Appendix A

TOPIC BASED SCHEMES ASSESSMENT: AoS FOR AIRPORTS NPS

A-7 WATER

June 2018

TABLE OF CONTENTS

7 WATER 1

7.1 INTRODUCTION 1

7.2 POLICY AND LEGISLATION 2

7.3 BACKGROUND TO THE ASSESSMENT 5

7.4 INTERACTION WITH OTHER TOPICS 6

7.5 ASSESSMENT CRITERIA 6

7.6 SUMMARY OF BASELINE 7

7.7 MITIGATION INCLUDED IN ASSESSMENT 9

7.8 APPROACH TO ASSESSMENT OF WATER 11

7.9 ASSESSMENT OF SHORTLISTED SCHEMES 13

7.10 MITIGATION 40

7.11 ASSUMPTIONS AND LIMITATIONS 42

7.12 CONCLUSIONS 43

7 WATER

7.1 INTRODUCTION

7.1.1 This topic based assessment considers each airport expansion scheme under the Water topic. This includes water quality, water resources and flood risk. The shortlisted schemes are London Heathrow Extended Northern Runway (LHR-ENR), London Heathrow Northwest Runway (LHR-NWR) and London Gatwick Second Runway (LGW-2R).

7.1.2 By law, before designating an Airports National Policy Statement (NPS) an Appraisal of Sustainability (AoS) must be carried out. This AoS is a strategic level assessment. It is based on the contents of the Airports NPS. The AoS considers alternatives to the Government's preferred scheme as set out in the Airports NPS, including the outline masterplans supplied to the Airports Commission for the three shortlisted schemes. This AoS considers the impacts of expansion without the benefits of the mitigation package put forward by scheme promoters, unless stated otherwise. The Government has outlined that it expects a significant mitigation package to be put in place by the promoter of its preferred scheme to ensure that wherever possible significant effects are avoided, reduced or offset.

7.1.3 Further project-level design will be required which will inform an environmental impact assessment carried out by the promoter. This would include an assessment, which is likely to include effects identified in the AoS as well as more detailed mitigation developed as detailed design progresses. This will also be developed through consultation with both affected communities and other stakeholders.

7.1.4 This assessment builds upon the previous Sustainability Appraisal undertaken by the Airports Commission (AC) but also responds to the AoS Appraisal Framework. The Framework addresses Water issues which have been identified through a review of plans, policies and programmes, and also national and local baseline information. Each scheme is considered against the AoS Appraisal Framework Objectives and Questions. The Objectives and Questions which are addressed within this assessment are as follows:

AoS Objective 11: To protect the quality of surface and ground waters, and use water resources sustainably.

- **AoS Question 18:** Will proposals have adverse effects on the achievement of the environmental objectives established under the Water Framework Directive?
- **AoS Question 19:** Will it result in the modification of watercourses?
- **AoS Question 20:** Will it result in the loss in productivity of fisheries?
- **AoS Question 21:** Will it lead to an increase in the consumption of available water resources?

AoS Objective 12: To minimise flood risk and ensure resilience to climate change.

- **AoS Question 22:** Will it increase flood risk through increased run off?
- **AoS Question 23:** Will it increase areas of development within areas at risk of flooding?

- **AoS Question 24:** Will it be able to adapt to climate change?

7.1.5 These Objectives and Questions are used to investigate the impact from the proposed work and evaluate the sustainability of the intended design. It should be noted that the questions provide a framework for the evaluation of the issues, so for example questions under Objective 11 will be used to assess the full breadth of the impact from the scheme in relation to the Water Framework Directive (WFD) (as transposed by the UK legislation). This will include potential deterioration of the waterbody from a chemical or biological perspective. There are also changes to the waterbody's ability to support existing or desired habitats, geomorphological changes and even changes that may prevent future improvement of the overall quality.

7.2 POLICY AND LEGISLATION

7.2.1 The following policy and legislation relevant to the Water assessment is summarised below and its context and applicability is explained as appropriate in the relevant sections of the assessment.

WATER FRAMEWORK DIRECTIVE (WFD)

7.2.2 The WFD (2000/60/EC) is implemented in England by "The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003" (SI 3242/2003) as amended by "The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2015" (SI 1623/2015).

7.2.3 The WFD has the overarching objective of enabling all water bodies in Europe to attain Good or High Ecological Status. The Environment Agency is the competent authority in England responsible for delivering the WFD. River Basin Management Plans have been created by the Environment Agency (2009), setting out measures to ensure that water bodies in England and Wales achieve 'Good Ecological Status' (GES) by 2027 with two interim cycles, with targets for individual water features set for 2015 and 2021. Following the completion of the first cycle in 2015 (running from 2009-2015) and following further planning and consultation, the River Basin Management Plan will be updated and reissued.

7.2.4 For surface water bodies to achieve overall 'GES' or 'Good Ecological Potential' (GEP), both ecological and chemical parameters must be judged to be at least 'Good'. GES refers to situations where the ecological characteristics show only a slight deviation from a natural reference condition. In such a situation the biological, chemical/physico-chemical and hydro morphological conditions are associated with limited or no human pressures. Artificial and Heavily Modified Water Bodies (A/HMWB) have a target to achieve GEP which recognises their important uses, whilst making sure the biological, physico-chemical and hydro morphological elements are protected as far as possible.

7.2.5 For groundwater bodies the overall ecological status is informed by two classifications: the chemical quality (diffuses and point sources) and quantitative quality (abstraction, dewatering, low groundwater levels and saline intrusion). Both of these classifications must be achieving Good status for the overall ecological quality of the groundwater body to be good.

7.2.6 The WFD aims to provide an overall framework for the management of water, both in terms of quality and quantity. This promotes an integrated approach to sustainable water management to balance the needs of water uses within a catchment.

7.2.7 The WFD outlines a number of objectives including:

- Preventing deterioration in the status of water bodies;

- Aiming to achieve Good status in water bodies by 2015, 2021 or 2027 (dependent upon feasibility);
- For water bodies that are designated as artificial or heavily modified, aiming to achieve GEP by 2015, 2021 or 2027 (dependent upon feasibility);
- Complying with objectives and standards for protected areas where relevant; and
- Reducing pollution from priority substances and ceasing discharges, emissions and losses of priority hazardous substances.

7.2.8 Article 4(7) of the WFD makes provision for circumstances where good status or potential is not achieved or deterioration of status may occur provided that all the following conditions are met:

- All practicable steps are taken to mitigate the adverse impact on the status of the body of water;
- The reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;
- The reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in Article 4(1)(a)(i) and 4(1)(b)(i) are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development; and
- The beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

RIVER BASIN MANAGEMENT PLANS (RBMP)

7.2.9 RBMPs focus on the pressures facing the water environment in a river basin district and the actions that are required to address them. The RBMP is prepared under the WFD (and associated Water Environment Regulations) and is reviewed on a six-year planning cycle.

7.2.10 Both Gatwick Airport and Heathrow Airport lie within the Thames RBMP area. The Thames RBMP focuses on the protection, improvement and sustainable use of the water environment and is used by the Environment Agency to ensure continued improvement in the Thames River Basin District. The River Thames and its tributaries are an important water source providing 60% of potable water supplies; the remainder is supplied from groundwater sources the most important being from the Chalk aquifers. The Thames catchment and the wider South East region, is deemed to be under “severe water stress”. Water stress arises when water demand is a high proportion of effective rainfall.

THE WATER INDUSTRY ACT 1991 (AS AMENDED BY THE WATER INDUSTRY ACT 1999 AND THE WATER ACT 2003)

7.2.11 This addresses the duties of water supply and sewerage companies and their regulation, and sets out the requirement for the preparation of Water Resources Management Plans.

WATER RESOURCES MANAGEMENT PLANS (WRMP)

7.2.12 Public water supply is a significant pressure on the water environment and water resources need to be effectively managed to ensure that there are sufficient resources to meet demand for water both now and in the future without detriment to the environment.

7.2.13 All water undertakers have a statutory duty under the Water Act 2003 to prepare and maintain a WRMP showing how they intend to maintain the balance between water supply and water demand over a rolling 25 year planning period. The WRMP informs the basis of their business planning and funding and is reviewed and updated every five years.

7.2.14 WRMP reflect the increasingly complex management of water resources including the distribution of water for supply both within and between water company water resource zones, and through inter-company transfers. Consequently, identifying the exact source of potable water for a given airport is often not possible. Moreover, with increasing pressure on water resources in the South East, inter-company and even regional water transfers are likely to become more commonplace. Therefore the statutory water undertakers' WRMP are now being developed in the context of a more regional view of supply and demand.

THE WATER RESOURCES ACT 1991 (AS AMENDED BY THE WATER ACT 2003) (WRA)

7.2.15 The WRA sets out the regulatory controls and restrictions that provide protection to the water environment through controls on abstraction, impounding and discharges as well as identifying water quality and drought provisions.

ENVIRONMENTAL PERMITTING (ENGLAND AND WALES) REGULATIONS 2016

7.2.16 The Environmental Permitting (England and Wales) Regulations 2016 consolidated and replaced the Environmental Permitting (England and Wales) Regulations 2010, which in turn replaced the WRA 1991 as the key legislation for preventing water pollution in the UK. Under the Environmental Permitting Regulations it is an offence to cause or knowingly permit a water discharge activity, including the discharge of polluting materials to freshwater, coastal waters, relevant territorial waters or groundwater, unless complying with an environmental permit or exemption.

THE WATER ACT 2014

7.2.17 The Water Act amends both the above Acts introducing the basis for reforming abstraction to link it more closely with water availability. The Water Act includes duties for water companies to secure long term resilience of water supplies and services and improve water resource planning. It also introduces more supplier choice for business customers for their water and sewerage services and opens up some of the upstream services to competition, for example, water resource provision and sludge management.

CATCHMENT ABSTRACTION MANAGEMENT STRATEGY (CAMS)

7.2.18 The CAMS sets out how the Environment Agency will manage water resources at a catchment scale and how they will manage existing abstraction licences and water availability for further abstraction. The strategy also details how the requirement of the WFD to ensure no ecological deterioration to rivers, will be met.

NATIONAL PLANNING POLICY FRAMEWORK 2012 (NPPF)

7.2.19 The NPPF, published on 27 March 2012 sets out the Government's planning policies for England and how these are expected to be applied.

7.2.20 Section 10 – 'Meeting the challenge of climate change, flooding and coastal change of the NPPF' states that:

'Developments should not increase flood risk elsewhere and that developments should be safe for their users for the whole of the development's lifetime.'

7.2.21 Paragraph 120 of Section 11 of the NPPF 'Conserving and Enhancing the Natural Environment" states:

'The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken in account.'

7.2.22 Planning Practice Guidance (PPG) was released in March 2014, and provides more technical guidance information, the most relevant section being "Flood Risk and Coastal Change". This defines flood zones as:

- **Zone 1, Low Probability:** Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
- **Zone 2, Medium Probability:** Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land is having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
- **Zone 3a High Probability:** Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
- **Zone 3b The Functional Floodplain:** This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map).

7.3 BACKGROUND TO THE ASSESSMENT

7.3.1 The assessment is based on the following reports:

- Jacobs, 2014. *9. Water and Flood Risk: Baseline*[1];
- Jacobs, 2014. *9. Water and Flood Risk: Water Quantity and Quality Assessment*[2]; and
- Jacobs, 2014. *9. Water and Flood Risk: Flood Risk Assessment*[3].

7.3.2 Additional work has also been undertaken to build on the AC Sustainability Assessment for this AoS. This is to ensure that a comparative assessment of the baseline conditions for all three schemes is presented for the Water Environment, in terms of designated sites and WFD measures. Mitigation options are considered beyond the immediate 1km of the scheme as the implications associated with the water environment can extend further. An initial search up to 10km was undertaken and the general functionality of wider catchments is considered in the evaluation.

7.3.3 The original assessment undertaken by the AC has been supplemented with further evaluation of the WFD objectives for the affected catchments.

[1] Jacobs, 2014. 9. *Water and Flood Risk*: *Baseline*. [online] Accessed 05/01/2016.
[2] Jacobs, 2014. 9. *Water and Flood* Risk: *Water Quantity and Quality Assessment*. [online] Accessed 05/01/2016.
[3] Jacobs, 2014. 9. *Water and Flood* Risk: *Flood Risk Assessment*. [online] Accessed 05/01/2016.

7.4 INTERACTION WITH OTHER TOPICS

7.4.1 The assessment of water is closely related to other topic-based assessments in the AoS. In particular, the following interactions are noted:

Table 7.1: Interaction of the Water Topic with Other Topics

TOPIC	INTERACTION
Community	Water has considerable interactions with communities including issues relating to flood risk, water resources (quality and availability), waterscape (see landscape), and amenity value.
Biodiversity	Water quality (ecological and chemical), quantity and geomorphology affect aquatic habitats (including watercourses and wetland habitats) and the overall biodiversity of all relevant water bodies including groundwater aquifers. Biodiversity is directly impacted by changes related to a river channel, flow rates and routes as well as storage areas and water level trends (including groundwater level patterns).
Soils	Water plays a significant role in the geomorphology of soils and is a key aspect in mobilisation of contaminants.
Carbon	Carbon emissions make a significant contribution to greenhouse gases which cause climate change. Impacts of climate change include a number of effects on water such as changes in weather patterns and sea level rise which increase flood risk and cause changes to water availability.
Landscape	Waterbodies are an integral part of the landscape and changes to the visibility of a waterbody or its orientation will have an impact on the waterscape.
Historical Environment	The historical environment forms a key part of the setting of the water environment, particularly the flood plain.
Resources and Waste	Potential for interactions with historical landfills and impacts upon water quality along with the disposal/discharge of resources.
Air Quality	There is potential for interactions with air quality and water quality, with any pollutants to be absorbed into the water environment.

7.5 ASSESSMENT CRITERIA

7.5.1 The AoS schemes were appraised against the AoS Objectives and Questions and the significance of effects was assessed as set out in Table 7.2 below. The general criteria used for assessing the significance of effects on water from the three airport expansion schemes are set out in the methodology in Section 3 of the AoS to which this appendix is attached. It should be noted that schemes are assessed individually against the requirements of the SEA Regulations and presented together for comparison. This means that although the nature of effects can vary between schemes, the significance may be the same.

Table 7.2: Identification of Significant Effects in the AoS

++	*Significant positive effect*
+	*Positive effect*
-	*Negative effect*
--	*Significant negative effect*
+/-, ++/--	*Mixed positive and negative effect*
?	*Uncertain effect*
0	*No relationship / neutral effect*

7.6 SUMMARY OF BASELINE

LOCAL BASELINE

7.6.1 The baseline[4] assumes the 'do minimum'[5] base case defined as 'how water quality, quantity and flood risk will develop in the surrounding area in the absence of an airport scheme'. This takes account of any proposed changes to the airports as indicated in their respective current master plans. In establishing the baseline, the 'do minimum' has a base date of 2025 for Gatwick and 2026 for Heathrow.

7.6.2 The baseline assessment considers the existing airport area and the extended area which would be covered by the proposed scheme footprint for Water Quantity. In terms of Water Quality the baseline assessment extends across 10 km from the scheme boundary to identify any sites designated for nature conservation that could potentially be impacted by changes to the water environment. Further evaluation will be required as part of an Environmental Impact Assessment (EIA) for scheme development. The study area in terms of flood risk has not been defined in the same way; it is predominantly restricted to the scheme area and extended in some locations to consider features which may alter the risk (i.e. flood alleviation schemes upstream or flood risk downstream etc.).

7.6.3 The south-east of England is already water stressed and therefore any additional demand must be mitigated to prevent further stress being placed on water resources. The Water and Flood Risk Baseline report[6] calculated baseline demands at each airport for 2012/2013, 2025 (Gatwick), 2026 (Heathrow), 2050, 2085 (Gatwick) and 2086 (Heathrow), assuming constrained growth based on forecasts from the AC. The water resource baseline position has been assessed[7] reviewing the RBMP, CAMS and WRMP covering the airport locations. This allowed for a baseline to be calculated against which to compare the proposed airport schemes.

[4] Jacobs, 2014. 9. *Water and Flood* Risk: *Baseline.* [online] Accessed 05/01/2016.
[5] represents the conditions which would exist if the scheme did not go ahead
[6] Jacobs, 2014. 9. *Water and Flood Risk:* Baseline. [online] Accessed 05/01/2016.
[7] Jacobs, 2014. 9. *Water and Flood Risk: Baseline.* [online] Accessed 05/01/2016.

7.6.4 There are areas of flood risk associated with all schemes from fluvial (river) and surface water flooding, in addition to groundwater at Heathrow. In terms of Gatwick the current Environment Agency Flood Map for Planning demonstrates that all three flood zone classifications extend across the current and proposed boundaries. Flood Zones 2 and 3 are more extensive across the current runways and developed area, further upstream in the proposed boundaries the flood zones are more constrained to the watercourses. In terms of Heathrow there is an extensive network of watercourses which flow to the west of the current airport boundary but within the proposed boundaries. These have relatively constrained areas within Flood Zone 3 but more extensive areas within Flood Zone 2.

7.6.5 The Ecosystem Services Assessment undertaken by the AC[8] has identified a range of services from the existing baseline which have a value at both Gatwick and Heathrow:

- Provision of water – both surface water (e.g. reservoirs) and groundwater provides water for communities;
- Regulating water quality – water quality is important for reservoirs, rivers and groundwater; and
- Regulating water flow – flood regulation is a key issue and both existing waterbodies as well as Greenfield land provide this service.

GATWICK AIRPORT

7.6.6 Biological elements of assessed water bodies in the Gatwick study area were mainly classified in the RBMP as Moderate or Poor. Three of the four assessed rivers were classified as having poor status for fish. The main reasons being:

- The heavily modified nature of several of the water bodies mean there are limited refuges and hiding places for fish to shelter;
- The large volume of input of fine sediment caused by high runoff rates and the clay geology affects water quality and smothered gravels reducing the effectiveness of fish spawning; and
- Barriers (including weirs, steps, dams and culverts) could affect fish movement and migration.[9]

HEATHROW AIRPORT

7.6.7 Within the LHR-NWR scheme study area there are eight watercourses, five lakes/reservoirs and one groundwater body. The majority of the water bodies are classified as A/HMWB and are not expected to improve in ecological status by 2015. Not all waterbodies require assessment for WFD reporting, three out of the four watercourse water bodies were assessed to have a Moderate or higher status for fish, and five out of six were classified as Moderate status or higher for invertebrates.

7.6.8 Only two of the lake water bodies have been assessed for Chironom invertebrates, both of which are achieving Poor status. The composition of Chironmid species or groups of species can be a parameter that is indicative of the nutrient enrichment in lakes. All of the lake water bodies in the study area (five in total) have been assessed for phytoplankton, of which one is achieving High, two are Good, one is Moderate and one is Poor. There is no mitigation measures detailed in the RBMP for the lake water bodies. The groundwater is the Lower Thames Gravels which currently is assessed to be achieving GES.

[8] Jacobs 2014, 7. *Biodiversity: Ecosystem Services*. [online] Accessed 20/06/2016.
[9] Jacobs, 2014. *Water and Flood Risk: Baseline*, p. 12. [online] Accessed 05/01/2016.

7.6.9 There are a further six watercourses and one lake within the LHR-ENR scheme. Five out of the six watercourse water bodies were assessed to have a Moderate or higher status for fish, and six out of seven were classified as Moderate status or higher for invertebrates'.

FUTURE BASELINE AND ISSUES

7.6.10 In establishing the baseline, the 'do minimum' has a base date of 2025 for Gatwick and 2026 for Heathrow, and an end date at 2085 and 2086 respectively based on a 60 year assessment period. The potential impacts of climate change are therefore considered for both dates.

7.6.11 In the future, climate change may increase peak river flows and rainfall. In addition, flood alleviation schemes are also being implemented (the Upper Mole Flood Alleviation Scheme and the Gatwick Stream Flood Alleviation Scheme).

7.6.12 Consideration of how flood risk may change over the period 2025 through to 2085 indicates that peak river flows could increase by 25% up to 2025 and by 70% up to 2085 and rainfall by up to 10% and 40% respectively. However, there is uncertainty associated with these climate change predictions and sensitivity to higher values should be considered.

7.6.13 Water bodies are likely to be put under considerable pressure over the next century through increased water demand and discharge from the existing airport and surrounding infrastructure. This pressure could affect the biological, physico-chemical and hydro morphological elements assessed under the WFD, which could prevent these water bodies from achieving 'GES' in the future.

7.6.14 Changes within the groundwater levels may bring these closer to the foul water systems increasing the risk and magnitude of groundwater ingress, which would require improvements to these assets.

7.7 MITIGATION INCLUDED IN ASSESSMENT

7.7.1 This assessment has been undertaken utilising the scheme design/mitigation incorporated within the scheme promoters' submission documents, as detailed in the mitigation section of the reports[10,11]. This mitigation incorporates measures included within the scheme design such as realigned/restored watercourses, surface water attenuation ponds, water treatment along with measures to reduce flood risk (from surface water and fluvial mechanisms) and water efficiency measures.

7.7.2 It has been assumed that all the scheme promoters would apply current standard practice mitigation as minimum which includes:

Construction Phase

- Construction Environmental Management Plan (CEMP);
- Storage of potentially polluting substances including fuel, oils, de-icer and other chemicals to be located away from surface watercourses and areas with permeable soils;
- Storage of excavated materials would be minimised and any temporary storage located away from surface watercourses and areas with permeable soils;

[10] Jacobs, 2014. 9. *Water and Flood Risk: Water Quantity and Quality Assessment*. [online] Accessed 05/01/2016.
[11] Jacobs, 2014. 9. *Water and Flood Risk: Flood Risk Assessment*. [online] Accessed 05/01/2016.

- Details about location specific risks to groundwater and surface water quality and specific mitigation measures required at each location;
- Groundwater and surface water monitoring requirements to be carried out before and during construction and during operation;
- Any contaminated water from excavation or dewatering activities would be passed to attenuation features such as treatment wetlands, ponds or storage tanks. There would be no direct discharge of contaminated water to surface watercourses;
- Pollution control in design for operation; and
- Operational emergency spill response plan.

Operational Phase

- Runoff from operational areas where activities such as de-icing, aircraft cleaning and aircraft servicing takes place would be passed to attenuation and treatment features. There would be no direct discharge of contaminated water to surface watercourses. The capacity and treatment levels to be achieved by the drainage system would be agreed with the Environment Agency and/or sewerage undertaker, as appropriate, during the design phase;
- Storage of potentially polluting substances including fuel, oils, de-icer and other chemicals would be located away from surface watercourses and areas with permeable soils;
- Attenuation storage would be provided to mitigate for the increase in runoff rates and volume due to the increase in impermeable area; and
- To ensure that water resources are used efficiently, all schemes will include forms of rainwater harvesting. This could include harvesting rainwater from roofs, including those of new buildings, which would be intercepted and directed to rainwater harvesting systems for potable water reuse. This would reduce the volume of water being discharged to watercourses. Low flush or flush stop toilets, aerated taps and waterless urinals will also be incorporated as practical in the design with the aim of reducing water demand.

7.7.3 Some of the scheme promoters' submissions have made specific recommendations that they will adopt in addition to best practise mitigation, these are outlined below for each of the schemes and are derived from the Jacobs Reports.

LGW-2R

7.7.4 In terms of the LGW-2R the measures include:

- Centralised de-icing facilities to limit areas in which runoff is known to be heavily contaminated;
- De-icer contaminated runoff to be managed through a positive drainage system and attenuated in a pollution storage lagoon;
- Measures to reduce de-icer use and capture de-icer waste at source to be developed; and
- A weir would be required to compensate for an expected 2m reduction in bed level at the Crawter's Brook/River Mole confluence. This weir would be designed with the

specific requirements and mitigation measures provided by the Environment Agency (and other bodies) would need to be followed for the structure to allow suitable fish migration.

LHR-ENR

7.7.5 In terms of the LHR-ENR scheme the mitigation measures include:

- Runoff would be directed from petrol interceptors via an online Total Organic Carbon (TOC) quality monitoring to detect the presence of de-icers. Runoff contaminated with de-icers would be diverted to treatment whereas non-contaminated water would be discharged to the normal attenuation storage;
- Compensatory storage areas in the same catchment and as close as practical to the areas of floodplain loss have been identified; and
- Groundwater will be appropriately managed during the construction and operation with consideration given to surface water – groundwater interactions.

LHR-NWR

7.7.6 In terms of the LHR-NWR the mitigation measures include:

- Dedicated areas for de-icing aircraft and a glycol recovery procedure to reduce the concentration of glycol within surface water runoff;
- Re-use of surface water would be maximised. Rainwater would be harvested from building roofs, treated water from the wetland and soft water from the glycol recovery process would be re-used. This would reduce the volume of water being discharged to watercourses;
- Connectivity maintained between all river channels in the Colne valley;
- Infill lost watercourses with permeable material to preserve established groundwater flow paths. Similarly, highly permeable materials will be used around new barriers to groundwater flow to prevent groundwater mounding; and
- Surface water quality monitoring would be undertaken in key risk construction areas in close proximity to surface watercourses and boreholes will be installed.

7.8 APPROACH TO ASSESSMENT OF WATER

7.8.1 The potential impacts to the water environment from the proposed schemes comprise impacts to groundwaters and surface waters (streams, rivers, lakes, reservoirs and wetlands). These have been identified from the AC's reports. Further work has been undertaken to evaluate the potential for impacts for each shortlisted scheme upon sites designated for nature conservation within a 10 km buffer zone.

7.8.2 In terms of water quality, this was assessed using the WFD classification system, considering impacts on protected areas, no deterioration of water body, status and achieving Good status/potential in water bodies (this includes ecological and chemical quality as well as quantitative status).

7.8.3 In terms of flood risk this was undertaken to assess:

- How the airport site and the local and wider area are protected from flooding including an assessment of how the creation/expansion and operation of the airport will affect the operation of the floodplain; and

- That the development does not displace water or alter water flows increasing flooding elsewhere.

7.8.4 In terms of water quantity the assessment included:

- The impacts on water resources in terms of availability, reliability, rarity and substitutability, are fully considered; and
- Measures are proposed to mitigate any detrimental impact on water resources.

7.8.5 Passenger numbers and average water consumption per passenger were used to assess the water demand. An assessment of readily available data relating to projected passenger number increases, proposed water efficiency measures and climate change were utilised by the AC to estimate the baseline water demand at 2025 and beyond to 2085. Given the current water resource planning process and recent legislation reforming abstraction controls and improving protection of water resources, it is likely that the increased demand will need to be spread regionally rather than increasing pressure on local resources beyond sustainable levels.

7.8.6 Each scheme was assessed against the baseline scenario using evidence presented within the AC's Sustainability Appraisal, which was informed by the scheme promoters' submission documents and responses to clarifications. It is also assumed that scheme will have regard to current standard best practice and this assumption has been applied as a minimum to the mitigations proposed.

7.8.7 As each submission is unique in its approach and the level of detail provided varies between the schemes, a high level assessment was undertaken in terms of estimates of water use and surface water attenuation to meet Greenfield rates[12]. These have been used within this AoS to ensure consistency between all the proposed schemes.

7.8.8 The scheme promoters' submissions have been undertaken to a high level strategy, it is anticipated that these will be followed, in due course, by appropriately detailed flood risk assessments fully compliant with NPPF[13] and the more recent Planning Practice Guidance (PPG)[14], along with detailed Water Framework Directive Assessments (WFDa). The WFDa are considered likely to demonstrate that, whilst improvements can be made in some areas, a detrimental impact will result and therefore the scheme will be required to progress through an Article 4.7 (of the WFD) route and a case proven that any environmental damage is outweighed by a greater public need for an airport development. Specific conditions set out in Article 4.7 must be met before this defence can be applied.

7.9 ASSESSMENT OF SHORTLISTED SCHEMES

AoS Objective 11: To protect the quality of surface and ground waters, and use water resources sustainably

7.9.1 All schemes could impact surface water and groundwater quality with polluted runoff during construction and operation, including sediment (construction) and de-iceants, cleaning agents and cadmium (operation). The schemes could also lead to a decrease in pesticides and herbicides applied to the land, due to change of land use from agricultural. It is assumed a CEMP will be implemented for all schemes, which will include procedures to reduce the residual risks during construction. It is assumed that all scheme designs will incorporate pollution control measures, such as storing potentially polluting substances away from surface watercourses and areas with permeable soils. However, there will be some residual pollution at times.

[12] Jacobs, 2014. 9. *Water and Flood Risk: Water Quantity and Quality Assessment*. [online] Accessed 05/01/2016.
[13] *Department for Communities and Local Government, 2012. National Planning Policy Framework*. [online] Accessed 05/01/2016.
[14] *Department for Communities and Local Government, 2014. Planning Practice Guidance*. [online] Accessed 05/01/2016.

7.9.2 Cumulative effects on water quality, fisheries (in combination with culverting) and consumption of water (water demand) may arise in combination with other nearby allocated schemes. This also includes construction of major infrastructure delivered in support of the National Networks National Policy Statement, Waste Water National Policy Statement, Minerals and Waste Plans and Local Development Plans. Cumulative effects on water demand will be considered as part of the Water Resource Management Plans.

7.9.3 It is assumed that no improvements will be made to the water environment to meet the interim WFD targets in 2021 as these improvements have yet to be quantified and may be classified as disproportionately expensive. These improvements are likely to alter the baseline conditions. Reviews of the current WFD objectives in the Environment Agency's Catchment Data Explorer[15] show that the water bodies are as a rule classified as "heavily modified" and while some are of poor or moderate quality, improvements are scheduled for the 2027 target. The general exception is the River Mole at Gatwick, which although is classed as Heavily Modified is reaching good potential.

7.9.4 For all three schemes, ecosystem services will be affected in the short to medium term at least, until mitigation is established. Ecosystem services include the provision of freshwater supply, which will be disrupted, and reduction in the capacity to purify water.

LGW-2R

7.9.5 A risk during construction is posed by the historic landfill within the proposed footprint of this scheme's development, which poses a risk during the construction phase if contaminants are mobilised.

7.9.6 An active wetland is proposed as part of the design to improve water quality at the discharge point, together with other measures such as slot drains laid and combined filter drains with grass or swales along the edges of taxiways and runaway shoulders, a dirty pond and detention basin. All runoff flows would be pumped to a balancing tank and treated via an active wetland treatment system. In addition, centralised de-icing facilities would be used to limit contaminated runoff and de-icer contaminated runoff would be managed through a positive drainage system and storage lagoon.

7.9.7 Waste water will continue to be sent to an expanded Crawley Sewage Treatment Works (STW) for treatment in a similar manner to that at present. Alternatively a local treatment plan would be installed to allow contaminated runoff to be treated on site. Additional sewage and waste water wetland treatment system would be built.

7.9.8 Discharges could affect the Glovers Wood Site of Special Scientific Interest (SSSI) which is hydraulically connected via minor watercourses to Gatwick although it is unlikely given its location upstream of the airport.

7.9.9 It is estimated that approximately 7km of existing watercourses would need to be replaced with diverted/realigned channels. Particularly the diversions of the Crawters Brook and 1km of the River Mole along with the addition of a weir to compensate for the 2m reduction in bed level at their confluence. This could have impacts on channel processes, ecology and fisheries.

7.9.10 The waterbodies designated under the WFD that have a risk of deterioration under this scheme, based upon current design assumptions are the Mole upstream of Horley, Tilgate Brook and Gatwick Stream at Crawley and the River Mole (Horley to Hersham).

[15] Environment Agency, 2016. *Crane Rivers and Lakes*. [online] Accessed 15/05/16.

7.9.11 To ensure that water resources are used efficiently rainwater harvesting and other water saving measures would be incorporated within the design. This will help reduce per passenger potable water demand by 10% by 2050, leading to a demand of 1.33Mm^{3}pa. This will be met by Sutton and East Surrey Water who have a surplus in this water resource zone and will need to complete resilience measures to ensure continuity of supply.

LHR-ENR

7.9.12 A risk during construction is posed by the historic landfill within the proposed footprint of this scheme's development, which poses a risk during the construction phase if contaminants are mobilised.

7.9.13 Of the WFD water bodies in the LHR-ENR Study Area, The Colne, confluence with the River Chess, to the River Thames are classified as having a 'Failing' chemical status. A potential increase in pollutants may increase the impact on these water bodies.

7.9.14 The mitigation measures proposed for this scheme include runoff attenuation Sustainable drainage systems (SuDs) and interceptors to provide storage for major spills. Runoff from operational areas where activities such as de-icing, aircraft cleaning and aircraft servicing takes place should be passed to attenuation and treatment features. There is unlikely to be direct discharge of contaminated water to surface watercourses. The capacity and treatment levels to be achieved by the drainage system would be agreed with the Environment Agency and/or sewerage undertaker as appropriate, during the design phase.

7.9.15 Surface water quality monitoring would be undertaken in key risk construction areas in close proximity to surface watercourses and boreholes will be installed.

7.9.16 A Sustainable Drainage Strategy will include dedicated areas for de-icing aircraft and a glycol recovery procedure to reduce the concentration of glycol within surface water runoff and separate storage tanks for 'clean' and 'first flush' surface water. There is also the possibility of a new STW with some of the treated water to be re-used for non-potable purposes within the airport.

7.9.17 There is potential for hydrological conditions to be altered on Staines Moor SSSI and SWLW Special Protection Area (SPA). There would also be works directly adjacent to King George VI Reservoir, which forms part of Staines Moor SSSI and South West London Waterbodies Special Protection Area (SWLW SPA) and nearby Wraysbury Reservoir (also part of the SWLW SPA). This could have a negative effect; depending on design (also see Appendix A.5).

7.9.18 Significant watercourse replacement with diverted/realigned channels is proposed with approximately 12 km of watercourse impacted. The diversions of the Colne Brook and Poyle Channel, approximately 5 km around the west end of the runway, would be technically difficult and are considered likely to have significant effects on the hydromorphology, geomorphology and WFD compliance, as the scheme would involve culverting of around 12 km of additional culverts. The Longford River, the Duke of Northumberland's River, River Colne and Wraysbury River would be culverted underneath the proposed runway. This could have impacts on channel processes, ecology and fisheries.

7.9.19 The waterbodies designated under the WFD that have a risk of deterioration under this scheme, based upon current design assumptions are the River Colne (confluence with Chess to River Thames) and Colne Brook.

7.9.20 To ensure that water resources are used efficiently, surface water reuse will be maximised and rainwater harvesting and other water saving measures will be incorporated within the design. Rainwater harvesting is expected to account for 9% of the additional demand. The potable demand will be met by increased abstractions and Affinity Water whose WRMP concluded that there is a deficit in the water resource zone.

LHR-NWR

7.9.21 A risk during construction is posed by the currently permitted and historic landfill within the proposed footprint of this scheme's development, which poses a risk during the construction phase if contaminants are mobilised.

7.9.22 For this scheme, long term storage would be provided to delay the additional surface water volume from being discharged to watercourses, by infiltration, rainwater harvesting or by restricting the discharge rate to 2 litres per second per hectare (l/s/ha).

7.9.23 Surface runoff from paved areas (which is likely to be contaminated) would receive at least two levels of treatment:

7.9.24 Surface water from adopted highways would be intercepted by source control features such as filter drains which provide a primary level of treatment. Retention ponds or detention basins will be designed to provide secondary level treatment; and

7.9.25 Surface runoff from the new runway and apron would be intercepted by linear drainage channels before being directed into a network of collector pipes, diverting flows to a petrol/oil interceptor. The discharge from the interceptor would be directed via an online TOC detector (this would require a suitable maintenance regime and fail safe mechanism) to either clean attenuation tanks or polluted water holding tanks. Clean water would be discharged and polluted water treated.

7.9.26 The interceptor would also provide storage for any major spills. Polluted runoff would be attenuated within a polluted water holding tank and released for treatment at a rate agreed with the treatment plant operator.

7.9.27 There is potential for hydrological conditions to be altered on Staines Moor SSSI by the diversion of the River Colne and this would need to be addressed during detailed design. There are also a number of reservoirs and gravel pits which make up the SWLW SPA further downstream from the airport. Given the information currently available, there is uncertainty that the potential adverse effects to ecological features could be avoided via mitigation (also see Biodiversity Appendix A.5 which applies a precautionary principal for effects on site integrity).

7.9.28 Significant watercourse replacement with diverted/realigned channels is proposed with approximately 12 km of watercourse impacted. The diversion of approximately 1 km of the Colne Brook around the western end of a new runway, diversion of parts of the Duke of Northumberland's River and River Colne to the south of the new runway and creation of a new channel (the 'River Colne Spur') would be technically difficult and are considered likely to have significant effects on hydro morphology and geomorphology. The WFD aims to enhance and maintain good status of all waterbodies; this scheme would involve culverting of around 3 km of additional culverts. Furthermore the River Colne and Wraysbury River would be combined into a single culvert, and the Duke of Northumberland's and Longford Rivers would be combined into a single culvert, reducing total channel length and change morphological and ecological conditions. This could have impacts on channel processes, ecology and fisheries.

7.9.29 A residual risk has been identified for LHR-NWR in that the diversion of approximately 1km of the Colne Brook around the western end of a new runway, diversions of parts of the Duke of Northumberland's River and River Colne to the south of the new runway and creation of a new channel (the 'River Colne Spur') would not only present technical challenges, but would probably have residual negative effects on the hydro morphology / geomorphology due to the changed gradients and other associated uncertainties.

7.9.30 The waterbodies designated under the WFD that have a risk of deterioration under this scheme, based upon current design assumptions are the River Colne (confluence with Chess to River Thames) and Colne Brook.

7.9.31 There is potential for a 10 to 15% saving on current potable water demand through the use of waste water recycling and/or reverse osmosis. Rainwater harvesting is expected to account for 2% of the additional demand. The potable demand will be met by Affinity Water whose WRMP concluded that there is a deficit in the water resource zone.

AoS Objective 12: To minimise flood risk and ensure resilience to climate change

7.9.32 The increase in impermeable areas for all schemes, without sufficient and suitable mitigation, could lead to runoff rates greater than the Greenfield rate resulting in increased risks of flooding elsewhere.

7.9.33 The Water and Flood Baseline report concludes that for Heathrow and Gatwick peak river flows would increase by 10% up to 2026 and by 25% up to 2086 and rainfall by 5% and 20% respectively. Subsequent to the publication of this report, the Environment Agency published revised climate change allowance guidance[16]. This revised guidance indicates that for Heathrow and Gatwick peak river flows could increase by 25% up to 2026 and by 70% up to 2086 and rainfall by up to 10% and 40% respectively. This may mean that developments on the floodplain and zones susceptible to groundwater flooding could be at risk from increases in rainfall intensity. An assumption has been made by calculating the future peak river flow predictions in the absence of major development. Risk of flooding from reservoirs at the proposed site is considered negligible.

7.9.34 This flood risk further increases in combination with future residential, commercial and infrastructure development that is planned by local authorities as part of their local development plans, or major infrastructure which is planned in support of the National Networks National Policy Statement. Due to the increased pressure on the available open space it is likely that the ability of nearby projects to provide further adaptation to provide mitigation for climate change will decrease due to airport expansion in combination with future development that is planned by local authorities as part of their local development plans. Cumulative effects are likely to be limited, as there are environmental and regulatory requirements which will seek to limit any negative effects.

7.9.35 Without appropriate mitigation all schemes could result in increased risks to the proposed development and sites elsewhere as a result of increased peak river/overland flows, runoff rates from across the scheme and altered volumes available for abstraction for water use. The scheme promoters of all schemes when undertaking this assessment of the flood risks have applied a 20% increase in peak flows and rainfall. During production of this document revised climate change guidance has been published by the Environment Agency[17] which will need to be incorporated into all three of the designs.

[16] Environment Agency, 2016. *Flood risk assessments*: *climate change allowances*. [online] Accessed 20/06/2016.
[17] Environment Agency, 2016. *Flood risk assessments: climate change allowances*. [online] Accessed 09/01/2016.

7.9.36 The WRMP incorporates an allowance for climate change; however, this only covers the period to 2050 due to limitations with available forecast figures and the restricted planning horizon reported in the WRMP. This demonstrates that sufficient water is available to meet potable and non-potable requirements.

7.9.37 The baseline water quantity scenarios for 2025 and 2050 for all schemes is based on continued, but constrained, growth at Gatwick and Heathrow without any major infrastructure construction.

7.9.38 For all three schemes, ecosystem services in relation to loss of flood storage will be reduced in the short to medium term at least until mitigation is established.

LGW-2R

7.9.39 Conservative Greenfield runoff rates have been used to estimate the required attenuation volumes. Two schemes have been put forward for the storage: a 'Business as Usual' scheme; and an 'Exemplar scheme'.

7.9.40 The Business as Usual scheme involves collector drains, tanks and culverts prior to pumping to an attenuation pond and discharge to the River Mole at Greenfield rates.

7.9.41 The discharge route for the entire site is not known which may mean that additional attenuation volumes are required, particularly to provide for a higher level estimate. This may mean that this is an increase in flood risk.

7.9.42 Further consideration will need to be given to flow path lengths and natural attenuation to ensure that changes to these and earlier discharge to the River Mole does not increase Greenfield runoff rates.

7.9.43 The Exemplar Scheme may provide a volume of storage near the Jacobs estimates; however refinement of the types of SuDs incorporated will need to be reviewed to ensure contamination is prevented.

7.9.44 Approximately half of the area proposed for the Gatwick development is located in Flood Zones 2 and 3 and is at risk from fluvial flooding. Flooding from the River Mole and Gatwick Stream are recognised problems in the area, with two flood risk alleviation schemes currently being implemented. The Upper Mole Flood Alleviation Scheme is anticipated to provide protection up to a 2% (1 in 50) Annual Exceedance Probability (AEP) flood event, whilst the Gatwick Stream Flood Alleviation Scheme is designed to provide protection up to 1% (1 in 100) AEP flood event. This situation should represent the baseline in 2025, however may not be sufficient to cover the predicted increases in peak river flows of between 35% and 70% by 2085. This in turn may impact on increased developed areas at risk outside the airport development.

7.9.45 The proposed area for the second runway and associated terminal buildings cover areas of medium surface water flood risk, with some areas to the west part of the site at high surface water risk. Risks of groundwater flooding at the proposed site are considered negligible.

7.9.46 To ensure that the scheme is able to adapt to meet the impacts of climate change, consideration has been given by the scheme promoter to the incorporation of additional peak rainfall in the design of the surface water drainage strategy. Further consideration of the latest climate change guidance for rainfall and river flows will need to be incorporated into the scheme design.

LHR-ENR

7.9.47 Elevated groundwater may also contribute to the surface water runoff to the ponds during significant rainfall events or prolonged wet periods. This may further reduce the attenuation volumes available.

7.9.48 The proposed runway will extend onto the floodplains of the River Colne, Wraysbury River and the Colne Brook. This will result in development occupying floodplain areas designated as Flood Risk Zones 2 and 3. However, the existing fluvial flood risk to Heathrow Airport, established from flood risk mapping and recent flood events, is low.

7.9.49 The development is expected to lead to a loss of up to 45 ha of undefended flood plain with only a 33 ha being set aside for compensation purposes. The assessment method used is also potentially leading to an underestimation of the loss of flood plain storage due to the scheme. The consequences of this loss of flood storage would be a direct increase of flood areas downstream of the site with the likely impact of increased risk to developed areas.

7.9.50 Analysis of surface water flood mapping indicates that there are isolated areas within the extended footprint that are at medium or high risk of surface water flooding.

7.9.51 Heathrow Airport and the proposed schemes are located on River Terrace Gravels, which are classified as Primary and Secondary Aquifers. Various groundwater studies have highlighted the potential for elevated groundwater levels and/or groundwater flooding in the area. It is considered that groundwater flood risk is a concern across the proposed site. No consideration appears to be given to the implications of climate change on the River Terrace Gravels, other than the scheme will be raised above existing ground levels.

7.9.52 To ensure that the scheme is able to adapt to meet the impacts of climate change consideration has been given by the scheme promoter to the incorporation of additional peak rainfall in the design of the surface water drainage strategy. Further consideration of the latest climate change guidance for rainfall and river flows will need to be incorporated into the scheme design, along with the potential impacts upon the River Terrace Gravels.

LHR-NWR

7.9.53 A high level assessment of the attenuation volume required for LHR-NWR has been undertaken. This may mean there is potential for more land being needed for additional attenuation. In addition the runoff rate is greater than the appropriate Greenfield rate. The consequence of these assumptions is that the attenuation volumes may also be under estimates. This is particularly a concern as the non-paved areas of the site draining to the ponds appear to have used a low value for the percentage runoff from hard standing which also drains to these ponds.

7.9.54 Elevated groundwater may also contribute to the surface water runoff to the ponds during significant rainfall events or prolonged wet periods. This may further reduce the attenuation volumes available.

7.9.55 The scheme promoter has used a greenfield estimate of 4l/s/ha which is greater than that calculated for the expected rate in the AC baseline assessment of 1l/s/ha.

7.9.56 The scheme promoter has assumed that there will be a SUDs scheme draining into attenuation tanks which will require pumping at Greenfield rates.

7.9.57 The proposed runway will extend onto the floodplains of the River Colne, Wraysbury River and the Colne Brook. This will result in development occupying floodplain areas designated as Flood Risk Zones 2 and 3. However, the existing fluvial flood risk to Heathrow Airport, established from flood risk mapping and recent flood events, is low.

7.9.58 The development is expected to lead to a loss of up to 40 ha of undefended flood plain with 47 ha being set aside for compensation purposes. This is likely to lead to an increase in the overall flood storage for the catchment. The progression of the mitigation solution design will need to detail how the mitigation will be achieved and how it will be implemented to ensure that there is no detrimental impact on the conveyance. Analysis of surface water flood mapping indicates that there are isolated areas within the extended footprint that are at medium or high risk of surface water flooding.

7.9.59 Heathrow Airport and the proposed new runway are located on River Terrace Gravels, which are classified as both Primary and Secondary Aquifers. Various groundwater studies have highlighted the potential for elevated groundwater levels and/or groundwater flooding in the area. It is considered that groundwater flood risk is a concern across the proposed site. There are also implications of climate change on flooding the River Terrace Gravels that would need to be taken into account.

7.9.60 To ensure that the scheme is able to adapt to meet the impacts of climate change consideration has been given by the scheme promoter to the incorporation of additional peak rainfall in the design of the surface water drainage strategy. Further consideration of the latest climate change guidance for rainfall and river flows will need to be incorporated into the scheme design, along with the potential impacts upon the River Terrace Gravels.

Objective 11: To Protect the Quality of Surface and Ground Waters, and Use Water Resources Sustainably

Question 18: Will Proposals Have Adverse Effects on the Achievement of the Environmental Objectives Established Under the Water Framework Directive?

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
Description of Impact (including receptor)	Physical impacts are considered in question 19 below. Water quality impacts arising from polluted runoff during construction and operation. The scheme could lead to a decrease in pesticides and herbicides applied to the land. A further risk during construction is posed by the historic landfill within the proposed development footprint, posing a risk if contaminants are mobilised. A number of measures would be considered to improve water quality. Waste water will continue to be sent to an expanded Crawley STW for treatment. Alternatively a local treatment plan would be installed to allow contaminated runoff to be treated on site. Additional sewage and waste water wetland treatment system would be built. To ensure that water resources are used efficiently rainwater harvesting will be installed along with other water saving design. Discharges could affect Glovers Wood SSSI which is hydrologically connected via minor watercourses to Gatwick although it is unlikely given its location upstream of the airport.	Physical impacts are considered in question 19 below. Water quality impacts arising from polluted runoff during construction and operation. A further risk during construction is posed by the historic landfill within the proposed development footprint, posing a risk if contaminants are mobilised. Two of the WFD water bodies in the study area are classified as having a 'Failing' chemical status, so a potential increase in pollutants could have a more magnified impact on these water bodies. A number of measures would be considered to improve water quality. Surface water quality monitoring would be undertaken in key risk construction areas in close proximity to surface watercourses and boreholes will be installed. A Sustainable Drainage Strategy will include dedicated areas for de-icing aircraft and a glycol recovery procedure to reduce the concentration of glycol within surface water runoff and separate storage tanks for 'clean' and 'first flush' surface water. Possible addition of a new STW with some of the treated water to be re-used for non-potable purposes within the airport. Re-use of surface water would be maximised, including rainwater harvesting,	Physical impacts are considered in question 19 below. Water quality impacts arising from polluted runoff during construction and operation. The scheme could lead to a decrease in pesticides and herbicides applied to the land. A further risk during construction is posed by the currently permitted and historic landfill within the proposed development footprint, posing a risk if contaminants are mobilised. Long term storage would be provided to delay the additional surface water volume from being discharged to watercourses, by infiltration, rainwater harvesting or by restricting the discharge rate to 2 litres per second per hectare (l/s/ha). Surface runoff from paved areas (which is likely to be contaminated) would receive at least two levels of treatment, including interception source control features. Clean water would be discharged and polluted water treated. The interceptor would also provide storage for any major spills. Polluted runoff would be attenuated within a polluted water holding tank and released for treatment at a rate agreed with the treatment plant operator; To ensure that water resources are used efficiently rainwater harvesting will be installed along with other water saving design. There is the potential for a 10 - 15% saving on current potable water demand from the use of wastewater recycling/reverse osmosis.

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
		which will be installed. There is potential for hydrological conditions to be altered on Staines Moor SSSI from diversion of the River Colne and this would need to be addressed during detailed design. There would also be works directly adjacent to King George VI Reservoir, which forms part of Staines Moor SSSI and SWLW SPA and nearby Wraysbury Reservoir (also part of the SWLW SPA). This could have negative effects; depending on design (also see Appendix A.5). There are a number of reservoirs and gravel pits which make up the SWLW SPA further downstream from the Airport, (see Appendix A.5 for effects on site integrity).	There is potential for hydrological conditions to be altered on Staines Moor SSSI from diversion of the River Colne and this would need to be addressed during detailed design. There are a number of reservoirs and gravel pits which make up the SWLW SPA further downstream from the Airport, (see Appendix A.5 for effects on site integrity).
Direct/ Indirect/ Cumulative	**Direct, Indirect and Cumulative** Cumulative effects may arise in combination with nearby development. Cumulative effects are likely to be limited, as it is reasonable to assume these developments would be constructed and operated in accordance with best practice.	**Direct, Indirect and Cumulative** Cumulative effects may arise in combination with nearby development. Cumulative effects are likely to be limited, as it is reasonable to assume these developments would be constructed and operated in accordance with best practice.	**Direct, Indirect and Cumulative** Cumulative effects may arise in combination with nearby development. Cumulative effects are likely to be limited, as it is reasonable to assume these developments would be constructed and operated in accordance with best practice.
Probability (High, Medium, Low, Very Low)	**High** There is a High probability of run-off containing some contaminants.	**High** There is a High probability of run-off containing some contaminants.	**High** There is a High probability of run-off containing some contaminants.
Phase, Duration (Long-term, Medium-term, Short-term), Frequency	**Construction and Operation, Long-term**	**Construction and Operation, Long-term**	**Construction and Operation, Long-term**

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
Permanent/ Temporary **Irreversible/ Reversible**	**Temporary, Reversible.**	**Temporary, Reversible.**	**Temporary, Reversible.**
Magnitude and Spatial Extent, incl. Transboundary	**Regional, Medium** Due to wider impacts on catchment and deterioration of chemical status.	**Regional, Medium** Due to wider impacts on catchment and deterioration of chemical status.	**Regional, Medium** Due to wider impacts on catchment and deterioration of chemical status.
Assumptions and Limitation	Assumed that best practice measures will be taken to minimise impacts. Later stages of the design will incorporate suitable measures to ensure that environmental standards are met in relation to the risks of preventing contaminated surface water runoff from the extended entering the watercourse. Assumed that the design incorporates pollution control measures proposed by the promoter. However, there will be some residual pollution at times. Assumed that no improvements will be made to the water environment to meet the interim WFD targets in 2021. Assumed that variations in the environmental permits can be secured for the discharge of any additional waste water flows and this water can be treated to required levels by technology currently available to the sewage undertaker.	Assumed that best practice measures will be taken to minimise impacts. Later stages of the design will incorporate suitable measures to ensure that environmental standards are met in relation to the risks of preventing contaminated surface water runoff from the extended entering the watercourse. Assumed that the design incorporates pollution control measures proposed. However, there will be some residual pollution at times. Scheme promoter has assumed that no improvements will be made to the water environment to meet the interim WFD targets in 2021. Assumed that hydraulic modelling to a sufficient level will be undertaken to understand the interaction between surface and ground waters to ensure appropriate mitigation is in place. Assumed that variations in the environmental permits can be secured for the discharge of any additional waste water flows and this water can be treated to required levels by	Assumed that best practice measures will be taken to minimise impacts. Later stages of the design will incorporate suitable measures to ensure that environmental standards are met in relation to the risks of preventing contaminated surface water runoff from the extended entering the watercourse. Assumed that the design incorporates pollution control measures proposed by the promoter, however there will be some residual pollution at times. Scheme promoter has assumed that no improvements will be made to the water environment to meet the interim WFD targets in 2021. Assumed that hydraulic modelling to a sufficient level will be undertaken to understand the interaction between surface and ground waters to ensure appropriate mitigation is in place. Assumed that variations in the environmental permits can be secured for the discharge of any additional waste water flows and this water can be treated to required levels by technology

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
		technology currently available to the sewage undertaker.	currently available to the sewage undertaker.
Significance	Negative effect (-)	Negative effect (-)	Negative effect (-)
	Direct, indirect and cumulative effects on water quality; high probability; long-term, occurring during construction and operation; temporary and reversible; effect is potentially regional in extent and of medium magnitude.	Direct, indirect and cumulative effects on water quality; high probability; long-term, occurring during construction and operation; temporary and reversible; effect is potentially regional in extent and of medium magnitude.	Direct, indirect and cumulative effects on water quality; high probability; long-term, occurring during construction and operation; temporary and reversible; effect is potentially regional in extent and of medium magnitude.

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
Description of Impact (including receptor)	Estimated that approximately 7 km of existing watercourse would be replaced with diverted/realigned channels. Of particular note is: the diversion of approximately 1 km of the River Mole to the west of the airport; and the diversion of the Crawter's Brook and the addition of a weir to compensate for a 2 m reduction in bed level at the Crawter's Brook/River Mole confluence. The diversion with appropriate mitigation will enhance the existing engineered channel as the River Mole would be removed from approximately 600 m of existing culvert and engineered channel. Whilst the weir has the potential to have impacts in terms of creating a barrier to flow and sediment processes as well as fish migration and can act as a segregating factor for the river corridor habitats. Changes to the sedimentation processes can lead to deterioration in water quality and could impact the waterbody status should the sediment contain contaminants. No new culverting is proposed.	Approximately 12 km of existing watercourse would be replaced with diverted/realigned channels and culverts. The diversions of the Colne Brook and Poyle Channel (approx. 5 km) around the west end of an extended north runway would be technically difficult and are likely to have effects on the hydro morphology/ geomorphology due to the changed gradients and other associated uncertainties. An initial estimate suggests there could be in excess of 12 km of additional culverts[18]. The Longford River, the Duke of Northumberland's River, River Colne and Wraysbury River would be culverted underneath the proposed runway. Water bodies are sensitive and extensive diversions/culverting would counteract improvements to waterbodies, including environmentally friendly flood schemes (as part of the Lower Colne Catchment flood scheme) maintaining open channels for Heathrow Terminal 5. The WFD strongly discourages culverting due to the detrimental impacts on the overall environment both that of the waterbody and the surrounding area. There are also significant cumulative impacts from culverting on the biodiversity, soils and landscape. Changes to the sedimentation processes can lead to deterioration in water quality and could impact the waterbody status should the sediment contain contaminants.	Approximately 12 km of existing watercourse would be replaced with diverted/realigned channels. Diversion of approximately 1 km of the Colne Brook around the western end of a new runway, diversions of parts of the Duke of Northumberland's River and River Colne to the south of the new runway and creation of a new channel (the 'River Colne Spur') would be technically difficult and affect the hydro morphology and geomorphology. Combining the River Colne and Wraysbury River into a single culvert and the Duke of Northumberland's and Longford Rivers into a single culvert would reduce total channel length and change the channel morphology including sediment processes with concurrent ecological implications. Approximately 3 km of currently open channels would be culverted. The water bodies are sensitive and extensive diversions/culverting would counteract improvements to waterbodies, including environmentally friendly flood schemes (as part of the Lower Colne Catchment flood scheme) maintaining open channels for Heathrow Terminal 5. The WFD strongly discourages culverting due to the detrimental impacts on the overall environment both that of the waterbody and the surrounding area. There are also significant cumulative impacts from culverting on the biodiversity, soils and landscape. Changes to the sedimentation processes can lead to deterioration in water quality and could impact the waterbody status should the

[18] Jacobs, 2014. *9. Water and Flood Risk: Water Quantity and Quality Assessment*, p. iii. [online] Accessed 05/01/2016.

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
			sediment contain contaminants.
Direct/ Indirect/ Cumulative	**Direct and Cumulative** Other projects which are planned nearby are unlikely to modify affected watercourses to the extent where any cumulative effects are significant.	**Direct and Cumulative** Other projects which are planned nearby are unlikely to modify affected watercourses to the extent where any cumulative effects are significant.	**Direct and Cumulative** Other projects which are planned nearby are unlikely to modify affected watercourses to the extent where any cumulative effects are significant.
Probability (High, Medium, Low, Very Low)	**High**	**High**	**High**
Phase, Duration (Long-term, Medium-term, Short-term), Frequency	**Construction, Operation, Long-term**	**Construction, Long-term**	**Construction, Long-term**
Permanent/ Temporary **Irreversible/ Reversible**	**Permanent, Irreversible**	**Permanent, Irreversible.**	**Permanent, Irreversible.**
Magnitude and Spatial Extent, incl. Transboundary	**Regional, Medium** Due to wider impacts on catchment and deterioration of ecological status.	**Regional, High** Due to wider impacts on catchment.	**Regional, High** Due to wider impacts on catchment.
Assumptions and Limitations	Detailed design and feasibility for channel modifications has not yet been undertaken and could provide further information on positive and negative effects on waterbodies.	Detailed design and feasibility for channel modifications has not yet been undertaken and could provide further information on positive and negative effects on waterbodies.	Detailed design and feasibility for channel modifications has not yet been undertaken and could provide further information on positive and negative effects on waterbodies.
Significance	Negative effect (-)	Significant Negative effect (--)	Significant Negative effect (--)
	Watercourse modification (approx. 7 km); direct and potentially cumulative effects; High	Watercourse modification (approx. 12 km) and culverting (12 km); direct and potentially	Watercourse modification (approx. 12 km) and culverting (3km); direct and potentially

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
	probability; effect will occur during construction and will be long-term throughout operation; effect is permanent and irreversible; medium magnitude and potential regional extent.	cumulative effects; High probability; effect will occur during construction and will be long-term throughout operation; effect is permanent and irreversible; high magnitude and potential regional extent.	cumulative effects; High probability; effect will occur during construction and will be long-term throughout operation; effect is permanent and irreversible; high magnitude and potential regional extent.

Question 20: Will It Result in the Loss in Productivity of Fisheries?

AoS Criteria	LGW-2R	LHR-ENR	LHR-NWR
Description of Impact (including receptor)	Replacement of 7 km of the existing watercourse with diverted/realigned channels and diversions of River Mole and Crawters Brook may cause a deterioration of the ecological status, which could affect the productivity of fisheries. In addition the creation of a weir may prevent the passage of fish.	Diversion of Colne Brook and Poyle Channel and culverting of the Longford River, the Duke of Northumberland's River, River Colne and Wraysbury River may affect the hydro morphology/geomorphology which may cause a deterioration of the ecological status, potentially affecting productivity of fisheries. Construction of approximately 12 km of culvert as part of the scheme would have negative impacts on fisheries. Fisheries could also be negatively impacted by residual water quality impacts from polluted runoff.	Shortlisted Scheme will result in the combination of the River Colne and Wraysbury River, which would reduce total channel length significantly and could fundamentally alter the channel morphology including sediment processes with concurrent adverse changes to ecological status. Construction of approximately 3km of culvert as part of the scheme would have adverse impacts on fisheries. The fisheries could also be negatively impacted through changes in runoff rates that could mobilise contaminated sediments along and the residual water quality impacts from polluted runoff and impact the waterbody status.
Direct/ Indirect/ Cumulative	**Direct, Indirect and Cumulative** Cumulative effects on fisheries may arise in combination with culverting of watercourses associated nearby development. The cumulative effects of any overshadowing are likely to be limited compared to the airport expansion.	**Direct, Indirect and Cumulative** Cumulative effects on fisheries may arise in combination with culverting of watercourses associated nearby development. The cumulative effects of any overshadowing are likely to be limited compared to the airport expansion.	**Direct, Indirect and Cumulative** Cumulative effects on fisheries may arise in combination with culverting of watercourses associated nearby development. The cumulative effects of any overshadowing are likely to be limited compared to the airport expansion.
Probability (High, Medium, Low, Very Low)	**High**	**High**	**High**
Phase, Duration (Long-term, Medium-term, Short-term), Frequency	**Construction and Operation, Long-term**	**Construction and Operation, Long-term**	**Construction and Operation, Long-term**
Permanent/ Temporary	**Permanent, Irreversible**	**Permanent, Irreversible**	**Permanent, Irreversible**

AoS Criteria	LGW-2R	LHR-ENR	LHR-NWR
Irreversible/ Reversible			
Magnitude and Spatial Extent, incl. Transboundary	**Regional, Medium** Due to wider impacts on catchment and deterioration of ecological status.	**Regional, High** Due to wider impacts on catchment and deterioration of ecological status.	**Regional, High** Due to wider impacts on catchment and deterioration of ecological status.
Assumptions and Limitations	No baseline information on current and future status of fisheries has been collected at a strategic level so a precautionary principle has been applied.	No baseline information on current and future status of fisheries has been collected at a strategic level so a precautionary principle has been applied	No baseline information on current and future status of fisheries has been collected at a strategic level so a precautionary principle has been applied
Significance	Negative effect (-)	Significant Negative effect (--)	Significant Negative effect (--)
	Effects on fisheries from modification of watercourses and change to water quality; effects are direct, indirect and cumulative; high probability; occurs during construction and operation; long-term, permanent and irreversible; medium magnitude and regional extent.	Effects on fisheries from modification of watercourses/ culverting and change to water quality; effects are direct, indirect and cumulative; high probability; occurs during construction and operation; long-term, permanent and irreversible; high magnitude and regional extent.	Effects on fisheries from modification of watercourses/ culverting and change to water quality; effects are direct, indirect and cumulative; high probability; occurs during construction and operation; long-term, permanent and irreversible; high magnitude and regional extent.

Question 21: Will It Lead to an Increase in the Consumption of Available Water Resources?

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
Description of Impact (including receptor)	Total annual potable water demands for 2025 and 2050 are 0.77 Mm^3/year (million cubic metres per year) and 1.33 Mm^3/year, respective increases of 0.05 Mm^3/year and 0.61 Mm^3/year from 2012 demands. A doubling of 2012 passenger numbers has been forecast after the completion of the second runway at Gatwick to 69.4 million per year by 2050, which despite water efficiency measures reducing demand per passenger by 10% to 0.0192 m^3 pp, a reduction on 0.0310 m^3 in 2010 would result in an increase in demand for water at the airport to 1.33 Mm^3pa by 2050. No figures are available for 2085 due to limitations in the forecast figures and information within the WRMP. Sutton and East Surrey Water state they currently have a surplus in the water resource zone and are completing resilience measures to supply Gatwick Airport from alternative water treatment works. Construction of the scheme will lead to short term increases in water demand.	Total annual potable water demands for 2026 and 2050 are 2.62 Mm^3/year and 3.76 Mm^3/year, respective increases of 0.32 Mm^3/year and 1.46 Mm^3/year from 2013 demands. A 77% increase in passenger numbers relative to 2013 has been forecast after the completion of the extended northern runway to 134.9 million per year by 2050. Rainwater harvesting is expected to account for 9% of the additional demand. Water efficiency measures are considered able to reduce the demand by 2 to 5%. Leakage reduction measures could also save up to 0.115 Mm^3. No figures are available for 2085 due to limitations in the forecast figures and information within the WRMP. The scheme promoter's submission outlines that the water demands for the Shortlisted Scheme can be feasibly met by increased abstraction from surface and/or groundwater. The Affinity Water WRMP concluded that there is a deficit in the Water Resource Zone that supplies Heathrow, in 2013 only 46% of the licensed volume was abstracted. Construction of the scheme will lead to short term increases in water demand.	Total annual potable water demands for 2026 and 2050 are 2.64 Mm^3/year (million cubic metres per year) and 3.94 Mm^3/year, respective increases of 0.34 Mm^3/year and 1.64 Mm^3/year from 2013 demands. An 86% increase in passenger numbers relative to 2013 has been forecast after the completion of the northwest runway to 150.7 million per year by 2050. Rainwater harvesting is expected to account for 2% of the additional demand. Water efficiency measures are considered able to reduce the demand by 2 to 5%. Leakage reduction measures could also save up to 0.115Mm^3. No figures are available for 2085 due to limitations in the forecast figures and information within the WRMP. Affinity Water has not been consulted; however the scheme promoter's submission outlines a reduction in the reliance on potable water supply from Affinity Water both with and without the scheme. The Affinity Water WRMP concluded that there is a deficit in the Water Resource Zone that supplies Heathrow, in 2013 only 46% of the licensed volume was abstracted. Construction of the scheme will lead to short term increases in water demand.
Direct/ Indirect/ Cumulative	**Direct, Cumulative** Cumulative effects on consumption of water may arise as a result of increased demand for water due	**Direct, Cumulative** Cumulative effects on consumption of water may arise as a result of increased demand for water	**Direct, Cumulative** Cumulative effects on consumption of water may arise as a result of increased

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
	to growth in population, attracted by nearby development. Cumulative effects are likely to be limited, as demand for water which arises from these developments will be considered as part of the long term supply plans for water suppliers.	due to growth in population, attracted by nearby development. Cumulative effects are likely to be limited, as demand for water which arises from these developments will be considered as part of the long term supply plans for water suppliers.	demand for water due to growth in population, attracted by nearby development. Cumulative effects are likely to be limited, as demand for water which arises from these developments will be considered as part of the long term supply plans for water suppliers.
Probability (High, Medium, Low, Very Low)	**High**	**High**	**High**
Phase, Duration (Long-term, Medium-term, Short-term), Frequency	**Construction and Operation, Long-term, Continual**	**Construction and Operation, Long-term, Continual**	**Construction and Operation, Long-term, Continual**
Permanent/ Temporary **Irreversible/ Reversible**	**Permanent, Irreversible**	**Permanent, Irreversible**	**Permanent, Irreversible**
Magnitude and Spatial Extent, incl. Transboundary	**Regional, High**	**Regional, High**	**Regional, High**
Assumptions and Limitations	Uncertainty in the forecast baseline for 2025/2026, related to: passenger numbers; staff numbers; and implementation of water efficiency measures covering both passenger use and operational requirements. It has been assumed that 100% of the water supplied to Gatwick Airport is via piped mains water from Sutton and East Surrey Water.	Uncertainty in the forecast baseline for 2025/2026, related to: passenger numbers; staff numbers; and implementation of water efficiency measures covering both passenger use and operational requirements. The lack of distinction between the two components of the scheme, airport extension and hub interchange, has led to a level of uncertainty with regard to the calculation of impacts on water resources from the scheme promoters submission.	Uncertainty in the forecast baseline for 2025/2026, related to: passenger numbers; staff numbers; and implementation of water efficiency measures covering both passenger use and operational requirements.

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
Significance	Significant Negative effect (--)	Significant Negative effect (--)	Significant Negative effect (--)
	Increased water consumption is direct and cumulative effects; high probability; occurring during construction and operation; long term, permanent and irreversible; High magnitude and regional extent.	Increased water consumption is direct and cumulative effects; high probability; occurring during construction and operation; long term, permanent and irreversible; High magnitude and regional extent.	Increased water consumption is direct and cumulative effects; high probability; occurring during construction and operation; long term, permanent and irreversible; High magnitude and regional extent.

Objective 12: To Minimise Flood Risk and Ensure Resilience to Climate Change

Question 22: Will It Increase Flood Risk Through Increased Run Off?

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
Description of Impact (including receptor)	Increase in impermeable areas, without suitable mitigation, could lead to runoff rates greater than the greenfield rate resulting in increased risks of flooding elsewhere. There are methods of reducing flood risk. Conservative greenfield runoff rates have been used to estimate the required attenuation volumes. Two schemes have been put forward for the storage a 'Business as Usual' and an 'Exemplar scheme'. Business as Usual scheme involves collector drains, tanks and culverts prior to pumping to an attenuation pond and discharge to the River Mole at greenfield rates. Discharge route for entire site is not known, meaning additional attenuation volumes are required. This may mean that this is an increase in flood risk. Exemplar Scheme may provide a volume of storage near the Jacobs estimates; however, refinement of the types of SuDs incorporated will need to be reviewed to ensure contamination is prevented.	Increase in impermeable areas, without suitable mitigation, could lead to runoff rates greater than the greenfield rate resulting in increased risks of flooding elsewhere. There are methods of reducing flood risk. Scheme promoter may need to update method for estimating the attenuation requirements as more appropriate methodologies are available. Despite this the volume is similar to estimates by Jacobs. Elevated groundwater may also contribute to the surface water runoff to the ponds during significant rainfall events or prolonged wet periods. This may further reduce the attenuation volumes available.	Increase in impermeable areas, without suitable mitigation, could lead to runoff rates greater than the greenfield rate resulting in increased risks of flooding elsewhere. There are methods of reducing flood risk. Scheme promoter appears to have underestimated the attenuation volume required based upon Jacobs assessment and may need to revaluate findings as a design stage. In addition the runoff rate is greater than the appropriate greenfield rate. As a consequence the attenuation volumes may be underestimates. This is particularly a concern as non-paved areas draining to the ponds appears to have used a low value for the percentage runoff from hard standing which also drains to these ponds. Elevated groundwater may contribute to the surface water runoff to the ponds during significant rainfall events or prolonged wet periods. This may further reduce the attenuation volumes available. Scheme promoter has used a greenfield estimate of 4l/s/ha which is greater than that calculated for the expected rate in the AC baseline assessment of 1l/s/ha. Scheme promoter has assumed that there will be a SUDs scheme draining into attenuation tanks which will require pumping at greenfield rates.
Direct/ Indirect/ Cumulative	**Direct and Cumulative** Flood risk may increase due to an increase in impermeable areas in combination with	**Direct and Cumulative** Flood risk may increase due to an increase in impermeable areas in combination with future	**Direct and Cumulative** Flood risk may increase due to an increase in impermeable areas in combination with

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
	future development. Cumulative effects are likely to be limited, through regulatory requirements.	development. Cumulative effects are likely to be limited, through regulatory requirements.	future development. Cumulative effects are likely to be limited, through regulatory requirements.
Probability (High, Medium, Low, Very Low)	**Low (Exemplar Scheme) to High (business as Usual Scheme)**	**Medium to High**	**Low to Medium**
Phase, Duration (Long-term, Medium-term, Short-term), Frequency	**Construction and Operation, Long-term, Intermittent**	**Construction and Operation, Long-term, Intermittent**	**Construction and Operation, Long-term, Intermittent**
Permanent/ Temporary **Irreversible/ Reversible**	**Permanent, Reversible**	**Permanent, Reversible**	**Permanent; Reversible**
Magnitude and Spatial Extent, incl. Transboundary	**Local, Low**	**Local, Medium**	**Local, Medium**
Assumptions and Limitations	Verification of scheme promoter's model will need to be undertaken against the 2013 flooding to ensure that drainage infrastructure is outside of this flood envelope. Drainage infrastructure is reliant on pumping and may have little resilience to associated risks of pump failure. Surface water attenuation requirements have been based upon application of climate change allowances for a design life of 2050, which differs from the assumed development lifetime to 2085.	Resilience of pumping would need to be assessed further. A Critical Drainage Area is located within the scheme boundary and would need to be considered in flood risk assessment. Calculations and design for surface water runoff should be considered as preliminary at this stage[19]. Surface water attenuation requirements have been based upon application of climate change allowances for a design life of 2055-2085, which differs from the assumed development lifetime to 2086.	Further consideration of risks from Surface Water flooding as identified by the Environment Agency flood maps. A Critical Drainage Area is located within the scheme boundary and would need to be considered in flood risk assessment. Calculations and design for surface water runoff should be considered as preliminary at this stage[20]. Surface water attenuation requirements have been based upon application of climate change allowances for a design life of 2055-2085, which differs from the assumed development lifetime to 2086.

[19] Jacobs, 2014. *9. Water and Flood Risk: Flood Risk Assessment*, p. 64. [online] Accessed 05/01/2016.
[20] Jacobs, 2014. *9. Water and Flood Risk: Flood Risk Assessment*, p. 45. [online] Accessed 05/01/2016.

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
Significance	Negative effect (-)	Negative effect (-)	Negative effect (-)
	Direct and cumulative effects from increased flood risk from impermeable area (design incorporates some mitigation); probability low to high dependent on design; occurs during construction and operation; long-term and intermittent; permanent and reversible; low magnitude and local extent.	Direct and cumulative effects from increased flood risk from impermeable area (design incorporates some mitigation); probability medium to high dependent on design; occurs during construction and operation; long-term and intermittent; permanent and reversible; medium magnitude and local extent.	Direct and cumulative effects from increased flood risk from impermeable area (design incorporates some mitigation); probability medium to high dependent on design; occurs during construction and operation; long-term and intermittent; permanent and reversible; medium magnitude and local extent.

Question 23: Will It Increase Area of Development Within Areas at Risk Of Flooding?

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
Description of Impact (including receptor)	Approximately half of the area proposed for development is located in Flood Zones 2 and 3 and at risk from fluvial flooding. Flooding from the River Mole and Gatwick Stream are recognised problems in the area, with two flood risk alleviation schemes currently being implemented. The Upper Mole Flood Alleviation Scheme is anticipated to provide protection up to a 2% AEP flood event, whilst the Gatwick Stream Flood Alleviation Scheme is designed to provide protection up to a 1% event. This situation should represent the baseline in 2025, however may not be sufficient to cover the predicted increases in peak river flows of between 35% and 70% by 2085. This in turn may impact on increased developed areas at risk outside the airport development. Proposed area for the runway and terminal buildings cover areas of medium surface water flood risk, with areas to the west of the site at high surface water risk. Risks of groundwater flooding or flooding from reservoirs at the proposed site are considered negligible. Peak flow and rainfall is expected in increase from the baseline to 2086, meaning that developments on the floodplain and zones susceptible to groundwater flooding could be at risk from increases in rainfall intensity.	Proposed runway will extend onto the floodplains of the River Colne, Wraysbury River and the Colne Brook, resulting in occupying floodplain areas designated as Flood Risk Zones 2 and 3. The existing fluvial flood risk to Heathrow Airport is low. Development is expected to lead to a loss of up to 45 ha of undefended flood plain with only a 33 ha being set aside for compensation purposes. Assessment method has potentially led to an underestimation of the loss of flood plain storage. Consequences of this flood storage loss would be direct increase of flood areas downstream, with the likely impact of increased risk to developed areas. There are isolated areas within the extended footprint that are at medium or high risk of surface water flooding. Heathrow Airport and the proposed new runway are located on River Terrace Gravels, which is classified as Primary and Secondary Aquifers. There is the potential for elevated groundwater levels and/or groundwater flooding in the area. Risk of flooding from reservoirs is considered negligible. Peak flow and rainfall is expected in increase from the baseline to 2086, meaning that developments on the floodplain and zones susceptible to groundwater flooding could be at risk from increases in rainfall intensity.	Proposed runway will extend onto the floodplains of the River Colne, Wraysbury River and the Colne Brook, resulting in development occupying floodplain areas designated as Flood Risk Zones 2 and 3. The existing fluvial flood risk to Heathrow Airport is low. Development is expected to lead to a loss of up to 40 ha of undefended flood plain with 47 ha being set aside for compensation purposes. This is likely to lead to an increase in the overall flood storage for the catchment. The assessment of the mitigation solution does not detail how the mitigation will be achieved or if it can be implemented without detrimental impact on the conveyance. There are isolated areas within the extended footprint that are at medium or high risk of surface water flooding. Heathrow Airport and proposed new runway are located on River Terrace Gravels, which is classified as Primary and Secondary Aquifers. There is the potential for elevated groundwater levels and/or groundwater flooding in the area. It is considered that groundwater flood risk is a concern across the proposed site. Risk of flooding from reservoirs at the proposed site is considered negligible. Peak flow and rainfall is expected in increase from the baseline to 2086, meaning that developments on the floodplain and zones susceptible to groundwater flooding could be at risk from increases in rainfall intensity.

SEA Criteria	LGW-2R	LHR-ENR	LHR-NWR
Direct/ Indirect/ Cumulative	**Direct and Cumulative** The area of development on areas as risk of flooding will increase due to combination with future development. Cumulative effects are likely to be limited by regulatory requirements.	**Direct and Cumulative** The area of development on areas as risk of flooding will increase due to combination with future development. Cumulative effects are likely to be limited by regulatory requirements.	**Direct and Cumulative** The area of development on areas as risk of flooding will increase due to combination with future development. Cumulative effects are likely to be limited by regulatory requirements.
Probability (High, Medium, Low, Very Low)	**Medium – High**	**Medium**	**Medium**
Phase, Duration (Long-term, Medium-term, Short-term), Frequency	**Operation, Long-term, Intermittent**	**Operation, Long-term, Intermittent**	**Operation, Long-term, Intermittent**
Permanent/ Temporary **Irreversible/ Reversible**	**Permanent, Irreversible**	**Permanent, Irreversible**	**Permanent, Irreversible**
Magnitude and Spatial Extent, incl. Transboundary	**Local, Medium**	**Local, High**	**Local, Low**
Assumptions and Limitations	Future peak river flow predictions, and therefore flood risk, are calculated in the absence of major development.	Future peak river flow predictions, and therefore flood risk, are calculated in the absence of major development.	Future peak river flow predictions are calculated in the absence of major development.
Significance	Negative effect (-)	Significant Negative effect (--)	Neutral effect (0)
	Direct and cumulative effects from increased development in areas at risk of flooding; medium to high probability; occurs during operation; long-term and intermittent; permanent and irreversible; medium magnitude and local extent.	Direct and cumulative effects from increased development in areas at risk of flooding; medium probability; occurs during operation; long-term but rare frequency; permanent and irreversible; high magnitude and local extent.	Direct and cumulative effects from increased development in areas at risk of flooding; medium probability; occurs during operation; long-term but rare frequency; permanent and irreversible; low magnitude and local extent.

Question 24: Will It Be Able to Adapt to Climate Change?

AoS Criteria	LGW-2R	LHR-ENR	LHR-NWR
Description of Impact (including receptor)	Without appropriate mitigation the scheme could result in increased risks to itself and sites elsewhere as a result of increased peak river/overland flows, runoff rates from across the scheme and altered volumes available for abstraction for water use. Scheme promoter has applied a 20% increase in peak flows and rainfall; a 40% allowance will need to be assessed to be compliant with current guidance. The WRMP demonstrates that sufficient water is available to meet potable and non-potable requirements.	Without appropriate mitigation the scheme could result in increased risks to itself and sites elsewhere as a result of increased peak river/overland flows, runoff rates from across scheme and altered volumes available for abstraction for water use. Scheme promoter has applied a 20% increase in peak flows and rainfall; a 40% allowance will need to be assessed to be compliant with current guidance. No consideration appears to be given to the implications of climate change on the River Terrace Gravels, other than the scheme will be raised above existing ground levels, no consideration is given to the implications of raised ground levels across the wider area. The WRMP demonstrates that sufficient water is available to meet potable and non- potable requirements.	Without appropriate mitigation the scheme could result in increased risks to itself and sites elsewhere as a result of increased peak river/overland flows, runoff rates from across the scheme and altered volumes available for abstraction for water use. Scheme promoter has applied a 20% increase in peak flows and rainfall; a 40% allowance will need to be assessed to be compliant with current guidance. The scheme promoter has also used the Environment Agency's Flood Zone 2 as a proxy for the impacts of climate change. No consideration appears to be given to the implications of climate change on the River Terrace Gravels. The WRMP demonstrates that sufficient water is available to meet potable and non-potable requirements.
Direct/ Indirect/ Cumulative	**Direct and Cumulative** The ability of nearby projects to adapt to climate change will decrease due to airport expansion in combination with future authorities. Cumulative effects are likely to be limited, as there are environmental and regulatory requirements which will seek to limit any negative effects.	**Direct and Cumulative** The ability of nearby projects to adapt to climate change will decrease due to airport expansion in combination with future development that is planned by local authorities as part of their local development plans. Cumulative effects are likely to be limited, as there are environmental and regulatory requirements which will seek to limit any negative effects.	**Direct and Cumulative** The ability of nearby projects to adapt to climate change will decrease due to airport expansion in combination with future development that is planned by local authorities as part of their local development plans. Cumulative effects are likely to be limited, as there are environmental and regulatory requirements which will seek to limit any negative effects.
Probability (High, Medium, Low, Very Low)	**Low to Medium**	**Low to Medium**	**Low to Medium**

AoS Criteria	LGW-2R	LHR-ENR	LHR-NWR
Phase, Duration (Long-term, Medium-term, Short-term), Frequency	**Operation, Long-term**	**Operation, Long-term**	**Operation, Long-term**
Permanent/ Temporary **Irreversible/ Reversible**	**Permanent, Irreversible**	**Permanent, Irreversible**	**Permanent, Irreversible**
Magnitude and Spatial Extent, incl. Transboundary	**Regional, Low**	**Regional, Low**	**Regional, Low**
Assumptions and Limitations	Baseline water quantity scenarios for 2025 and 2050 is based on continued, but constrained, growth at Gatwick and Heathrow without any major infrastructure construction.	Baseline water quantity scenarios for 2025 and 2050 is based on continued, but constrained, growth at Gatwick and Heathrow without any major infrastructure construction.	Baseline water quantity scenarios for 2025 and 2050 is based on continued, but constrained, growth at Gatwick and Heathrow without any major infrastructure construction.
Significance	Negative effect (-)	Negative effect (-)	Negative effect (-)
	Adaptation to climate change; direct and cumulative; low to medium; occurs during operation, long-term; permanent and irreversible; low magnitude and regional extent.	Adaptation to climate change; direct and cumulative; low to medium; occurs during operation, long-term; permanent and irreversible; low magnitude and regional extent.	Adaptation to climate change; direct and cumulative; low to medium; occurs during operation, long-term; permanent and irreversible; low magnitude and regional extent.

7.10 MITIGATION

7.10.1 Mitigation of detrimental impact is an essential part of any major infrastructure project but the fundamental principle must still be that in the first instance efforts should be made to prevent or avoid impact. If this is not possible the impact should be minimised and only then should compensation be considered. The scheme promoters should aim to design the schemes to achieve exemplar standards and an overall net environmental gain, where possible seeking opportunities for wider environmental enhancement.

7.10.2 The development proposals should seek to pursue an exemplar approach to proposed mitigation and enhancement measures, in particular with regards to meeting WFD objectives.

7.10.3 To ensure the status and integrity of the water environment is maintained and enhanced and there are no negative impacts during the project construction and operation, it is essential that effective mitigation of elemental impact is considered as an integral part of the design. The following mitigation measures are starting points and will need to be considered, developed and enhanced by any applicant:

7.10.4 The scheme will need to be developed in consultation with all the regulatory bodies and relevant stakeholders.

7.10.5 A WFD assessment will be required to support the proposals. This could demonstrate that the 2021 and 2027 targets can be achieved as well as maintaining the longer term status (including allowance for the potential changes for risk elements such as climate change) of the waterbodies through avoiding or at worse minimising the negative impacts (this would require passing an Article 4.7 test) in terms of:

- Biological quality
- Hydro morphological quality
- Physical-chemical quality
- Chemical quality

7.10.6 The scheme will need to be developed to ensure that it is safe from flooding and will not increase flood risk elsewhere from all sources.

7.10.7 The WRMP could be refined to ensure that a full account of the water requirements over the lifetime of the proposed scheme is assessed; this could also incorporate foul water treatment and discharge to ensure the protection of the wider environment.

7.10.8 A water efficiency and minimisation plan will need to be developed to detail how potable water use will be minimised during the operational phase of the scheme.

7.10.9 There is a potential conflict between the need to manage bird strike (i.e. discourage use of the area by birds) and new open watercourses (to compensate for watercourses lost to development). Methods such as netting of open water bodies could have a detrimental impact on the water environment such as loss of biodiversity. Innovative environmental measures to reduce the risk of bird strikes could be researched and incorporated where possible to reduce the impact on the water environment, so the applicable standards (including the WFD) are not compromised.

7.10.10 The applicant will need to assess the impacts of the scheme design and the on and off site mitigation in relation to how it will interlink as a whole and how it links to the wider water environment (on a catchment scale as well as between, water quality, quantity, preferential flow paths and surface/groundwater interactions).

7.10.11 Detailed design of realigned watercourses will need to be undertaken sensitively, incorporating natural features and being similar in characteristics (where appropriate) to the old/existing natural channel. As well as ensuring that all relevant standards are met they could consider the following:

- Incorporate variations in flow, depth and width to provide a variety of habitats
- Materials used could be environmentally appropriate and include timber and local rock rather than concrete or sheet piling
- Landscape plans could be formulated to minimise the visual impact of artificial structures
- Realigned channel could be similar in length, width, depth and gradient to the old (original) channel
- Design could incorporate similar bed material to the original channel and be consistent with that of surrounding watercourses
- Banks could be vegetated with native species
- Channel design to be able to convey high and low flows
- Transfer of original/natural substrate to realigned channel
- River length, width, depth and gradient not to compromise flow conveyance in downstream/upstream reaches and channels
- Design could consider areas of contaminated land. Mitigation could include lining of the channel
- Channel culverting could be undertaken in accordance with the Environment Agency Culvert Guidelines and CIRIA Culvert Design and Operation Guide
- The outfalls to watercourses could be designed so that they:
  - Direct the discharge downstream to minimise impacts to flow patterns
  - Direct the discharge away from the banks of the river to minimise any potential risk of erosion
  - Minimising the size/extent of the outfall where possible to reduce the potential impact on the banks

7.10.12 Further detail could be provided for LHR-ENR as to how the Colne Brook could be diverted, whether this would be through the construction of a natural or concrete channel. This would improve prediction of impacts.

7.10.13 Culverting the Longford River, the Duke of Northumberland's River, River Colne and Wraysbury River beneath the proposed runway in LHR-NWR would probably have significant negative residual impacts. There is considerable scientific literature showing that certain impacts of culverts are largely unable to be mitigated, because of this the normal method is for the impact to be offset. For larger sections of culverting the role of the habitat lost in the wider environment must be assessed in order for the compensation to be appropriately designed.

7.10.14 In all three instances it is recognised (from other case studies and prior experience) that (for example) despite mitigation at airports, contaminants such as de-icers do reach receiving watercourses at certain times as no water quality treatment solution is 100% effective. Depending on quantity and frequency of such discharges there is a potential for a negative residual effect on WFD physico-chemical status despite mitigation commitments. Under such conditions it may be necessary to offset the deterioration in quality with quantitative improvement measures. The impact is such that it is likely that the impact will be required to progress through the Article 4.7 of the WFD route.

7.10.15 Opportunities should be explored to enhance existing waterbodies to provide strong wider environmental benefit, particularly in terms of biodiversity, geomorphology and WFD, amongst others. In particular such opportunities exist at Gatwick and consideration should be given to moving the River Mole out of its existing culvert, and enhancing the Crawters Brook.

7.10.16 The provision of a quantitative compensation approach would provide significant opportunity to enhance aspects of the water environment both in term of flood risk management and water environmental terms. Such offsetting can be located away from the immediate area where the loss of attribute occurred and so could be more tailor-made to achieve a specific wider goal.

7.11 ASSUMPTIONS AND LIMITATIONS

7.11.1 The assessment has been based upon information as set out within the scheme promoters' documents and by the AC having regard to current standard best practice mitigation which it is assumed will be applied as a minimum.

7.11.2 The most recent climate change guidance for flood risk assessment[21] was not considered in the source material and has only been considered in general terms in this document. It is anticipated that updated guidance will be used for flood risk assessment as part of detailed design.

7.11.3 Attenuation requirements have been based on a high level calculation and this should be revisited during project design.

7.11.4 It has been assumed that there would be no changes to de-icing practice or management would occur (other than an increase in load proportional to the increase in peak winter aircraft movements). There would be no new technologies that would substantially change the issues relating to de-icer recycling.

7.11.5 Per passenger water consumption rates have remained constant from those reported in 2012 for Gatwick Airport and in 2013 for Heathrow Airport.

7.11.6 Gatwick Airport uses potable water to meet all demands; water is supplied via piped mains water from Sutton and East Surrey Water and Heathrow Airport is primarily supplied by a potable mains supply provided by Affinity Water (81%), on site boreholes (19%) and a limited contribution from rainwater harvesting options.

7.11.7 The baseline water quantity scenarios for 2025 and 2050 is based on continued, but constrained, growth at Gatwick and Heathrow without any major infrastructure construction.

[21] Environment Agency, 2016. *Flood risk assessments: climate change allowances*. [online] Accessed 20/06/2016.

The assessment was not extended further to 2085, which is the lifespan of the project, due to the limitations with available forecast figures and the restricted planning horizon reported in the WRMP.

7.11.8 It has been assumed that no improvements will be made to the water environment to meet the interim WFD targets in 2021. Any improvements are likely to alter the baseline conditions. Reviews of the current WFD objectives in the relevant Catchment Management Plan show that water bodies are as a rule classified as “heavily modified” and while some are of poor or moderate quality improvements are scheduled for the 2027 target. This assessment has been largely undertaken prior to the publication of the 2015 RBMP, the latest objectives will need to be fully reviewed and suitably referred to during the implementation phase. In terms of the current quality and 2027 predicted quality as detailed in the latest RBMP, there have been movements both in terms of water body improvements and degradation over the study area, with more improvements, thus increasing baseline quality.

7.11.9 Where a detrimental impact has been identified the scoring of the impact has been based on the reported mitigation proposal, in the mitigation section of this assessment further comments were made relating to the potential for limiting any detrimental impacts. This assessment cannot fully consider the potential for fully applying the mitigation pyramid (avoid, minimise, compensate) to these schemes as this would require consideration of the design rationale. However the assessment has identified several areas, such as the weir at Gatwick, where if mitigation was considered in parallel with the design it is likely that an alternative solution could be found avoiding the need for the new structure.

7.11.10 There are a number of limitations identified at the strategic level due to the limited information on drainage design and use of methods to calculate run-off and attenuation. It is assumed that these would need to be addressed during detailed project design.

7.11.11 The three schemes assess their potential impacts on the water environment to different degrees, the Gatwick submission is the most detailed, whereas the LHR-ENR scheme assess the potential implications in less detail. However, it is assumed in this assessment that more detailed design and mitigation can be applied during scheme development for all three schemes.

7.11.12 The implications of the changes required to facilitate surface access to the three schemes are not fully assessed within this annex as they were not finalised at the time of preparation. One way in which the implications may impact the water environment is additional lengths of culvert. Other aspects such as flood risk will be managed and mitigated through the individual proposals in accordance with current policies and best practice.

7.12 CONCLUSIONS

7.12.1 The three shortlisted schemes would all impact the water environment in different ways. Some of the impacts have the potential to be similar, for example the discharge of waters contaminated with de-icer, whereas for some impacts there is a clear variation in the degree of impact between the schemes, for example the Heathrow schemes both involve significantly greater impacts upon existing waterbodies and flood risk.

AoS Objective 11: To protect the quality of surface and ground waters, and use water resources sustainably

7.12.2 Each of the shortlisted schemes would increase the risk to the water environment especially in regards to quality of the surface and ground waters mainly through the discharge of waters contaminated with de-icer along with hydrocarbons and other pollutants. In addition, there are cumulative risks such as that of the currently permitted and historic landfill within the footprints of the schemes, which could lead to negative impacts during construction should the contaminants or landfill gas be mobilised during construction. All schemes make a commitment to use water resources efficiently and incorporate measures within the terminal building(s) to reduce water use along with rainwater harvesting.

7.12.3 Detailed design and feasibility for channel modifications has not yet been undertaken and could provide further information on positive and negative effects on waterbodies. The current information cannot confirm or rule out that detailed design could remove the potential for deterioration of the waterbody status under the WFD. The current plan level design and associated impacts are that Gatwick will have some benefits from the deculverting work (600m of the 7km of watercourse alterations), while the two LHR schemes require increased culverting of watercourses. A provisional estimate of the LHR-NWR scheme shows that approximately 3km (of the total 12km of watercourse alterations) of currently open channels would be culverted by the proposals whereby the LHR-ENR scheme would lead to approximately an additional 12km of culvert. The extent of culverting for either of these schemes is unusual, as the current policy of the Environment Agency is to minimise the length of any culvert, these lengths must be classified as very significant. This is due to the fact that the impacts of culverts these lengths are considered largely not to be possible to offset by direct mitigation[22]. Instead the impact would have to be compensated for through the provision of enhancement of alternative water environment attributes such as additional fish habitats, ponds etc.

7.12.4 The size and nature of all three schemes mean that they will all require the modification of watercourses. However, the modifications required at Gatwick would be significantly less/fewer than at Heathrow. Modifications of open water bodies are not necessarily detrimental, especially as many of the existing features are highly channelized. These schemes could provide options to return the heavily modified waterbodies to a more naturalised state. New modified watercourses can be designed to bring an engineered feature back to its original state.

7.12.5 All three schemes by their nature will lead to an increase in the consumption of available water resources. The WRMP for the relevant water companies show that there is sufficient capacity. Further assessment as to the long term environmental impacts of abstractions is undertaken should new/modified licences be required. All of the schemes include measures such as rainwater harvesting to reduce the reliance and need upon abstracted water.

7.12.6 Within assessment, the LHR-ENR scheme is considered to perform the worst in relation to this Objective as there is the far higher potential for different watercourses to be combined (e.g. into one channel) as they are realigned, and partially culverted, with the significant reduction in the available habitat.

7.12.7 It should be noted that there is a potential conflict between the need to manage bird strikes for which the introduction of new open watercourses is a negative impact. The alternatives for managing this will most likely also include netting of open water bodies something that potentially will have a detrimental impact on the water environment especially the management of water bodies.

[22] Jacobs, 2014. 9. *Water and Flood Risk: Water Quantity and Quality Assessment*, p. 36. [online] Accessed 05/01/2016.

7.12.8 For all three schemes, ecosystem services will be affected in the short to medium term at least, until mitigation is established. Ecosystem services include the provision of freshwater supply which will be disrupted and reduction in the capacity to purify water.

7.12.9 The assessment has found that all three of the schemes would be likely to result in deterioration of the water environment particularly in terms of the WFD. Consequently, the design for all preferred schemes would be required to progress through consideration of Article 4.7 of the WFD, which requires environmental effects to be outweighed by a greater public need (in this case for an airport development). Article 4.7 of the WFD assessment is considered when all stage-appropriate design processes have been completed, and no technically feasible or economically viable alternatives have been identified. The design and assessment processes for the shortlisted schemes have not yet reached this stage as potentially deliverable schemes are under consideration at a policy level.

7.12.10 Appendix B outlines the long-list of alternatives considered by the AC and this report considers the three short-listed schemes. Proposals in the long list in Appendix B have been discounted for a number of reasons including strategic fit, economic impact, surface access requirements, environmental impact, passenger requirements, cost, operational viability and delivery risk.

7.12.11 It is clear from the assessment that based on the current design solutions an appraisal under Article 4.7 would be need to be carried out in relation to each of the schemes. This is because each scheme results in an effective barrier to passage in both water and ecological terms, which would result in a decrease in waterbody status under the WFD.

7.12.12 Project level design would need to determine whether the detrimental impact can be mitigated, offset and where a like for like replacement is not possible, compensation within a wider environmental framework should be acceptable.

AoS Objective 12: To minimise flood risk and ensure resilience to climate change. This is covered through the questions below

7.12.13 All the schemes incorporate high level surface water drainage strategies to demonstrate that they can provide a robust approach to providing the required attenuation. All the scheme promoters have approached this differently and there are elements of each that will need to be refined during detailed design. In particular strategies that rely on pumping must demonstrate not only that sufficient pump rates and resulting storage can be achieved but also that exceedance flows can be managed. Some of the schemes will need to refine their approach to the calculations of Greenfield runoff and the resulting storage volumes. Overall the LGW-2R scheme is the most detailed and the potential for an exemplar surface water management scheme is provided, while the LHR-ENR scheme is the least detailed. However, it is acknowledged that there is potential for all three schemes to improve surface water management through detailed design having regard to current standard practice mitigation which it is assumed will be applied as a minimum .

7.12.14 The schemes all demonstrate how the operational sites will be defended but there are losses of flood plain storage in all cases. Loss of flood plain storage may lead to an increase in the area outside the airport that is affected by flooding. The Gatwick scheme has solutions in place to deal with the impacts up till 2085. LHR-ENR would lead to a significant loss of flood plain while LHR-NWR will be able to increase the amount of flood plain storage within the catchment and therefore may even be able to have a positive impact on the local flood risk.

7.12.15 The schemes all demonstrate how they will minimise their risks to climate change, particularly looking at flood risk to the site and elsewhere, surface water runoff rates and potable water supply. Gatwick provides clear evidence of how they intend to manage this while the two Heathrow schemes are giving inconclusive evidence in how they intend to give consideration to the Terrace Gravels and associated groundwater. This is important as climate change may impact the associated flood risk or associated water quantity.

7.12.16 In terms of flood risk, water quality and quantity all the schemes have impacts to varying degrees for which mitigation is proposed. No one scheme stands apart from the others in terms of a lower impact on the water environment apart from LHR-ENR which is worse in terms of the magnitude of the flood risk impact and has been assessed as a Significant Negative effect.

7.12.17 For all three schemes, ecosystem services in relation to loss of flood storage, will be affected in the short to medium term at least until mitigation is established.