments that form the ZoI in which the application site is situated.	Received 16 June 2018. Required data provided
EA	Details of all licensed surface water abstractions for the ZoI in which the application site is situated.	Received 16 June 2018 and 25 September 2018. Required data provided
NSC Flood Risk Management Team	Records of 'local' sources of flooding affecting land, property and infrastructure around the application site, adjacent to the A38 or any downslope receptors.	Received 11 July 2018. Required information supplied
Various	Details of existing drainage networks under the A38.	Details included within the A38 highway improvements Drainage Strategy (refer **Appendix 12A** - FRA and Appendix E therein)
NSC Public Health Team	Records of private water supplies within the ZoI in which the application site is situated.	Received 30 August 2018. No recorded surface water private water supplies within the ZoI
Wessex Water	Foul drainage connection and capacity details.	Included within the Drainage Strategy prepared for the Proposed Development within the boundary of Bristol Airport (refer **Appendix 12A** - FRA and Appendix D therein)

Survey work

12.4.7 The general layout of surface types and surface drainage features within the public areas of the application site (North Zone car parking, arrivals area, old terminal area, A38 Downside Road-Lulsgate Bottom and along the realigned section of the A38) were observed during site meetings in early April 2018 and May 2018.

12.4.8 Much of the key infrastructure, such as drainage pipes, infiltration structures and pollution control structures are located in controlled areas or below ground. Information on these assets is readily available via a review of Bristol Airport and A38 drainage records held by BAL and NSC (details are provided in the respective Drainage Strategy documents (**Appendix 12A**, see appendices D and E therein) and specific survey relating to these elements was therefore unnecessary.

12.5 Overall baseline

Current baseline

Location, topography and land-use

12.5.1 Bristol Airport is located approximately 11km south-west of Bristol city centre (national grid reference 350440, 165195), within the local authority administrative area of NSC. It is situated on a ridge of high ground called Broadfield Down, with the A370 Bristol to Weston-super-Mare, 4km to the north and the M5 motorway 11km to the west of the application site. The A38 carriageway is directly adjacent to Bristol Airport, on its eastern extent.

12.5.2 The area surrounding the application site is predominately open, undulating countryside. Located within National Character Area (NCA) 118: The Bristol, Avon Valleys and Ridges. The area is characterised by alternating ridges and broad valleys, with steep wooded slopes and open farmland. Extensive wooded areas are located to the west of the site and, form a key feature of the wider landscape. Beyond the woodland lie the villages of Claverham, Yatton and Congresbury, approximately 5km west of the Proposed Development.

12.5.3 Elsewhere, the landscape is characterised by arable farmland and moderately sized villages or smaller clusters of residential properties. To the north-east, the most prominent settlements are Felton, Pottershill and Lulsgate bottom, while to the south, the closest village is Redhill.

12.5.4 OS map coverage of the area indicates the application site is situated on a plateau with land falling away to the north, south and west (**Figure 12.1**). OS mapping indicates that the highest point, located on the south-west of the application site, is 196m Above Ordnance Datum (AOD) while the lowest point is at the northern application site boundary and is approximately 150m AOD.

12.5.5 BAL's land ownership covers a total area of 196ha. This land currently comprises large impermeable areas associated with the runway, taxiways and apron and also the site buildings, large car parking areas and associated road network. The rest of Bristol Airport, including the land between and around the runway and taxiways, is currently set to grass.

Geology - solid and drift geology

12.5.6 The British Geological Survey (BGS) geological map identifies the application site as largely underlain by the Black Rock Limestone Subgroup. The exception is an area in the south associated with the Silver Zone Parking and Bristol and Wessex Aeroplane Club, and also to the very north-west, covering the north of Tall Pines Golf Club, where the bedrock geology is the Brockley Down Limestone. There is also a small area in the south-west of the application site where the Westbury Formation and Cotham Member (undifferentiated) are present. Geology is discussed in more detail in **Chapter 13: Groundwater**.

Hydrology

12.5.7 Rainfall records for the nearest river flow gauging station (Congresbury Yeo at Iwood - 52017[33] located 5km south-west of Bristol Airport) indicate typical average annual precipitation of approximately 1049mm (1990 to 2015).

12.5.8 As the application site is located on a plateau, there are no substantial areas of surface water originating off-site that run on to the application site and nor are there any major surface water

[33] National River Flow Archive (2018). 52017 Congresbury Yeo at Iwood, [online]. Available at: http://nrfa.ceh.ac.uk/data/station/info/52017 [Checked 16/07/2018].

bodies present within it (a small pond (Pond 6 in **Table 12.5** is located in south-west of the application site beside the Bristol Airport boundary). Furthermore, no watercourses are present immediately adjacent to the application site and water from low-magnitude rainfall events (less than 5mm) typically infiltrates to ground producing no off-site runoff. Typically around 50% of UK annual rainfall events are below 5mm[34], and approximately the first 5mm of rainfall is retained on natural surfaces[34] (interception), although higher levels of retention occur where there is woodland/depressions. Around 45% of the site comprises grass, and will under these conditions produce limited runoff. Whilst the remaining 55% comprises various developed surfaces (impermeable surfaces such as roofs, hardstanding and roads plus large areas of permeable car park surfacing), this area is served by a drainage system, designed to collect and infiltrate runoff. Runoff from the application site would therefore typically only occur for both: a) events in excess of the natural capacity of grass areas to intercept or infiltrate rainfall; and b) those above the drainage system's design standard. However, during periods of intense rainfall, where the quantity of rainfall temporarily exceeds the infiltration capacity of the ground, runoff would, unless obstructed by infrastructure or low-points, follow topography and drain off-site towards one of the three catchments shown on **Figure 12.2** and **Figure 12.3**:

- Runoff from the southern extent of the airport site, defined by the drainage divide with runs west-east approximately along the runway, drains to the south and west into the 'Kenn Moor Site of Special Scientific Interest (SSSI)' WFD water body catchment (23km^2). This catchment encompasses Goblin Combe (a dry valley). Springs emerge parallel to the western side of the A370 and feed into the ditch network of the Kenn Moor SSSI, an area managed by the North Somerset Internal Drainage Board and then into the Blind Yeo watercourse that flows into the Bristol Channel at Clevedon;
- Runoff from the north-western extent of the airport site, drains to the north and west into the 'River Kenn – Source to Kenn Moor SSSI' WFD water body catchment (35km^2). This catchment covers flows to the north, covering the settlement of Nailsea and flows into the River Kenn EA Main River. Springs emerge west of the A370 and feed into the upper River Kenn which then flows into the Kenn SSSI and ultimately into the Bristol Channel via the Blind Yeo; and
- Runoff from the north-eastern corner of the airport site and the area of the proposed A38 highway improvement works drains to the east into the 'Winford Brook - Source to Confluence with River Chew' WFD water body catchment (20km^2). This catchment covers the settlement of Felton and drains to the east, to the Winford Brook EA Main River. This joins the River Chew in Chew Magna, which flows into the River Avon, which ultimately flows into the Bristol Channel.

12.5.9 The Great Crested Newt (GCN) survey report (**Appendix 11C**), included as part of **Chapter 11: Biodiversity** has identified eight ponds within 500m of the application site. Details of the ponds are included in **Table 12.5**.

Table 12.5 Ponds within 500m of Bristol Airport

Pond reference (from GCN Survey)	Grid reference	In ZOI with flow path from the Bristol Airport Site	Details	HSI / GCN present?
P1	ST 48502 65094	Yes	Abspit Pond. Located in former quarry working.	Average / Yes

[34] HR Wallingford (2018). 'What is Interception?', [online]. Available at: http://www.uksuds.com/FAQRetrieve.aspx?ID=55020 [Checked 08/11/18].

P2	ST 48478 65085	Yes	Small woodland pond.	Excellent / Yes
P3	ST 48515 65266	Yes	Water filled wheel ruts.	Average / Yes
P4	ST 48584 64636	Yes	Muddy hollow with limited water.	Below average / No
P5	ST 49570 64748	Yes	Concrete lined pond in field, dry.	Average / No
P6	ST 49918 64515	Yes	Heavily shaded small pond.	Below average / No
P7	ST 49943 64288	Yes	Medium pond in woodland.	Average / No
P8	ST 49629 64362	Yes	Small plastic lined pond in garden.	Average / No

Further details are provided in Table 3 of the Great Crested Newt survey report (**Appendix 11C**).

Surface water quality

12.5.10 A summary of the water quality with respect to the three WFD river water bodies within 1km of the centre of the application site (based on the Severn River Basin Management Plan[35] (RBMP) and the latest data on the EA's Catchment Data Explorer website[36]) is provided in **Table 12.**. A detailed breakdown of the classifications for each water body, along with the water body objectives is provided in **Appendix 12C.**

Table 12.6 Summary of local WFD river water bodies and their associated status definitions (EA (Cycle 2), 2016)

WFD water body	River Kenn – Source to Kenn Moor SSSI	Kenn Moor SSSI	Winford Brook – source to confluence River Chew
Water Body Identifier	GB109052021670	GB109052021682	GB109053021900
Heavily Modified Water Body (HMWB)	No	Yes	No
Overall current (2016 Cycle 2) status	Good	Moderate	Poor
Objectives	Good by 2015	Good by 2021	Good by 2027 (due to disproportionate burdens)

12.5.11 The Moderate score for the Kenn Moor SSSI (**Table 12.)** relates to two WFD elements only: Fish and Supporting Elements (Surface Water) Mitigation measures assessment. A score of Poor is associated with fish, due to fish stocking causing direct biological pressures on the natural

[35] Defra (2016). Severn river basin district - River Basin Management Plan, [online]. Available at: https://www.gov.uk/government/publications/severn-river-basin-district-river-basin-management-plan [Checked 19/03/18].
[36] Environment Agency Catchment Data Explorer (2018). Severn River Basin District, [online]. Available at: http://environment.data.gov.uk/catchment-planning/RiverBasinDistrict/9 [Checked 28/08/18].

populations. The moderate score for mitigation measures relates to the artificial nature of the river and drainage channels in this catchment (a Heavily Modified Water Body). It should be noted that fish stocking and channel modification are in-channel factors without linkage to the application site, such that the Proposed Development here would not influence them.

12.5.12 The Poor score for the Winford Brook (**Table 12.**) relates to one WFD element only: Fish. The 'Reasons for Not Achieving Good' data for this waterbody indicate that this relates to Bristol Water's impounding dam at Chew Magna Reservoir, which blocks fish passage, and achieving 'Good' status is considered to be disproportionately expensive. It should be noted that the impounding dam is also a factor without linkage to Bristol Airport and as such the Proposed Development will have no effect on the WFD score for this element.

12.5.13 For all three waterbodies, most other statuses are at Good or High for assessed elements. The only exceptions are the 'Does Not Support Good' scores for Hydrological Regime element for the Kenn Moor SSSI (on account of it being a Heavily Modified Water Body) and for the Winford Brook (on account of the effect of impoundments). Again, it should be noted that these are factors without linkage to the application site and therefore the Proposed Development will have no effect on the WFD score for this element.

12.5.14 The application site is not situated within a surface Nitrate Vulnerable Zone (NVZ). The nearest NVZ is a Eutrophic Water NVZ located approximately 1.5km to the south-east of the application site, however, there are no surface water flow paths to this NVZ.

12.5.15 A Drinking Water Safeguard Zone (Surface Water) covers the eastern extent of the application site and extends to the east covering the catchment of the Winford Brook that drains to Chew Magna Reservoir. These zones are primarily intended to manage the risk of pollution from land-uses within the zone to raw water supply (and thus reduce the level of treatment required to supply drinking water). The application site occupies less than 2% of the overall zone and is located at the most upstream end of it. No watercourses are present here, which could provide a potential pathway to rapidly convey contaminants.

12.5.16 The key EA water quality data held for watercourses within the ZoI is presented in **Table 12.7** (data 10 January 2000 to 5 June 2018, refer to **Appendix 12D** for full details). Sampling points are shown on **Figure 12.4**.

12.5.17 The data indicate typical conditions for watercourses receiving substantial baseflow from calcareous sources (pH in the upper 7 to 8 range, high conductivity). For lowland waters, the recorded values for phosphate, Biological Oxygen Demand (BOD) and ammonia are indicative of water bodies towards the good quality end of expected ranges[37]. Nitrate values are moderate[37]. Copper and Zinc levels are slightly elevated by UK standards, associated with metal deposits and historic mining within the Mendip Hills source area. Low average suspended solid values reflect high quality conditions associated with baseflow dominance, with elevated maximum concentrations reflecting periodic contributions from more turbid surface water runoff.

[37] Based on Environment Agency WFD classes (see the EA Catchment Data Explorer website[36] and status guidance, [online]. Available at: https://environment.data.gov.uk/catchment-planning/help#help-status-description), plus UK TAG WFD standards, [online]. Available at: https://www.wfduk.org/reference/environmental-standards-0 [Checked 02/11/18].

Table 12.7 Summary of EA surface water monitoring data for the three WFD waterbodies that comprise the ZoI.

Sample Location		pH	Dissolved Oxygen (saturation %)	Conductivity (uS/cm)	BOD mg/l)	Ammonia (mg/l)	Nitrate (mg/l)	Suspended Solids (mg/l)	Orthophosphate (mg/l)	Cu Filtered, ug/l	Zinc - as Zn, ug/l
Winford Brook at The Batch	Minimum	7.7	85.9	450	1.3	0.03	1.33	3.0	0.01	1.02	5.1
	Maximum	8.5	113.3	674	2.1	0.51	3.96	52.4	0.16	5.58	47.6
	Average	8.2	99.2	608	1.6	0.08	2.82	9.9	0.05	1.81	15.3
River Kenn River Chelvey	Minimum	7.5	61.5	433	-	0.03	0.34	-	0.03	-	-
	Maximum	8.1	111.7	682	-	0.72	6.13	-	0.30	-	-
	Average	7.7	82.9	599	-	0.14	3.16	-	0.09	-	-
River Kenn Upstream of confluences with the Blind Yeo	Minimum	6.8	42.4	469	1.1	0.03	1.11	3.0	0.01	1.00	5.0
	Maximum	8.6	155.2	721	5.2	0.51	6.71	49.8	0.37	9.90	57.3
	Average	7.6	87.9	669	1.9	0.12	4.09	11.2	0.06	2.28	14.3

Surface water abstractions and discharges

Abstractions

12.5.18 The only known significant surface water abstraction within the ZoI is associated with Bristol Water's Chew Magna Reservoir. The EA has confirmed that they have no information on any other licensed abstractions from the surface water environment (**Appendix 12E**)**.** It should be noted that this dataset covers only licensed abstractions of 20m^3/day or more. No details are included in the dataset of abstractions below this threshold since these are exempt from licensing.

12.5.19 The Winford Brook drains to Chew Magna reservoir, owned by Bristol Water. The reservoir is stocked for fishing. Water from here can be used as compensation flow on the downstream River Chew or pumped from here to Bristol Water's main Chew Valley Reservoir.

12.5.20 NSC Environmental Health has confirmed that there are no recorded surface water sourced Private Water Supplies (PWS) within the ZoI (**Appendix 12F**).

Discharges

12.5.21 EA licensed Discharge Consents are shown on **Figure 12.4**. Analysis of the data indicates five Discharge Consents to surface water within the ZoI (refer to **Appendix 12E**). These comprise a

storm tank/combined sewer overflow, and discharges from a bakery, car garage, farm house and Bristol Water's Chelvey Water Treatment Works. In addition to this, there are also discharges via infiltration from Bristol Airport and Wessex Water's Lulsgate-Downside Sewage Treatment works.

Flood risk and drainage

Flood risk

12.5.22 An FRA (**Appendix 12A**) and two Drainage Strategies, one for the main Bristol Airport site (see FRA Appendix D), and one for the A38 highway improvements (see FRA appendix E) have been produced for the Proposed Development and provide further baseline detail on the existing site context. Key elements are summarised here.

12.5.23 The EA Flood Map for Planning (**Figure 12.5**) confirms that the whole of Bristol Airport is within Flood Zone 1 (the lowest flood risk area - less than 0.1% Annual Exceedance Probability - AEP). As such, Bristol Airport can be considered to be at low risk of fluvial flooding. Whilst the flood modelling underpinning this mapping typically only considers fluvial flood risk for watercourses with catchments greater than 3km^2, there are no watercourses within or immediately adjacent to the application site, confirming the Flood Zone 1 classification, surface water flood risk mapping (refer to paragraph 12.5.24) provides the key guide to areas at risk from flooding.

12.5.24 The nearest areas of Flood Zone 2 and 3 (medium and high risk) to which the application site drains are located in the settlements of Winford (associated with the Winford Brook) (<100m AOD) to the east, and to the west, the low lying (<10m AOD) Kenn Moor levels and River Kenn west of Claverham and Brockley.

12.5.25 The EA Flood Risk from Surface Water mapping (**Figure 12.6**) shows that the majority of the application site is at 'very low' (less than 0.1% AEP) risk of surface water flooding (runoff pathways or areas of temporary ponding associated with intense rainfall).

12.5.26 **Figure 12.6** shows several areas of surface water ponding associated with low points between the runway and taxiways. On the south side of terminal buildings, areas of surface water flooding are shown extending across the concrete aprons where runoff draining northwards is shown to pond against these buildings. However, it should be noted that several of the areas south (upslope) of the piers do not reflect the 'bridge' sections of the piers which would allow surface water to pass under and continue draining northwards rather than ponding on the upslope apron. To the west of the terminal building a large area of ponded surface water is shown, although this is associated with a former service yard which has now been built over as part of another previous western terminal extension. These areas of ponding contain areas at low, medium, and high risk of surface water flooding (0.1% AEP to 1% AEP, 1% AEP to 3.33% AEP, and greater than 3.33% AEP respectively).

12.5.27 **Figure 12.6** also shows several notable surface water flowpaths that originate on-site. These drain to and follow the routes of the dry valleys of the upper Winford Brook, Goblin Combe (draining to the River Kenn catchment) and Brockley Combe (draining to the Kenn Moor SSSI catchment). These flowpaths extend away from the application site to downslope settlements indicated as being at risk from surface water flooding (Felton and Winford in the east, Brockley and Cleeve in the west). The risk of surface water flooding along these flow paths is classified as low, medium and high, with narrow corridors along the valley bottoms.

12.5.28 NSC as LLFA have provided details of three areas of historic surface water flooding (refer to **Table 12.8**). All of these areas match with the EA surface water flood risk mapping. The areas are:

- On the corner of Cook's Bridle Path and Downside Road, which includes both garden and highway flooding;

- On the A38 between the Bristol Airport roundabouts; and
- At the Airport Tavern, Lulsgate Bottom in 2012.

12.5.29 The Landmark Information Group Envirocheck report (**Appendix 12B**) indicates that the BGS groundwater susceptibility mapping shows that the application site overlies geology classed as being in the lowest category of risk from potential groundwater flooding. Notable areas of risk nearby are confined to the deeper combes and valley bottoms. NSC (LLFA) has confirmed that no records are held of flooding from groundwater in the vicinity of Bristol Airport (**Appendix 12F**).

12.5.30 There is negligible flood risk from artificial sources of flooding, as indicated by the EA's flood risk from reservoirs mapping[38] which shows that the application site is approximately 3km south-west of and at elevations in excess of 50m above the nearest area at risk of flooding due to reservoir failure (associated with the Barrow Gurney reservoirs).

Drainage

12.5.31 Details of both the existing surface water and foul drainage network arrangements at Bristol Airport and of the existing A38 surface water drainage are provided in the respective Drainage Strategies, both contained within the FRA (**Appendix 12A**).

12.5.32 Bristol Airport's drainage system collects runoff on-site, passing this through interceptors to capture contaminants before discharge to ground. The existing drainage systems ensure that runoff from Bristol Airport's buildings, runways or taxiways and aprons, roads and associated impermeable or semi-impermeable areas is managed within the site. Drainage systems have a range of design standards, with those supporting more recent development elements being designed to the 1% AEP + climate change event as required by current guidance. This manages the risk of the development exacerbating or increasing off-site flood risk. Broadly the existing drainage strategy includes:

- North Side: new and old terminal buildings, access roads, surface and multi-storey car parking, hotel) - runoff routed to multiple soakaways located within the surface car parking and landscaping areas. A bund running along the northern and eastern Bristol Airport boundary acts to retain runoff during extreme events for on-site infiltration;
- Air Side: Runway, taxiway and aprons: runoff routed to multiple soakaways; and
- South Side: impermeable arrivals or collection car parking - routed to multiple soakaways. Silver Zone Car Park Extension (Phase 1) - infiltration via drainage blanket formed by the car park's aggregate surfacing. A bund running along the southern and eastern Bristol Airport boundary acts to retain runoff during extreme events for on-site infiltration.

12.5.33 With specific regard to the A38:

- Realigned A38 (between South Side and North Side access roundabouts): drainage provided by a roadside filter drain with infiltration to ground; and
- A38 North Side access roundabout to Lulsgate Bottom: traditional road edge gullies and piped system route runoff to a soakaway adjacent to the Airport Tavern.

12.5.34 BAL's environmental management system details strict policies for airport operations to ensure that it meets the requirements of the associated Discharge Consents. The key components being:

- Refuelling: runoff routed to Class 1 hydrocarbon interceptors before infiltration;

[38] Environment Agency (2018). Flood warning information service map, [online]. Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map [Checked 22/08/18].

- Fuel storage: stored within bunded storage area;
- De-icer application: use of low-impact de-icers;
- Fire training area: enclosed drainage system. Use of low environmental impact foams and tankering of contaminated runoff; and
- Emergency incidents (accidents or spillages): in addition to the above, pollution control valves are included within the drainage system to contain any contaminated runoff associated with such an incident.

12.5.35 BAL's foul drainage is currently discharged under licence to a Wessex Water foul sewer. The sewer drains to Wessex Water's Chew Stoke Sewage Treatment Works and treated effluent compliant with the terms of Wessex Water's Discharge Consent from the EA is discharged to the River Chew. The treated effluent discharge is situated just downstream of Chew Valley Lake.

Conservation sites

12.5.36 The Defra MAGIC[27] website indicates that there is only one SSSI with a hydrological basis to its designation within the ZoI that has a surface water flow path connecting it to the application site. This is the Tickenham, Nailsea and Kenn Moors SSSI located 5km north-west of the application site. The SSSI is split into 32 units, divided by a drainage network (known locally as rhynes). It is a human influenced environment, maintained by the management of land drainage by landowners and the North Somerset Internal Drainage Board. It is scientifically important due to the presence of a variety of aquatic plant life and rare dragonfly species.

Future baseline

Factors influencing the baseline

12.5.37 Baseline conditions for hydrology and flood risk could change over the anticipated lifetime of the Proposed Development as a consequence of changes in climate, land use, and as a result of measures taken to improve the water environment in the context of the WFD1.

12.5.38 As a result of climate change, it is predicted that winters will become generally wetter and summers generally drier, as indicated by results from the UK Climate Projections 2009[39] (UKCP09). It is also likely that peak rainfall intensities could increase, with a consequent effect on the frequency and magnitude of high river flows and associated flooding. The latest guidance on climate change allowances to be applied in England[11] was last updated in April 2016 and provides guidance on the potential enhanced rainfall intensity and seasonality. Estimates of enhanced rainfall intensity due to climate change are provided for development with lifetimes extending to 2115.

12.5.39 Changing land use, in the form of changing agricultural land management practices, urban development and major developments (on the application site or in the surrounding area) could cause changes to the surface water environment and flood risk within the study area. This could result in changes to patterns and rates of rainfall infiltration, changes in flow pathways, sources and magnitude of sediment inputs, direct morphological alterations to water bodies, or the introduction, alteration or removal of sources of pollution.

12.5.40 It is anticipated that the future status of all lower quality WFD river water bodies will improve, ultimately towards one of good status or potential by 2027, as required by the WFD.

[39] Met Office, UK Climate change projections (2009), [online]. Available at: http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87894&filetype=pdf [Checked 05/09/18].

12.5.41 In addition, the location and rate of surface and groundwater abstractions in the area could vary over time, leading to changes in groundwater levels (influencing river flows and flood risk), aquifer status and SPZ designations.

12.6 Consultation

12.6.1 **Table 12.8** provides a summary of the issues that have been raised by consultees and the responses given. A meeting was held at Bristol Airport on the 10 May 2018 to discuss the requirements of Surface Water And Flood Risk stakeholders (NSC and the EA). The issues raised within the meeting were subsequently formally detailed in the Scoping Opinion (**Appendix 10B**). As such **Table 12.8** covers all issues raised by stakeholders.

Table 12.8 Summary of issues raised during consultation regarding Surface Water And Flood Risk

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
"It is important that sustainable drainage principles should be applied to the site. British Geological Survey infiltration map suggests that infiltration will be possible, however, due to the source protection zone pollution control may be required, this should be confirmed with BRE 365 infiltration tests in the location of any proposed soakaways. Guidance on sustainable drainage should be followed and the Council recommend that where possible drainage is integrated into the green infrastructure spaces https://www.n-somerset.gov.uk/wp-content/uploads/2015/12/West-of-England-sustainable-drainage-developer-guide.pdf "	NSC Flood Risk Team	Infiltration forms the primary means of managing the Proposed Development's runoff. Infiltration systems have been designed in accordance with the results of infiltration testing undertaken at site. Suitable pollution control measures will be incorporated, and are set out in the accompanying CEMP (**Appendix 2B**). Proposals will follow the approaches set out in guidance such as BRE-365[40] and in the West of England sustainable drainage developer guide.	**Section 12.5**, **Table 12.13**, FRA (**Appendix 12A**) and Drainage Strategies (Appendices D and E in the FRA).
"Any watercourse (rhyne) network should remain open and allow easy access for maintenance and inspections, any EIA should assess the environment in and around the network. There must be no interruption to the surface water drainage system of the surrounding land because of the development. Provisions must be made to ensure that all existing drainage systems continue to operate effectively and that land owners upstream and downstream of the site are not adversely affected, therefore any EIA should assess the influence flooding might have on the environment both on site and on neighbouring land."	NSC Flood Risk Team	As the Proposed Development straddles the watershed over three catchments there are no 'upslope' landowners. Consideration has been given to how the Proposed Development could influence existing land drainage arrangements and flood risk within the development area to ensure potential significant effects are avoided. The drainage system within Bristol Airport itself is self-contained. Surface water is collected, managed and infiltrated within artificial drainage systems (primarily pipes) within Bristol Airport. No rhynes or similar open-watercourses are present on-site. The design of the upgraded A38 between the Northside access and Lulsgate bottom has incorporated a new soakaway to manage runoff from the new impermeable road area and a small proportion of the existing impermeable area.	**Section 12.5**, **Table 12.13**, FRA (**Appendix 12A**) and Drainage Strategies (Appendices D and E in the FRA).
"Historic surface water flooding on the A38 (realigned section, and near Lulsgate Bottom), plus near Cook's Bridle Path, Downside."	NSC Flood Risk Team	Appropriate design of the drainage system's for the proposed new on-site development to ensure off-site flood risk is not increased. Improvement of the A38 has provided an opportunity to divert a portion of the existing impermeable area as well as the proposed	**Section 12.5**, **Table 12.13**, FRA (**Appendix 12A**) and Drainage Strategies (Appendices D and E in the FRA).

[40] Building Research Establishment (2016). BRE-365 Soakaway design, [online]. Available at: https://www.brebookshop.com/details.jsp?id=327631 [Checked 05/10/18].

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
		new impermeable area to a new soakaway to be located in the former quarry adjacent to the A38 and Downside Road.	
"The Airport should be designed so as to reduce the risk to water resources, where possible using sustainable urban drainage together with appropriate pollution prevention problems."	EA	All new elements of the drainage system will include the required measures to comply with current Best Practice on drainage design and pollution control.	**Section 12.5**, **Table 12.13**, FRA (**Appendix 12A**) and Drainage Strategies (Appendices D and E in the FRA).
"The Airport design and infrastructure should be resilient to climate change. This may require the upgrade of soakaways, interceptor capacity etc. to reflect any changes in rainfall run-off etc."	EA	Appropriate climate change allowances have been incorporated in the design of new or modified components of the drainage design to serve the Proposed Development. However, where existing infrastructure is not being altered, no improvements of the associated drainage system are proposed on account of the difficulty of modifying systems at an operational airport. As investment in infrastructure at Bristol Airport is a continuous process, further opportunities may occur for adaptive improvements to these elements in response to future development proposals.	**Section 12.5**, **Table 12.13**, FRA (**Appendix 12A**) and Drainage Strategies (Appendices D and E in the FRA).
"Information to assess impacts on the natural environment in an ES should include, expected residues and emissions (including water pollution) resulting from the operation of the proposed development and a description of the aspects of the environment likely to be significantly affected by the development (including water)."	Natural England	The ES has used a 'ZoI' approach to identify potential receptors based on there being a flowpath from the Proposed Development to the receptor. All surface water and flood risk sensitive receptors within the ZoI have been included as potential receptors on this basis. These receptors have then been assessed against the predicted changes to water quantity and quality.	**Section 12.5** and **Table 12.13**.
"Develop a suitable foul drainage strategy, considering options and avoiding impacts."	Wessex Water	The Drainage Strategy for the Bristol Airport part of the application site (refer to **Appendix 12.A)** details foul drainage proposals for the Proposed Development that comply with the requirements of Wessex Water in terms of network capacity and ensuring compliance of their receiving waste water treatment work's effluent with its Discharge Licence.	See the FRA (**Appendix 12.A**, and therein Appendix D for the foul Drainage Strategy) and **Table 12.13**.

12.8 Scope of the assessment

Spatial scope

12.8.1 The spatial scope of the assessment covers the area of the Proposed Development, together with the ZoI which have formed the basis of the study area described in **Section 12.4**.

12.8.2 The Source-Pathway-Receptor (SPR) approach has been used as the main tool to define the spatial scope. This approach considers potential sources of flood risk and runoff (i.e. areas of hardstanding, or a river), and pathways (i.e. across a floodplain, along a road) via which these sources could reach receptors (i.e. people, land, property, features and infrastructure sensitive to runoff or flood risk).

12.8.3 The ZoI has been defined using the three WFD waterbodies as these are the fundamental units used on a national basis in England for reporting on the water environment with regards to the aquatic environment and water resources. The ZoI therefore forms the maximum envelope of effect.

12.8.4 Where it is shown that there is no effect on WFD waterbodies that form the ZoI, then any subsequent downstream receptors will also not be affected by the Proposed Development (since avoiding any deterioration in the quality of, or reduction in the ability to obtain good status or potential for a given waterbody also ensures that downstream receiving waterbodies are not equally compromised). Nonetheless, where specific receptors (i.e. SSSIs with an aquatic basis for their designation) are situated directly downstream (i.e. a pathway exists between the site and the receptor under consideration) then these are explicitly considered.

12.8.5 For flood risk, specific receptors situated on pathways downstream of the application site have been identified, this has been based on the use of OS maps, and the EA's surface water and fluvial flood maps to identify pathways between the site and potential receptors. The ZoI is considered to be an appropriate overall spatial extent over which to consider downstream flood risk on the basis that with increasing distance, the application site becomes an increasingly small overall proportion of the catchment.

Temporal scope

12.8.6 Two phases of the Proposed Development are assessed in this ES: construction and operation.

12.8.7 The construction phase is assumed to run from 2019 to 2026 with the various development elements occurring in phases within this time window (as detailed in **Chapter 2: Description of the Proposed Development**). In this chapter, the construction phase is therefore assessed against the current baseline.

12.8.8 The operational phase effectively runs from the completion of the construction phase for each element into perpetuity. For the purposes of this assessment a lifetime of 50 years has been used. NPPF[11] does not state a specific development lifetime for developments such as airports, however 50 years has been used as the period over which to assess current predictions or estimates of change. Three main changes are expected over the Proposed Development's operational phase: the impact of climate change on flood risk; improvements in the condition of WFD waterbodies; and the cumulative impacts of future development located within Bristol Airport's hydrological ZoI.

12.8.9 Climate Change: To assess the operational phase of the Proposed Development in line with the requirements of the NPPF[10], a development lifetime of 50 years has been used. NPPF's[10]

accompanying climate change guidance[41] specifies climate change allowances for peak rainfall intensity, peak river flows and sea level rise. Given Bristol Airport's location on an elevated plateau away from the sea and rivers, rainfall intensity is the key factor to consider. Table 2 in NPPF's climate change guidance[41] provides a range of allowances dictated by the design life of the scheme and an assessment of the application of either the Central or Upper End banding as appropriate. In the case of the Proposed Development, it is unlikely that it will remain unchanged beyond a period of 50 years. This would place the Proposed Development lifetime on the cusp between the 2040 to 2069 and 2070 to 2115 periods for which rainfall increases are specified. For the 2070 to 2115 period, a value of +40% is required if the 'Upper end' allowance is used, or +20% if the 'Central' allowance is used. CIRIA SUSDRAIN guidance[34] indicates that the +20% allowance can be used if runoff in excess of this drainage system design standard up to the +40% standard can be managed safely within suitable areas of the site. However, in order to ensure that there is sufficient contingency within the design, a figure of +30% has been used for sizing soakaways or piped drainage in this assessment. Final climate change allowances (whether +20%, +30% or +40%) would be selected based on subsequent detailed drainage design and available surface storage in each of the components of the Proposed Development.

12.8.10 WFD waterbody status: The use of the 2115 horizon also covers the period over which it is intended that the two WFD waterbodies in which Bristol Airport is situated that are currently classified as 'less than good' status will achieve 'good' ecological status or potential. These dates being by 2021 and by 2027. The third waterbody is already considered to have achieved 'good' status. In undertaking the assessment this means that potential effects must be considered on the basis that all three waterbodies are at 'good' or better status.

12.8.11 Cumulative Development: this is assessed separately within **Chapter 18: Cumulative Effects Assessment** of the ES.

Potential receptors

Identification of receptors that could be subject to likely significant effects

12.8.12 Receptors have been identified on the basis of the understanding of the SPR for the surface water environment within the ZoI - i.e. from the application site towards downslope receptors.

12.8.13 On the basis of the baseline appraisal, the following classes of receptors have been identified:

- Aquatic environment receptors;
- Water resources receptors; and
- Flood risk (primarily surface water) receptors – people, property and infrastructure.

Likely significant effects

12.8.14 The likely effects of the Proposed Development (see **Chapter 2: Description of the Proposed Development**) on these receptors that have the potential to be significant are:

- New flowpaths, and an increase in runoff and off-site flood risk due to the construction of new areas of impermeable surfaces and piped drainage systems. Reductions in river baseflow due to interception by impermeable surfaces and rapid conveyance to watercourses;
- Increased discharges of foul water for off-site treatment by Wessex Water;

[41] Ministry of Housing, Communities & Local Government (2014). Planning practice guidance, Climate change, [online]. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances [Checked 08/11/18].

- Contamination of surface water bodies downslope of the application site leading to a requirement for treatment of public water supply (or loss of that supply) and degradation of water quality; and
- Associated with changes in water quantity or quality, the reduction in ecological status or potential of the WFD waterbodies, or the deterioration of these elements of surface water dependent features or designated sites.

12.8.15 The following is a list of the potential sources of contamination associated with the Proposed Development:

- Construction: concrete wash water or residue; fuels, oils, lubricants and chemical used in the construction process; and silty runoff from exposed soils;
- Refuelling of aircraft: Potential contaminants may include fuel or oil hydrocarbons (i.e. total petroleum hydrocarbons, polycyclic aromatic hydrocarbons, benzene, toluene, ethylbenzene and xylene);
- Bristol Airport site operations: Potential contaminants may include de-icing chemicals, metals, fuel or oil hydrocarbons, surfactants, solvents, herbicides, organic and inorganic contaminants;
- Car parking and roadways: Potential contaminants may include metals and fuel or oil hydrocarbons; and
- Car valeting: Potential contaminants may include metals, solvents, detergents and fuel or oil hydrocarbons.

Receptors taken forward for assessment

12.8.16 The surface water and flood risk receptors that have been taken forward for assessment are summarised as follows:

- Water quantity and quality within the three WFD catchments in the ZoI and adjacent ponds;
- Aquatic environment receptors - designated sites such as the Kenn Moor SSSI;
- Water resources receptors - Chew Magna Reservoir; and
- Flood risk (primarily surface water) receptors – people, property and infrastructure downslope of the application site.

12.8.17 **Table 12.9** sets out the specific receptors identified for all three classes identified in paragraph 12.7.13 that are to be taken forward for assessment. **Figure 12.7** shows the locations of the identified receptors. Due to the nature of the receptors identified in **Table 12.9**, it can be seen that there is an overlap with some receptors being both aquatic environment and water resources receptors.

Table 12.9 Surface Water and Flood Risk receptors scoped in for further assessment

Receptors	Relevant assessment criteria	Likely significant effects
Aquatic Environment WFD catchments: 1) River Kenn source to Kenn Moor SSSI, 2) Kenn Moor SSSI, 3) Winford Brook Kenn Moor SSSI	The EU WFD[1] states that all waterbodies must achieve 'good' ecological and chemical potential. Where this is not possible due to a waterbody being so affected by human activity or its natural condition	Reduction in water quantity or quality. Construction of new hardstanding may lead to an increase in rapid runoff, and corresponding reduction in baseflow support to waterbodies.

Receptors	Relevant assessment criteria	Likely significant effects
Ponds within 500m of the Bristol Airport boundary	being such that achieving 'good' status would be infeasible or disproportionately expensive then waterbodies should aim to achieve 'good' potential.	The construction and operation of the Proposed Development may lead to unintentional release of pollutants or contaminants into waterbodies. Suitable capacity foul sewage treatment will be required to ensure effluent meets the requirements of discharge consents. For WFD waterbodies, this may lead to them either not achieving 'good' status or potential, or even resulting in a downgrade of their status.
Water Resources Chew Magna Reservoir	*The Water Resources Act 1991*[3] states that it is an offence to cause or knowing permit any poisonous, noxious or polluting material, or any solid waste to enter any controlled water.	The unintentional or accidental release of pollutants or contaminants during construction and operation may lead to the contamination of waterbodies used by BAL or by private users for abstraction for water supply.
On-site flood risk Existing and proposed development at Bristol Airport	Paragraphs 155-163 of the NPPF[10] state that a FRA must be prepared that demonstrates that the development will be safe for its lifetime, taking into account the vulnerability of its users.	Construction and operation of the Proposed Development may increase the risk of flooding at Bristol Airport via the construction of new assets potentially at risk of flooding, the redirection of flows via new flowpaths or new infrastructure blocking flowpaths and increases in runoff associated with new areas of hardstanding.
Off-site flood risk Adjacent road network Existing development at: Downside, Lulsgate Bottom, Winford, Combe Head Farm, Brockley, Cleeve and Hailstone Cottages	Paragraph 155 of the NPPF[10] states that flood risk must not be increased elsewhere as a result of development.	Without mitigation, increases in impermeable areas and new surface water flowpaths as a result of construction and operation of the Proposed Development have the potential to increase off-site flood risk at downslope or downstream receptors. Changes in the level of roads such as the A38 could block or redirect flows.

12.8.18 Other receptors are considered too distant and/or not in potential hydraulic continuity (i.e. no 'pathway') with the application site, including:

- Public water supply from Barrow Gurney reservoirs to the north-east, which are 4km from the application site and not downgradient of it; and
- Private Water Supplies - NSC have confirmed that there are no recorded surface water PWSs within the ZoI.

12.8.19 Several potential receptors were set out in the Scoping Report (**Appendix 1A**) as scoped out from further assessment because the potential effects to these receptors are not considered likely to be significant. The stakeholders consulted did not object to this approach. These receptors are:

- Public water supply from Chew Valley Lake (reservoir) to the east, on the basis there is no direct drainage route from the application site to this. Although on occasion water is pumped from Chew Magna Reservoir to Chew Valley Lake, Chew Magna is primarily used for fishing or to supplement flows in the downstream River Chew;

- In terms of WFD waterbody status, the potential assessment of effects to water quality only considers effects related to key determinands of relevance to the Proposed Development's construction and operation (i.e. hydrocarbons, de-icer compounds). Nutrients and pesticides associated with agriculture, Priority Substances or Specific Pollutants have not been assessed based on the Proposed Development having comparably minimal influence on these; and
- Potential receptors that are downstream or downslope of a receptor assessed as being unaffected by the Proposed Development will be scoped out on the basis that this will prevent downstream receptors being affected.

12.9 Environmental measures embedded into the development proposals

12.9.1 A range of environmental measures have been embedded into the development proposals as outlined in **Section 2.5**. **Table 12.10** outlines those embedded measures with a direct influence on the Surface Water And Flood Risk assessment. Existing mitigation measures are controlled via appropriate permits and consents, and future discharges will also be subject to the same controls.

Table 12.10 Summary of the embedded environmental measures

Receptor type	Changes and effects	Embedded measures
Aquatic Environment **Water Resources** **Flood Risk**	Changes in runoff quantity during period between site clearance and construction of the future drainage system. Uncontrolled sediment and associated contamination from the construction process entering the freshwater environment as a potential pollutant.	Owing to the range and scale of construction operations associated with the development proposals, suitable measures will be specifically defined in the CEMP (**Appendix 2B**) for the construction program associated with each component of the Proposed Development. These are likely to include: • Construction area access points will be regularly cleaned to prevent build-up of dust and mud; • Earth movement will be controlled to reduce the risk of silt combining with site run-off; • Properly contained wheel wash facilities will be used (where required) to isolate sediment rich run-off; • Where appropriate, excavated basins, cut-off ditches and/or geotextile silt-fences will be installed to collect runoff from excavations, exposed ground and stockpiles to prevent the uncontrolled release of runoff and sediments from the application site; • Silty water abstracted from excavations will be discharged to settlement tanks, sediment traps or proprietary treatment systems (i.e. 'siltbuster') to treat all runoff before discharge to surface water drains; • Only uncontaminated run-off will be permitted to discharge to ground. The CEMP (**Appendix 2B**) will detail specific methods to manage surface water discharges as appropriate based on an initial risk assessment; • Given the Proposed Development consists of a series of discrete developments, within sub-areas of the site, with each construction window of short duration, the following measures will be applied: Stockpiles and material handling areas will be kept as clean as practicable to avoid nuisance from dust; dusty materials will be dampened down using water sprays in dry weather or they will be

Receptor type	Changes and effects	Embedded measures
		covered; exposed or worked soils will be promptly revegetated; and • Contaminated soil will be identified by ground investigation prior to construction and either treated on-site and reused or removed and disposed of off-site by a licensed waste disposal operator at a correctly licensed waste depot. Contaminated water will be removed from the site by tanker and disposed of at a suitably licensed location.
Aquatic Environment **Water Resources**	Construction phase: spillages of oils and other chemicals associated with the construction process entering the freshwater environment as a potential pollutant.	Owing to the range and scale of construction operations associated with the development proposals, suitable measures will be specifically defined in the CEMP (**Appendix 2B**) for the construction program associated with each component of the Proposed Development. These are likely to include: • Plant and machinery will have drip trays beneath oil tanks, engines, gearboxes and hydraulics. These drip trays will be checked and emptied regularly by the contractor and correctly disposed of via a licensed waste disposal operator, in accordance with the CEMP (**Appendix 2B**); • Oils and hydrocarbons will be stored in designated locations (away from areas of heavy traffic, protected by traffic barriers) with specific measures to prevent leakage and release of their contents, including the siting of the storage area away from the drainage system on an impermeable base, with an impermeable bund that has no outflow and is of adequate capacity to contain 110% of the contents. Valves and trigger guns will be protected from vandalism and kept locked when not in use; • A spillage Environmental Response Plan (as part of the CEMP) will be produced, which site staff will have read and understood. On-site provisions will be made to contain a serious spill or leak through the use of spill kits, booms, bunding and absorbent material. A specialist contractor will be on call for any hydraulic equipment leaks via hoses to allow for swift remediation. Service Level Agreements (SLA's) will be included within the requirements of the CEMP (**Appendix 2B**); and • Only clean surface water will be discharged to ground. Any water contaminated with chemicals (i.e. concrete, plaster, paint, hydrocarbons, cleaning activities etc) will be disposed of via appropriate alternative means (i.e. off-site disposal at a licensed facility).
Aquatic Environment **Water Resources**	Construction phase: pollution incidents resulting from use of concrete and cement products on-site during the construction process.	Owing to the range and scale of construction operations associated with the development proposals, suitable measures will be specifically defined in the CEMP (**Appendix 2B**) for the construction program associated with each component of the Peoposed Development. These are likely to include: • Any handling of wet concrete that is required on-site will be undertaken in designated areas outside of Groundwater Source Protection Zone 1 and the location and configuration of the plant will be agreed via the CEMP (**Appendix 2B**); and • Excess concrete will either be returned to the depot, or scraped from equipment and segregated for disposal, prior to wash-down. A designated area will be used for any washing down or equipment cleaning associated with concrete or cementing processes and facilities provided to remove sediment prior to treatment and disposal of wash water. Various options exist for

Receptor type	Changes and effects	Embedded measures
		the pre-treatment of concrete wash-water to reduce the pH to an acceptable value. Exact arrangements will be detailed in the CEMP (**Appendix 2B**), with tankering off-site for disposal at a licensed facility being the preferred option.
Water Resources	Effects on the functionality of the water supply and sewer infrastructure around the site during the construction phase.	Owing to the range and scale of construction operations associated with the development proposals, suitable measures will be specifically defined in the CEMP (**Appenidx 2B**) for the construction program associated with each component of the Proposed Development. These are likely to include: • The exact locations of nearby sewers and water supply infrastructure will be established by on-site survey prior to construction. This is a requirement of Construction Design Management (CDM) and will be the responsibility of the Principal Contractor. An appropriate protection system will be implemented to minimise any impact to the public sewer network; • The water demand for the construction phase will be agreed with Bristol Water; • Water efficiency measures will be developed for construction processes as appropriate, examples of relevant construction phase activities are: water needed for concrete mixing, water needed for dust suppression, water needed for cleaning activities and water needed for welfare facilities; and • Appropriate storage will be provided on-site during the construction phase for any contaminated water awaiting tankering off-site.
Aquatic Environment **Water Resources** **Flood Risk**	Additional hard surfaces including new buildings, aprons, taxiways, carparks, yards and roads will reduce direct infiltration of rainfall recharge to the ground. This has the potential to increase the rate of surface water runoff and so increase flood risk. Large buildings and raised elements of infrastructure can block or re-direct runoff pathways. Changes to levels and surfaces associated with the A38 improvement works could increase runoff and block or alter existing surface water flowpaths.	Owing to the range and scale of construction operations associated with the development proposals, suitable measures will be specifically defined in the CEMP (**Appendix 2B**) for the construction program associated with each component of the Proposed Development. These are likely to include: • All runoff from hardstanding (roofs, taxiways, aprons, and some carparks) for the new development will be managed via SuDS, and will either be directed to soakaways or infiltrate direct to ground through permeable pavin; • The Silver Zone Car Park extension (Phase 2) will use a 'Netpave' permeable pavement system that allows infiltration to continue into the ground; • 'Netpave' permeable surfacing[42] consists of stone surfacing contained within a hollow interlocking casing. The permeable stone surfacing allows the runoff to infiltrate into the lower sub base layers of the pavement before draining laterally into gravel-filled infiltration trenches; • Where required, additional bunding will be provided to fully retain runoff on-site for the duration taken to infiltrate to ground (i.e. North Side surface and the Silver Zone Car Park). This will prevent the development from increasing off-site flood risk up to the 1% AEP + climate change allowance event; and

[42] Bristol City Council (2018). Case Study 05 - Bristol Airport Car Park, [online]. Available at: https://www.bristol.gov.uk/documents/20182/34524/WoE+SuDS+Case+Study+05+-+Bristol+Airport+carpark+SuDS.pdf/0053a9b0-d14f-4ca7-b019-7476beedce1a [Checked 05/10/18].

Receptor type	Changes and effects	Embedded measures
		• These measures will prevent an increase in flood risk associated with greater runoff and protect water resource quantity.
Aquatic Environment **Water Resources**	Activities on the areas of hardstanding will involve the use of potentially polluting materials, principally in the form of fuel oils. Spills or leaks of these materials from tanks, tankers, vehicles and aircraft are likely to be captured by the surface water drainage network, and could potentially be discharged to groundwater, reaching the surface water environment via springs. New areas of parking to the south of the airport will be on areas of permeable paving. Leaks and spills here have the potential to discharge directly to groundwater, reaching the surface water environment via springs. Pollution of groundwater could affect the operation of Chelvey Well (a significant public water supply operated by Bristol Water) and also pollute local rivers via baseflow.	Owing to the range and scale of construction operations associated with the development proposals, suitable measures will be specifically defined in the CEMP (**Appendix 2B**) for the construction program associated with each component of the Proposed Development. These are likely to include: • All surface water drainage will be in sealed drainage systems that direct water to treatment, with incorporation of emergency control valves and interceptors; • Oil water separators and anti-pollution control valves would be installed to control, retain and treat runoff before entry into the ground; • Handling of potentially polluting material will be subject to controls detailed in the CEMP (**Appendix 2B)** to manage the risk of leaks and spills; • All runoff passing through soakaways will be treated by passing through full retention oil water separators before infiltrating to ground to limit the potential for pollution of groundwater, and dependent surface water resources and receptors; • In areas of permeable paving, the pollution potential is lower (only parked cars). The attenuation capacity of the soil and unsaturated zone is retained and will act to reduce the impact on groundwater, and dependent surface water resources and receptors. This will allow adsorption, biological, and chemical degradation of soluble contaminants. Particle-bound contaminants will be captured within the media or within gullies and interceptors; • All potential contaminants will be adequately stored and monitored, and there will be minimised use and on-site storage of chemicals. All operational staff will be made aware of pollution responsibilities and be adequately trained. This will ensure compliance with Good Practice, the airports Environmental Management Plan, and adherence to manufacturer's usage and application guidance; and • Contaminated runoff (emergency incidents or spillages) will be collected and disposed of via a suitable method (tankered off site for treatment). Car valeting will utilise water-recycling methods, with appropriate management and disposal of any excess contaminated water.

12.10 Assessment methodology

12.10.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 4**: **Approach to Preparing the Environmental Statement**, specifically in **Sections 4.5** to **4.7**. However, whilst this has informed the approach that has been used in this Surface Water and Flood Risk assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this Surface Water and Flood Risk assessment.

Determination of significance

12.10.2 The EIA Regulations recognise that developments will affect different environmental elements to differing degrees, and that not all of these are of sufficient concern to warrant detailed investigation or assessment through the EIA process. The EIA Regulations require detailed assessment only of resources that are "likely to be *significantly affected* by the development".

12.10.3 The EIA Regulations themselves do not define significance and it is therefore necessary to state how this will be established for the EIA. The significance of an effect resulting from a development (during construction or operation) is most commonly assessed with reference to the sensitivity (or value) of a given surface water receptor and the magnitude of the change as a result of the development. This approach provides a mechanism for identifying areas where mitigation measures may be required and to identify the most appropriate measures to alleviate the risk presented by the development. This approach has been adopted for this assessment and the effects of the Proposed Development on the surface water environment will be evaluated assuming that the embedded environmental measures identified in **Table 12.10** are implemented.

12.10.4 In terms of the surface water environment, the EIA will be largely based on professional judgement, based on experience and the use of best practice guidance, such as that published by CIRIA[18], Defra[23] and the West of England Authority[24]. The key determinands of sensitivity and magnitude will relate to the aquatic environment, water resources and flood risk receptors.

12.10.5 **Table 12.1** details the basis for assessing receptor sensitivity.

Table 12.11 Establishing the sensitivity of receptors

Sensitivity	Criteria	Receptor type	Examples
Very High	Feature with a high quality and rarity at an international scale, with little potential for substitution	Aquatic environment	Conditions supporting sites with international conservation designations (Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites), where the designation is based specifically on aquatic features or where these are essential in supporting the designated features.
		Water resources	Regionally important public water supplies.
		Flood risk	Land use types defined as 'Essential Infrastructure' (i.e. critical national infrastructure) in the NPPF[10] flood risk vulnerability classification. For the purposes of this assessment this is considered to include all motorway or A-class roads.
High	Feature with a high yield and/or quality and rarity at a national scale, with a limited potential for substitution	Aquatic environment	Conditions supporting sites with national conservation designations (i.e. SSSI, National Nature Reserves (NNR)) where the designation is based specifically on aquatic features or where these are essential in supporting the designated features. Receptor water body: all relevant WFD supporting elements* at least good status or potential.
		Water resources	Local public water supplies.
		Flood risk	Land use types defined as 'Highly Vulnerable' in the NPPF flood risk vulnerability classification.
Medium	Feature with a medium yield and/or quality at a regional scale or good quality at a local scale,	Aquatic environment	Sites with local conservation designations where the designation is based specifically on aquatic features or where these are essential in supporting the designated features.

Sensitivity	Criteria	Receptor type	Examples
	with some potential for substitution		Receptor water body: all relevant WFD elements* at moderate or less status or potential.
		Water resources	Un-licensed potable surface water abstractions, e.g. private domestic water supplies.
		Flood risk	Land use types defined as 'More Vulnerable' in the NPPF[10] flood risk vulnerability classification. For the purposes of this assessment this is considered to include all minor roads maintained by NSC.
Low	Feature with a low yield and/or quality at a local scale, with some potential for substitution	Aquatic environment	Small watercourses not classified as a WFD river water body.
		Water resources	Licensed abstractions which are not public water supply, e.g. industrial process water, spray irrigation.
		Flood risk	Land use types defined as 'Less Vulnerable' in the NPPF[10] flood risk vulnerability classification.
Very Low	Feature with minimal yield and/or very low quality at a local scale, with a high potential for substitution	Aquatic environment	Minor water features such as ditches, not classified as a WFD river water body.
		Water resources	Un-licensed non-potable abstractions, e.g. livestock supplies.
		Flood risk	Land use types defined as 'Water-compatible development' in the NPPF[10] flood risk vulnerability classification and undeveloped land.

*For the purposes of this assessment, 'relevant WFD elements' are taken to mean:

- All biological quality elements e.g. fish, invertebrates etc.;
- All physico-chemical quality elements e.g. dissolved oxygen, phosphate etc.; and
- Hydromorphological supporting elements.

The definition of 'relevant WFD elements' (given the lack of potential for the Proposed Development to influence these substances) excludes:

- Priority Hazardous Substances; and
- Priority Substances; and Specific Pollutants.

12.10.6 **Table 12.1** details the basis for assessing magnitude of change.

Table 12.12 Establishing the magnitude of change

Magnitude	Criteria	Receptor type	Examples of negative change
Very High	Results in major change to feature, of sufficient magnitude to affect its use or integrity	Aquatic environment	Deterioration in river flow regime, morphology or water quality, leading to sustained, permanent or long-term breach of relevant conservation objectives (COs) or downgrading of WFD status (including downgrading of individual WFD supporting elements).
		Water resources	Complete loss of resource or severely reduced resource availability and/or quality, permanently compromising the ability of water users to exercise licensed rights.

Magnitude	Criteria	Receptor type	Examples of negative change
		Flood risk	Change in flood risk resulting in potential loss of life or major damage to property and infrastructure.
High	Results in noticeable change to feature, of sufficient magnitude to affect its use or integrity in some circumstances	Aquatic environment	Deterioration in river flow regime, morphology or water quality, leading to periodic, short-term and reversible breaches of relevant COs, or downgrading of WFD status (including downgrading of individual WFD supporting elements or ability to achieve future WFD objectives).
		Water resources	Moderate reduction in resource availability and/or quality, which may compromise the ability of water users to exercise licensed rights on a temporary basis or for limited periods.
		Flood risk	Change in flood risk resulting in potential for moderate damage to property and infrastructure.
Medium	Results in minor change to feature, with insufficient magnitude to affect its use or integrity in most circumstances	Aquatic environment	Measurable deterioration in river flow regime, morphology or water quality, but remaining generally within COs, and with no change to WFD status (of overall status or supporting element status).
		Water resources	Minor reduction in resource availability and/or quality, but unlikely to affect the ability of water users to exercise licensed rights.
		Flood risk	Change in flood risk resulting in potential for minor damage to property and infrastructure.
Low	Results in little change to feature, with insufficient magnitude to affect its use or integrity	Aquatic environment	Limited measurable deterioration in river flow regime, morphology or water quality and limited probability of consequences in terms of COs or WFD designations.
		Water resources	Limited measurable change in resource availability or quality and limited probability of changes to the ability of water users to exercise licensed rights.
		Flood risk	Increased frequency of flood flows, but which does not pose an increased risk to people, property and infrastructure.
Very Low	Results in no change to feature, with insufficient magnitude to affect its use or integrity	Aquatic environment	No measurable deterioration in river flow regime, morphology or water quality and no consequences in terms of COs or WFD designations.
		Water resources	No measurable change in resource availability or quality and no change in ability of water users to exercise licensed rights.
		Flood risk	No increase in frequency of flood flows, and no increase in risk to people, property and infrastructure.

12.10.7 **Table 12.1** provides an indication of how the level of effect will be categorised from the interaction of a receptor's sensitivity and the magnitude of change. A level of effect of Major or Moderate or greater is generally of most importance to the decision-maker, and so these effects are considered Significant. Whilst identification of a Major effect would trigger the need for further consideration, identification of a Moderate effect requires the application of professional judgement to ascertain the need for further measures. This serves as a precautionary approach for highly sensitive receptors (such as the airport itself) to ensure that the embedded measures are robust in managing

the potential degree of change. Where a level of effect is Minor or below, these are generally considered to be Not significant.

Table 12.13 Establishing the Level of Effect

		Magnitude of change				
		Very high	**High**	**Medium**	**Low**	**Very low**
Sensitivity/importance/value	**Very high**	Major (Significant)	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Probably significant)
	High	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)
	Medium	Major (Significant)	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Major (Significant)	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very Low	Moderate (Probably significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)
Key		Significant in EIA terms.				
		Probably significant in EIA terms				
		Not significant in EIA terms.				

12.11 Assessment of Surface Water and Flood Risk effects

Baseline conditions

Current baseline

12.11.1 The current baseline is set out in **Section 12.5**.

Predicted future baseline

12.11.2 The predicted future baseline is set out in **Section 12.5**.

Predicted effects and their significance

12.11.3 This section sets out the appraised receptor sensitivity, the expected magnitude of change as a result of the Proposed Development and the rationale for the final assessment of effect significance.

Receptor sensitivity

12.11.4 The assessment of the identified receptors has assigned a value of sensitivity using a precautionary basis (the precautionary basis is a key principle of EU environmental law[43]). For example, where a WFD waterbody's status would align with a medium sensitivity, but a water dependent SSSI is present in that WFD waterbody, a high sensitivity has been assigned.

12.11.5 The sensitivity of the three WFD waterbodies (in terms of water quantity and quality) has been set as per **Table 12.11**:

- The River Kenn source to Kenn Moor SSSI WFD catchment has been assigned a high sensitivity due to the current high status of the waterbody. The high value reflects there being relatively few WFD waterbodies with a high WFD status, which typically provide particularly good conditions for and assemblages of aquatic organisms;
- The Kenn Moor SSSI WFD catchment has been assigned a high sensitivity due to the SSSI, rather than medium (which it would be if sensitivity was judged on WFD status of moderate alone); and
- The Winford Brook WFD catchment has been assigned a medium sensitivity due to the current poor status of the waterbody. Assigning a medium status even to waterbodies with a poor WFD status is a precautionary approach to ensure that the quality of lower-scoring WFD waterbodies is not further reduced, or their ability to achieve good in future is not compromised.

12.11.6 The sensitivity of the ponds adjacent to Bristol Airport (**Table 12.5**) (in terms of water quantity and quality) has been assessed as per **Table 12.11**. These have been assessed as having a **high** (where GCN are present) and **very low** (where GCN are absent) sensitivity. This is on the basis that the GCN survey indicated GCN suitable or populated ponds were limited, with few alternative nearby ponds. For ponds without GCN a very low sensitivity is identified since these are minor water features have a high potential for substitution.

12.11.7 The sensitivity of Chew Magna Reservoir (in terms of water resources) has been set as **high** as per **Table 12.11**. This is on the basis that it can be utilised to provide a limited amount of water resource support to Chew Valley Lake (a SSSI and public water supply reservoir).

12.11.8 The sensitivity of on-site flood risk receptors (existing airport and the Proposed Development) has been set as **very high** as per **Table 12.11**. This is because the existing and Proposed Development is classified as 'Essential Infrastructure' under the NPPF.

12.11.9 For the sensitivity of off-site flood risk receptors - adjacent road network: the sensitivity has been set as **very high** for the A38 as per **Table 12.11**. This is because this part of the adjacent road network is assessed as being 'Essential Infrastructure' under the NPPF[10]. The sensitivity of Downside Road, West Lane, Cook's Bridle Path (road), and Winter's Road, has been set as **high** as per **Table 12.11**.

12.11.10 The sensitivity of off-site flood risk receptors - existing development has been set as **high** as per **Table 12.11**. This is because the types of development found in these settlements are classified by the NPPF as being 'highly vulnerable' or 'more vulnerable' types of development.

[43] European Commission (2017). Science for Environment Policy – Future Brief: The precautionary principle: decision-making under uncertainty, [online]. Available at: http://ec.europa.eu/environment/integration/research/newsalert/pdf/precautionary_principle_decision making under uncertainty_FB18_en.pdf [Checked 05/10/18].

Construction phase - potential effects

12.11.11 During the construction phase the potential effects are:

- Increased turbidity due to soil disturbance as a result of construction work and excavations. The surface waterbodies located downslope of the application site in the ZoI (as detailed under 'Hydrology' in **Section 12.5**) adjacent to the application site are all sensitive to turbidity;
- Increased runoff from compacted, disturbed and unvegetated surfaces. Runoff will be managed within construction areas with the discharge rate of runoff kept below baseline rates (i.e. greenfield rates, or the runoff rate from the previous developed land use); and
- Pollution as a result of leaks or spills of fuel oils used by construction equipment. The surface waterbodies downslope of the site within the ZoI are all sensitive to pollution.

12.11.12 To mitigate the potential effects during the operational phase, the Proposed Development will incorporate the following embedded environmental measures:

- Embedded environmental measures (**Table 12.10**) will minimise the potential for turbid water to reach these waterbodies - primarily the use of cut off-channels and silt fencing to retain runoff within the construction area to infiltrate, and the use of silt-buster devices to remove excess silt from runoff if discharge is proposed. In addition, the distance from construction areas to the more sensitive receptors (in excess of 1km), will allow for attenuation of any turbid water;
- Replacement drainage systems will be constructed as early as feasible, and surfaces dressed or revegetated; and
- Embedded environmental measures (**Table 12.10**) will minimise the potential for leaks and spills to occur, and provide for their containment in the event of incidents. Primarily this will be via the proper storage of chemicals, fuel and oil in bunding facilities and the regular inspection and maintenance of construction equipment. Designated refuelling areas, and drip trays will be used. Spill kits and absorbent matting will be placed at designated points within each construction areas and vehicles. Additionally, during most rainfall events, water would need to pass through the bedrock before reaching watercourses. Due to the depth to the aquifer, this pathway will result in the attenuation of minor spills and leaks before they reach the water table and the generally large distance from construction sites to the more sensitive receptors will permit time for attenuation of contaminants. During more extreme rainfall vents, contaminants would either be caught in the 'first flush' of runoff or diluted within the large quantity of runoff generated.

Construction phase - significance assessment rationale

12.11.13 A CEMP (**Appendix 2B**) detailing all embedded measures has been submitted as part of this application, prepared in line with best practice to manage and minimise the potential environmental effects of construction activities. Amongst other things, this covers measures to reduce or avoid the generation of pollution and maintain the discharge rate of runoff to below baseline rates. It is of note that previous construction works at Bristol Airport incorporated similar mitigation measures and good practice as will be incorporated into the construction of the Proposed Development (**Table 12.10**) and these have resulted in limited effects on surface water resources, surface water quality and flood risk at and adjacent to the application site. This provides confidence in their effectiveness, and hence future application as part of the Proposed Development. Receptor specific assessments are provided below.

Construction phase - aquatic environment (reduction in surface water quantity or quality)

12.11.14 Potential effects on the aquatic environment receptors are identified at paragraph 12.10.11, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.12. To protect this class of receptor, a range of key measures are included. Retention of construction runoff within the construction area for suitable treatment before discharge via an agreed route to agreed quality standards (i.e. infiltrated if uncontaminated, or disposed of off-site). Water quality measures incorporated in construction works will manage the risk of pollution entering the ground and therefore affecting these receptors. The construction works will occur within discrete phases within the overall construction phase, and the future drainage system will be promptly constructed at an early stage in the construction program. This minimises the potential for significant effects caused by multiple ongoing construction projects. As the receptors are distant from site, and the primary pathways are via groundwater all discharges will undergo significant attenuation and dilution between the site and receptors.

12.11.15 As a result of these embedded measures (**Table 12.10** and in the CEMP (**Appendix 2B**), the magnitude of change identified for these receptors is: **very low**. The rationale being that these measures reflect current best practice, and when applied for previous construction at Bristol Airport they have been fully effective. These measures will fully manage the quality and quantity of runoff within the construction areas until the new drainage system is constructed, preventing effects to local water quantity and quality. Once constructed early in the construction program, the drainage system will function as detailed for the operational phase to ensure that effects on water quality and quantity are prevented.

12.11.16 For the identified aquatic environment receptors (**Table 12.9**) sensitivities of **high, medium** and **very low** are identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, conclusions of **Minor/Negligible (Not significant)** are reached.

Construction phase – water resources

12.11.17 Potential effects on water resources receptors are identified at paragraph 12.10.11, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.12. To protect this class of receptor, the key measures are the same as those set out above under aquatic environment (paragraph 12.10.14).

12.11.18 As a result of these embedded measures (**Table 12.10** and in the CEMP (**Appendix 2B**), the magnitude of change identified for these receptors is: **very low**. The rationale being the same as that set out for aquatic environment receptors (paragraph 12.10.15).

12.11.19 For the identified water resources receptors (**Table 12.9**) a sensitivity of **high** has been identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, a conclusion of **Minor (Not significant**) is reached.

Construction phase - flood risk: on-site receptors: existing and proposed development at Bristol Airport

12.11.20 Potential effects on flood risk (on-site) receptors are identified at paragraph 12.10.11, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.12. To protect this class of receptor, a range of key measures are included. Construction site runoff will be initially retained on-site before discharge via an agreed route to appropriate rates (i.e. infiltrated if uncontaminated, or disposed of off-site). The construction works will occur within discrete phases within the overall construction phase, and the future drainage system promptly constructed at an early stage in the construction program. This minimises the potential for significant effects caused by multiple ongoing

construction projects. As the receptors are distant from the application site, and the primary pathways are via groundwater all discharges will undergo significant further attenuation between the application site and receptors.

12.11.21 As a result of these embedded measures (**Table 12.10** and in the CEMP (**Appendix 2B**)), the magnitude of change identified for these receptors is: **very low**. The rationale being the same as that set out for aquatic environment receptors (paragraph 12.10.15).

12.11.22 For the on-site flood risk receptor (**Table 12.9**) a sensitivity of **very high** has been identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, an initial precautionary conclusion of Moderate (Probably significant) is reached. However, the very high classification for 'Essential Infrastructure' is applied here on a precautionary basis to ensure suitable flood risk management measures are incorporated in the construction works. The receptor in question (Bristol Airport) is under the ownership of the applicant (BAL), and suitable measures to manage runoff during the construction of each component of the Proposed Development element will be put in place (as detailed in the CEMP (**Appendix 2B**)). Based on this application of professional judgement, a final conclusion of **Minor (Not significant)** has been reached.

Construction phase - flood risk: off-site receptors - road network

12.11.23 Potential effects on flood risk (off-site, road network) receptors are identified at paragraph 12.10.11, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.12. To protect this class of receptor, the key measures are the same as those set out above under flood risk (on-site) receptors (paragraph 12.10.20).

12.11.24 As a result of these embedded measures (**Table 12.10** and in the CEMP (**Appendix 2B**)), the magnitude of change identified for these receptors is: **very low**. The rationale being the same as that set out for aquatic environment receptors (paragraph 12.10.15).

12.11.25 For the identified road network receptors (**Table 12.9**) a sensitivity of **very high** for the A38 is identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, an initial precautionary conclusion of **Moderate (probably significant)** for the A38 receptor is reached. However, the very high classification for 'Essential Infrastructure' such as the A38 is applied here on a precautionary basis to ensure suitable flood risk management measures are incorporated in the construction phase. Professional judgement has been applied on the basis that the measures detailed in the CEMP (**Appendix 2B**) will result in no off-site increase in flood risk during the construction phase. The measures are considered suitable to fully manage flood risk associated with runoff associated with the construction areas until the new drainage system is constructed, preventing flood risk effects to the road network. Once constructed early in the construction program, the drainage system will function as detailed for the operational phase to ensure that effects on flood risk to the road network are prevented. Based on this application of professional judgement, a final conclusion of **Minor (Not significant)** is reached.

12.11.26 For the other identified road network receptors (**Table 12.9**) a sensitivity of **high** is identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, a conclusion of **Minor (Not significant**) is reached.

Construction phase - flood risk: off-site receptors - existing development

12.11.27 Potential effects on flood risk (off-site, existing development) receptors are identified at paragraph. 12.10.11, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.12. To protect this class of receptor, the key measures are the same as those set out above under flood risk (on-site) receptors (paragraph 12.10.20).

12.11.28 As a result of these embedded measures (**Table 12.10** and in the CEMP (**Appendix 2B**)), the magnitude of change identified for these receptors is: **very low**. The rationale being the same as that set out for aquatic environment receptors (paragraph 12.10.15).

12.11.29 For the identified existing development receptors (**Table 12.9**) a sensitivity of **high** has been identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, a conclusion of **Minor (Not significant**) is reached. This conclusion has been reached for the same reasons as those set out for 'Flood risk: off-site receptors - road network' above.

Construction phase - conclusions

12.11.30 Considering the embedded environmental measures in **Table 12.10**, which will be incorporated in the Proposed Development and will limit the potential for effects to influence the status of these receptors, the predicted magnitude of change during the construction phase of the Proposed Development is in all cases **very low**. A range of receptor sensitivities have been identified, ranging from **very low** to **very high**. Application of the level of effect matrix (**Table 12.13**) and professional judgement yields predicted levels of effect of: **Minor (Not significant)** and **Negligible (Not significant**). A summary of the results of the assessment of the Surface Water and Flood Risk is provided in **Table 12.14**.

Operational phase - potential effects

12.11.31 During the operational phase of the Proposed Development the potential effects are:

- The potential to increase flood risk to on-site and off-site flood risk receptors as a result of additional impermeable surfaces including new buildings, aprons, taxiways, carparks, yards and roads. Furthermore, increases in runoff imply a reduction in infiltration which would reduce groundwater resource and reduce baseflow to local rivers. Increased surface water runoff could also provide an additional conveyance pathway for contaminants to reach downslope surface water receptors;
- The potential to increase pollution of on-site and off-site receptors due to the use of pollutants, principally in the form of fuel oils but also de-icers, in areas of hardstanding. Spills or leaks of these materials have the potential to be captured by the site's surface water drainage system and to enter the groundwater body beneath it. During extreme rainfall events, the resulting runoff generated could convey these off-site to watercourses directly; and
- Leaks and spills in the new Silver Zone Car Park Extension (Phase 2) area in the south of the application site have the potential to discharge directly to groundwater (potentially reaching off-site watercourses fed by this) as it will be constructed over permeable paving. This could affect the WFD status of local rivers via baseflow affecting their ecological and chemical status.

12.11.32 To mitigate the potential effects during the operational phase, the Proposed Development will incorporate the following embedded environmental measures:

- During the operational phase, the surface water drainage system's operation and maintenance will follow recognised good practice with regards to sweeping and street cleansing, emptying of gullies, traps and interceptors. Discharges to groundwater (soakaways and infiltration areas) will be controlled via an Environmental Permit. This will seek to prevent the entry of hazardous substances and limit the entry of non-hazardous pollutants to groundwater through the use of pollution control measures at the surface and by passing water through a treatment system prior to discharge to ground; and
- Runoff from impermeable areas will be collected within the drainage system and infiltrated to ground. The elements of the drainage system serving the Proposed Development will be designed to the 1% AEP + climate change event as required by the NPPF[10].

Operational phase - significance assessment rationale

12.11.33 It is of note that the existing operations at Bristol Airport incorporate similar mitigation measures and good practice as will be incorporated into the Proposed Development (**Table 12.10**) and these have resulted in limited effects on surface water resources, surface water quality and flood risk at and adjacent to the application site. This provides confidence in their effectiveness, and hence future application as part of the Proposed Development. Receptor specific assessments are provided below.

Operational phase - aquatic environment (reduction in surface water quantity or quality)

12.11.34 Potential effects on aquatic environment receptors are identified at paragraph 12.10.31, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.32.

12.11.35 **Surface Water Quality** - rationale for expected Magnitude of Change: The nearest surface sections of these water features (channels that comprise part of a WFD waterbody, SSSI) are located at a distance of ~2km from the Proposed Development. The nearest ponds with GCN present are located 300m from Bristol Airport's western boundary, and 1.2km from the nearest part of the application site where development is proposed. There will be no direct surface discharge from the application site to these components under most rainfall conditions. The FRA (**Appendix 12A**) and the Drainage Strategy included in FRA appendices D and E, indicate, how for rainfall events up to the design event (drainage system design 1% AEP + climate change allowance) runoff will be managed via infiltration to ground. The quality of surface water runoff from the Proposed Development will be managed by a range of embedded environmental measures as set out in **Table 12.10**. Based on past applications at Bristol Airport, the same or similar mitigation measures have been shown to be effective in managing the quality of runoff. Discharges to ground from the drainage system would be in compliance with the respective Environmental Permit. During more extreme rainfall events above the design event, surface water flowpaths could provide a pathway between sources of pollutants within the Proposed Development and these receptors. However, in these situations, it would be expected that the initial runoff generated would route the 'first-flush' of any surface contamination into the drainage system for treatment. Any remaining contamination would be considerably diluted by the quantity of runoff generated by such extreme rainfall.

12.11.36 The Drainage Strategy (**Appendix 12A**, see Appendix D therein) details the proposed arrangements for managing foul flows from the Proposed Development. These have been prepared in consultation with Wessex Water to ensure that additional foul discharges can be accommodated within the foul drainage system's capacity and effluent discharges would remain compliant with Wessex Water's Discharge Licence.

12.11.37 **Surface Water Quantity** - rationale for expected Magnitude of Change: Whilst there will be a net increase in impermeable surfaces, leading to locally increased runoff and reduced infiltration at the development footprint, all runoff will be retained on-site and infiltrated to ground (further details are provided in the FRA (**Appendix 12A** and Drainage Strategy appendices therein). With there being no net decrease in the amount of water infiltrated within the application site it can be concluded that there will be no reduction in groundwater recharge and hence flow support to surface WFD waterbodies.

12.11.38 As a result of these embedded measures (**Table 12.10** and in the FRA (**Appendix 12A** and Drainage Strategy appendices therein), and the rationale at paragraphs 12.10.35 to 12.10.37, the magnitude of change identified for these receptors is: **very low**.

12.11.39 For the identified aquatic environment receptors (**Table 12.9**) sensitivities of **high**, **medium** and **very low** are identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, conclusions of **Minor/Negligible (Not significant**) are reached.

12.11.40 With regards to baseflow (the proportion of discharge in a watercourse derived from more slowly draining subsurface sources) support to surface watercourses, **Chapter 13: Groundwater** has concluded that there will be a **very low** magnitude of change to water quantity and quality in the groundwater body receptor. As the receptor has been classified as having a **high** sensitivity the expected impact on the quantity and quality of baseflow support to surface water features has been assessed as **Minor/Negligible (Not significant)**.

Operational phase - water resources

12.11.41 Potential effects on water resources receptors are identified at paragraph 12.10.31, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.32.

12.11.42 As a result of these embedded measures (**Table 12.10** and in the FRA (**Appendix 12A** and Drainage Strategy appendices therein), the magnitude of change identified for these receptors is: **very low**. The rationale being the same as that set out for aquatic environment receptors (paragraphs 12.10.35 to 12.10.37).

12.11.43 With regards to Water Resources receptors (**Table 12.9**) a sensitivity of **high** has been identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, a conclusion of **Minor (Not significant**) is reached. This is on the same basis as set out for Aquatic Environment (reduction in surface water quantity or quality).

Operational phase - flood risk: on-site receptors: existing and proposed development at Bristol Airport

12.11.44 Potential effects on flood risk (on-site) receptors are identified at paragraph 12.10.31, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.32.

12.11.45 Bristol Airport is served by an extensive drainage system designed to collect runoff, manage this at source and infiltrate it to ground. All additional impermeable areas of the Proposed Development will be served by new drainage infrastructure to infiltrate additional runoff to ground. As required by the NPPF[10], all of this infrastructure will be designed to manage runoff up to the 1% AEP event + a climate change allowance, this will ensure that runoff is managed at source and risks to existing development are not increased and new development is not at risk. Additionally, the re-development of areas at Bristol Airport provides the opportunity to upgrade existing drainage systems and bunding required to collect and infiltrate runoff. Further detail is provided in the FRA (**Appendix 12A**, and the Drainage Strategy included therein in Appendix D).

12.11.46 With regards to the section of the A38 included within the application site (main North-side access to Downside Road and West Lane), the upgrading of the carriageway provides the opportunity to renew existing drainage systems. This would result in a betterment over the baseline in that elements of the existing gully and piped drainage system in poor condition would be improved, and runoff from any net additional impermeable surfaces (plus a small proportion of existing) will be managed to current standards (with regards to managing runoff rates to the 1% AEP + climate change standard, and water quality). Further detail is provided in the FRA (**Appendix 12A**, and the Drainage Strategy included therein in Appendix E).

12.11.47 Flood risk from tidal, fluvial, groundwater and artificial sources of flooding has been judged as being minimal at the application site owing to its elevated location at distance from these sources of flood risk. Considering the embedded measures to manage runoff/drainage and hence the risk of surface water flooding, the potential for change to fluvial or groundwater flood risk elsewhere in the ZoI is limited since:

- Fluvial - the use of infiltration based drainage systems will avoid direct surface water runoff contributions to watercourses situated within the ZoI for events up to the 1% AEP + climate change allowance; and
- Groundwater - no concentration or redirection of runoff into a particular area of the aquifer is proposed, and any infiltrated water would be attenuated by the significant length of flowpaths through the unsaturated bedrock.

12.11.48 As a result of these embedded measures (**Table 12.10** and in the FRA (**Appendix 12A** and Drainage Strategy appendices therein), and the rationale set out in paragraphs 12.10.45 to 12.10.47, the magnitude of change identified for these receptors is: **very low**.

12.11.49 For the on-site flood risk receptor (**Table 12.9**) a sensitivity of **very high** has been identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, an initial precautionary conclusion of **Moderate (Probably significant)** is reached. However, the 'very high' classification for 'Essential Infrastructure' is applied here on a precautionary basis to ensure suitable flood risk management measures are incorporated in any development proposals. The receptor in question (Bristol Airport) is under the ownership of the applicant (BAL), and potential sources of flood risk at Bristol Airport are limited to surface water and associated drainage systems owing to the airport's location on an elevated plateau away from other sources of flood risk. Extensive measures to fully manage flood risk at the airport fully meeting the requirements of the NPPF[10] and current flood risk management best practice have been incorporated in the design. Further detail is provided in the FRA and accompanying Drainage Strategy (see **Appendix 12A** and appendices D and E therein). Based on this application of professional judgement, a final conclusion of **Minor (Not significant)** has been reached.

Operational phase - flood risk: off-site receptors - road network

12.11.50 As set out for '*Flood Risk: On-site receptors: existing and proposed development at Bristol Airport*' above, only surface water flood risk is considered further on the basis that the Proposed Development will not influence flood risk from other sources.

12.11.51 Potential effects on flood risk (off-site, road network) receptors are identified at paragraph 12.10.31, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.32.

12.11.52 In respect of the A38 (sections of carriageway that lie outside of the application site) - there are two sections within the ZoI with existing surface water flood problems:

- Surface water flooding on the realigned section of the A38, (i.e. the road section between the northern and southern airport access roundabouts). This surface water flooding is associated with road runoff or runoff from the higher ground to the east and poor maintenance of the current drainage system. The roadside filter trench and infiltration is currently heavily silted and overgrown. This stretch of road is the responsibility of the Highways Authority (NSC). No part of the application site drains to this part of the ZoI, and therefore there is no potential for the Proposed Development to affect flood risk at this location; and
- The A38-New Road junction east of Hailstone Cottages - this is associated with runoff following a westward draining dry valley which experiences ephemeral flows during periods of intense rainfall. No parts of the application site drain to this part of the ZoI, and therefore there is no potential for the Proposed Development to affect flood risk at this location.

12.11.53 For Downside Road, the EA surface water flood risk map (**Figure 12.6**) shows three pathways draining from the north-side of the Bristol Airport part of the application site towards this road. However, the majority of each pathway is shown as being "Low Risk" indicating runoff in response to rainfall events with an AEP of between 1% and 0.1%. Rainfall events of this magnitude are

extreme events which generate significant runoff, regardless of the permeability of the land surface. To manage runoff from the application site, embedded environmental measures (drainage system including infiltration and bunding to retain flows) are included within the Proposed Development up to the 1% AEP event + climate change allowance design standard as required by the NPPF[10]. This will ensure that runoff from rainfall events up to this threshold is managed on-site. This will therefore act to reduce any runoff from the application site from events below this threshold contributing to these existing areas indicated as being at risk of surface water flooding during "High" (greater than 3.33% AEP) and "Medium" (between 3.33% and 1% AEP) events.

12.11.54 In respect of West Lane, a surface water flowpath follows the road eastwards, between the A38 and the disused Lulsgate quarry (a geological SSSI), and this is associated with runoff from the A38 and Downside Road upslope to the west. The measures incorporated within the A38 aspects of the Proposed Development will assist in alleviating the existing surface water flooding at this location.

12.11.55 For Cook's Bridle Path (road), a narrow surface water flowpath is mapped as initiating within the Bristol Airport curtilage, 30m to the east of the road, before descending west to Brockley Combe with 95% of the catchment area being within the north-western corner of the application site. A second isolated area of surface water flooding is shown within the carriageway of the road immediately south of the junction with Downside Road, although only 20% of the catchment area is within the application site. Both areas, are shown as being "Low Risk" indicating runoff in response to rainfall events with an AEP of between 1% and 0.1%. Rainfall events of this magnitude are extreme events which generate significant runoff regardless of the permeability of the land surface. Flooding on the road is exacerbated by the lack of any drainage system (piped, gullies or roadside ditch), and since the road is slightly incised into the topography. To manage runoff from the application site, embedded environmental measures (drainage system including infiltration and bunding to retain flows) are included within the Proposed Development up to the 1% AEP event + climate change allowance design standard as required by the NPPF[10]. This will ensure that runoff from rainfall events up to this threshold is managed on-site.

12.11.56 With regards to Winter's Road, the Hailstones-Goblin Combe dry valley passes across this, with areas of high, medium and low surface water flood risk shown. Existing flood risk is exacerbated by the road being raised slightly above land upslope, impounding flows. The application site forms 20% of this pathway's catchment. To manage runoff from the application site, measures (drainage system including infiltration and bunding to retain flows) are included within the Proposed Development up to the 1%AEP event + climate change allowance design standard as required by the NPPF[10].

12.11.57 As a result of these embedded measures (**Table 12.10** and in the FRA (**Appendix 12A** and Drainage Strategy appendices therein), and the rationale set out in paragraphs 12.10.52 to 12.10.56, the magnitude of change identified for these receptors is: **very low**.

12.11.58 For the identified road network receptors (**Table 12.9**) a sensitivity of **very high** for the A38 is identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, an initial precautionary conclusion of **Moderate (Probably significant)** for the A38 receptor is reached. However, the 'very high' classification for 'Essential Infrastructure' such as the A38 is applied here on a precautionary basis to ensure suitable flood risk management measures are incorporated in any development proposals. The proposals include extensive measures to fully manage flood risk at the airport fully meeting the requirements of the NPPF[10] and current flood risk management best practice have been incorporated in the design. These will result in no off-site increase in flood risk. Furthermore improvements to the A38's drainage system are included in the proposals, such as to provide a slight betterment over the existing drainage system. Further detail is provided in the FRA and accompanying Drainage Strategy (see **Appendix 12A** and appendices D and E therein). Based on this application of professional judgement, a final conclusion of **Minor (Not significant)** is reached.

12.11.59 As a result of these embedded measures (**Table 12.10** and in the FRA (**Appendix 12A** and Drainage Strategy appendices therein), and the rationale set out in paragraphs 12.10.52 to 12.10.56, the magnitude of change identified for these receptors is: **very low**.

12.11.60 For the other identified road network receptors (**Table 12.9**) a sensitivity of **high** is identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, a conclusion of **Minor (Not significant**) is reached.

Operational phase - flood risk: off-site receptors - existing development

12.11.61 Potential effects on flood risk (off-site, existing development) receptors are identified at paragraph 12.10.31, with the embedded environmental measures to manage and limit the risk of these effects occurring detailed in **Table 12.10** and summarised at paragraph 12.10.32.

12.11.62 As a result of these embedded measures (**Table 12.10** and in the FRA (**Appendix 12A** and Drainage Strategy appendices therein), the magnitude of change identified for these receptors is: **very low**. The rationale being the same as that set out for flood risk (off-site, road network) receptors (paragraphs 12.10.52 to 12.10.56).

12.11.63 For the identified existing development receptors (**Table 12.9**) a sensitivity of **high** has been identified (**Table 12.11**), therefore with the expected magnitude of change of **very low**, a conclusion of **Minor (Not significant**) is reached. This conclusion has been reached for the same reasons as those set out for '*Flood risk: off-site receptors - road network*'. Further detail is provided in the FRA and accompanying Drainage Strategy (see **Appendix 12A** and appendices D and E therein).

Operational phase - conclusions

12.11.64 Considering the embedded environmental measures in **Table 12.10**, which will be incorporated in the Proposed Development and will limit the potential for effects to influence the status of these receptors, the predicted magnitude of change during operation of the Proposed Development is in all cases **very low**. A range of receptor sensitivities have been identified, ranging from **very low** to **very high**. Application of the level of effect matrix (**Table 12.13**) and professional judgement yields predicted levels of effect of: **Minor (Not significant)** and **Negligible (Not significant**). A summary of the results of the assessment of the Surface Water and Flood Risk is provided in **Table 12.14**.

Table 12.14 Summary of significance of adverse and beneficial effects - construction and operational phases

Receptor and summary of predicted effects		Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Construction phase					
Aquatic environment (reduction in surface water quantity or quality)	River Kenn source to Kenn Moor SSSI WFD catchment	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP (**Appendix 2B**) measures as detailed under '*Construction Phase - Aquatic Environment (reduction in surface water quantity or quality)*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.
	Kenn Moor SSSI WFD catchment	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP (**Appendix 2B**) measures as detailed under '*Construction Phase - Aquatic Environment (reduction in surface water quantity or quality)*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.
	Winford Brook WFD catchment	Medium	Very Low	Negligible (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP **(Appendix 2B)** measures as detailed under '*Construction Phase - Aquatic Environment (reduction in surface water quantity or quality)',* measures judged to be fully effective. For a receptor of 'medium' sensitivity this yields a significance of 'Negligible (Not significant)'.
	Ponds within 500m of the Airport boundary	High / Very Low	Very Low	Minor (Not significant) / Negligible (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP **(Appendix 2B)** measures as detailed under '*Construction Phase - Aquatic Environment (reduction in surface water quantity or quality)*', measures judged to be fully effective. For a receptor of 'high' (GCN present) or 'very low' (no GCN) sensitivity this yields a significance of 'Minor (Not significant)' and 'Negligible (Not significant)' respectively.
Water resources	Chew Magna Reservoir (CMR)	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP **(Appendix 2B)** measures as detailed under '*Construction Phase - Water Resources*', measures judged to be fully effective. For a receptor of 'very low' sensitivity this yields a significance of 'Negligible (Not significant)'.

Receptor and summary of predicted effects		Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Flood risk: On-site receptors: existing and proposed development at Bristol Airport		Very High	Very Low	Initial: Moderate (Probably significant), concluded as: Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP **(Appendix 2B)** measures as detailed under '*Construction Phase - Flood Risk: On-site receptors: existing and proposed development at Bristol Airport*', measures judged to be fully effective. For a receptor of 'very high' sensitivity this yields an initial significance of 'Moderate (Probably significant)'. However, the significance has been judged as being 'Minor (Not significant)' on the basis of the professional judgement applied (as detailed in the '*Construction Phase - Flood Risk: On-site receptors: existing and proposed development at Bristol Airport*' section).
Flood risk: off-site receptors	Adjacent road network: A38	Very High	Very Low	Initial: Moderate (Probably significant), concluded as: Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP **(Appendix 2B)** measures as detailed under '*Construction Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'very high' sensitivity this yields an initial significance of 'Moderate (Probably significant)'. However, the significance has been judged as being 'Minor (Not significant)' on the basis of the professional judgement applied (as detailed in the '*Construction Phase - Flood risk: off-site receptors - road network*' section).
	Adjacent road network: other identified receptors	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP **(Appendix 2B)** measures as detailed under '*Construction Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.
	Downside, Lulsgate Bottom, Winford	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP **(Appendix 2B)** measures as detailed under '*Construction Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.
	Combe Head Farm, Brockley	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP **(Appendix 2B)** measures as detailed under '*Construction Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.

Receptor and summary of predicted effects		Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
	Hailstone Cottages, Cleeve	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of CEMP **(Appendix 2B)** measures as detailed under '*Construction Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.
Operational phase					
Aquatic environment (reduction in surface water quantity or quality)	River Kenn source to Kenn Moor SSSI WFD catchment	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of the water quality measures and infiltration proposals as set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Aquatic Environment (reduction in surface water quantity or quality)*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.
	Kenn Moor SSSI WFD catchment	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of the water quality measures and infiltration proposals as set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Aquatic Environment (reduction in surface water quantity or quality)*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.
	Winford Brook WFD catchment	Medium	Very Low	Negligible (Not significant)	Conclusion of 'very low' magnitude of change based on application of the water quality measures and infiltration proposals as set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Aquatic Environment (reduction in surface water quantity or quality)',* measures judged to be fully effective. For a receptor of 'medium' sensitivity this yields a significance of 'Negligible (Not significant)'.
	Ponds within 500m of the Airport boundary	High / Very Low	Very Low	Minor (Not significant) / Negligible (Not significant)	Conclusion of 'very low' magnitude of change based on application of the water quality measures and infiltration proposals as set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Aquatic Environment (reduction in surface water quantity or quality)*', measures judged to be fully effective. For a receptor of 'high' (GCN present) or 'very low' (no GCN) sensitivity this yields a significance of 'Minor (Not significant)' and 'Negligible (Not significant)' respectively.

Receptor and summary of predicted effects		Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Water resources	Chew Magna Reservoir (CMR)	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of the water quality measures and infiltration proposals as set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Water Resources*', measures judged to be fully effective. For a receptor of 'very low' sensitivity this yields a significance of 'Negligible (Not significant)'.
Flood risk: On-site receptors: existing and proposed development at Bristol Airport		Very High	Very Low	Initial: Moderate (Probably significant), concluded as: Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of the flood risk management and drainage system design measures set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'very high' sensitivity this yields an initial significance of 'Moderate (Probably significant)'. However, the significance has been judged as being 'Minor (Not significant)' on the basis of the professional judgement applied (as detailed in the '*Operational Phase - Flood risk: off-site receptors - road network*' section).
Flood risk: off-site receptors	Adjacent road network: A38	Very High	Very Low	Initial: Moderate (Probably significant), concluded as: Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of the flood risk management and drainage system design measures set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'very high' sensitivity this yields an initial significance of 'Moderate (Probably significant)'. However, the significance has been judged as being 'Minor (Not significant)' on the basis of the professional judgement applied (as detailed in the '*Operational Phase - Flood risk: off-site receptors - road network*' section).
	Adjacent road network: other identified receptors	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of the flood risk management and drainage system design measures set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.

Receptor and summary of predicted effects		Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
	Downside, Lulsgate Bottom, Winford	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of the flood risk management and drainage system design measures set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.
	Combe Head Farm, Brockley	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of the flood risk management and drainage system design measures set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.
	Hailstone Cottages, Cleeve	High	Very Low	Minor (Not significant)	Conclusion of 'very low' magnitude of change based on application of the flood risk management and drainage system design measures set out in **Table 12.10**, and in **Appendix 12A** (FRA and drainage strategies therein), as detailed under '*Operational Phase - Flood risk: off-site receptors - road network*', measures judged to be fully effective. For a receptor of 'high' sensitivity this yields a significance of 'Minor (Not significant)'.

1. The sensitivity/importance/value of a receptor is defined using the criteria set out in **Section 12.9** and is defined as very low, very low, medium, high and very high.
2. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in **Section 12.9** and is defined as very low, medium, high and very high.
3. The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (probably significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in **Section 12.9**.

12.12 Consideration of optional additional mitigation or compensation

12.12.1 No additional mitigation measures are proposed to further reduce the surface water and flood risk effects that are identified in this ES chapter. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed in this chapter. These measures are considered to be likely to be effective and deliverable and address the likely significant effects of the Proposed Development.

12.13 Conclusions of significance evaluation

12.13.1 This assessment has concluded that there are **no significant effects** on Surface Water and Flood Risk from the Proposed Development after taking into account the embedded mitigation measures.

12.14 Implementation of environmental measures

12.14.1 **Table 12.15** describes the environmental measures embedded within the Proposed Development and the means by which they will be implemented, i.e. they will have been secured through planning conditions and by complying with the Bristol Airport Environmental Permit.

Table 12.15 Summary of environmental measures to be implemented – Surface Water and Flood Risk

Environmental measure	Responsibility for implementation	Compliance mechanism	ES section reference
Water management during construction.	Developer/Contractor	Planning condition or CEMP (**Appendix 2B**)	**Section 12.10**
Pollution control measures during construction.	Developer/Contractor	CEMP (**Appendix 2B**)	**Section 12.10**
Management of surface water runoff - attenuation and appropriate treatment before infiltration.	Developer	Planning condition	Section 12.10 FRA (**Appendix 12A**) and Drainage Strategies (Appendices D and E in the FRA).