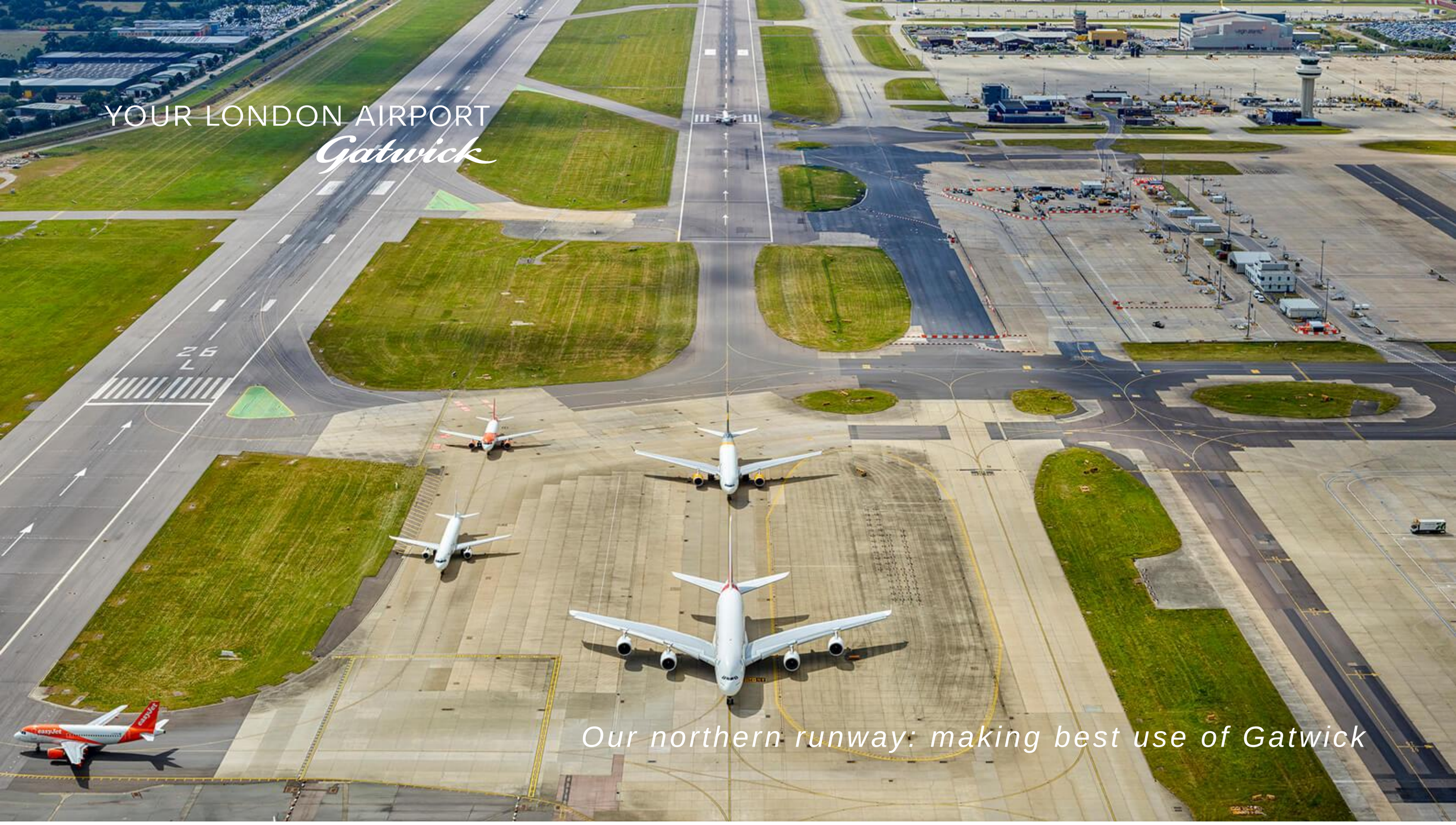

Preliminary Environmental Information Report
Appendix 11.9.1: Flood Risk Assessment

September 2021

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1 Introduction

1.1 General

1.1.1 This Flood Risk Assessment (FRA) forms Appendix 11.9.1 of the Preliminary Environmental Information Report (PEIR) prepared on behalf of Gatwick Airport Limited (GAL). The PEIR presents the preliminary findings of the Environmental Impact Assessment (EIA) process for the proposal to make best use of Gatwick Airport's existing runways (referred to within this report as 'the Project'). The Project proposes alterations to the existing northern runway which, together with the lifting of the current restrictions on its use, would enable dual runway operations. The Project includes the development of a range of infrastructure and facilities which, with the alterations to the northern runway, would enable the airport passenger and aircraft operations to increase. Further details regarding the components of the Project can be found in the Chapter 5: Project Description.

1.1.2 All technical terms and abbreviations used within this FRA report are defined in the Glossary included in Section 11.

1.2 Objectives

1.2.1 The purpose of this FRA is to demonstrate that the Project complies with flood risk requirements of relevant national and local planning policy, including the Airports National Policy Statement (Airports NPS) and the National Planning Policy Framework (NPPF). Mainly, that the Project would not exacerbate existing levels of flood risk on or off site and that it would be safe for users for its lifetime including a consideration of the predicted impacts of climate change.

1.2.2 To achieve this, the FRA:

- includes an assessment of flood risk to the Project, demonstrating that the intended land use is appropriate in terms of flood risk;
- includes an assessment of the predicted impact of the Project upon flood risk, taking account of future climate change impacts;
- demonstrates that the Project would not increase flood risk to surrounding areas and third parties and would be safe for its lifetime; and
- details mitigation measures required to achieve this outcome.

1.3 FRA Structure

1.3.1 This section describes the main objectives of the FRA and provides a brief summary of the report structure and contents.

1.3.2 Section 2 briefly describes the study area and provides the overview of the Project elements that could affect or be affected by flood risk. This section also describes some specific study area characteristics that are of interest to flood risk in general, including topography, local watercourses, rainfall, geology and hydrogeology, as well as land use. Further information on the study area and Project is included in PEIR Chapter 4: Existing Site and Operation and PEIR Chapter 5: Project Description. Only information that underpins this FRA is summarised in this chapter.

1.3.3 Section 3 provides an overview of the national and local planning policy that applies to the application for development consent for the Project. It refers to national guidance and drivers, as well as specific requirements for nationally significant infrastructure. It also explains the flood risk vulnerability classification for proposed developments and the application of the Sequential and Exception Tests as set out in the NPPF and its supporting guidance. Finally, Section 3 describes guidance and requirements regarding the impact of climate change on flood risk, throughout the lifetime of the Project.

1.3.4 Section 4 defines the scope of the assessment and any issues that have been scoped out of this FRA. This section also includes the assumptions made during the assessment and any related limitations that could potentially affect the conclusions of this document.

1.3.5 Section 5 describes the existing level of flood risk to the Project, considering all potential sources of flooding. The assessment includes fluvial, surface water and groundwater flooding, as well as flooding due to reservoir failure, flood defence failure and sewer/ water distribution infrastructure flooding. The data used include publicly available information and site-specific hydraulic modelling that has been developed by GAL (surface water drainage and wastewater) and in partnership with the Environment Agency (fluvial). This section also briefly describes historic flood events that have affected Gatwick.

1.3.6 Section 6 describes how the Project could affect flood risk to the Project site, as well as to third parties, assuming no mitigation was in place. Hydraulic modelling results have been used to determine the degree of fluvial and surface water drainage flood risk due to the Project, providing the basis for the assessment to be made. A desktop study has also been undertaken to consider potential Project qualitative impacts on groundwater flooding.

1.3.7 Section 7 describes the flood mitigation strategy that has been developed as part of the Project. This includes flood compensation areas, syphons, watercourse diversions and where required, the introduction, relocation and reconfiguration of surface water storage and attenuation features. Hydraulic modelling results have been used to determine the effectiveness of the proposed measures in mitigating fluvial, wastewater and surface water flooding.

1.3.8 Section 8 describes the planning and development requirements that have been considered as part of this assessment and explains how these have been addressed within the FRA document. This section covers relevant national planning policies, local planning requirements and Strategic Flood Risk Assessment (SFRA) recommendations for the study area.

1.3.9 Finally, Section 9 provides the summary and conclusions of this FRA.

2 Project and Environmental Overview

2.1 Study Area

2.1.1 A full description of the study area and Project is provided in Chapter 4: Existing Site and Operation and Chapter 5: Project Description. Only information that underpins this FRA is summarised in this chapter.

2.1.2 The land subject to the application for development consent extends to approximately 838 hectares, of which approximately 760 hectares lie within the ownership of Gatwick. The Project site boundary and study area for the purposes of this assessment is shown in Figure 2.1.1.

2.1.3 The study area used for this FRA is defined by a 2 km radius beyond the Project site boundary. Taking into account the nature of the Project, impacts are expected to occur in close proximity to the Project site and it is considered that a 2 km study area would be sufficient to identify any significant flood risk effects to third parties. In the case that impacts are identified at the edge of the study area, this would be locally extended until the point where no impacts are identified.

2.2 Project Description

2.2.1 The Project includes a number of proposed elements which are shown in Figure 2.2.1. The following key components are considered most likely to affect or be affected by flood risk and are considered relevant to this assessment:

- amendments to the existing northern runway including repositioning its centreline 12 metres further north to enable dual runway operations;
- reconfiguration of taxiways;
- pier and stand alterations (including a proposed new pier);
- reconfiguration of other airfield facilities;
- extensions to the existing airport terminals (north and south);
- provision of additional hotel and office space;
- provision of reconfigured car parking, including new car parks;
- surface access (including highway) improvements;
- reconfiguration of existing utilities, including surface water, foul drainage and power; and
- landscape/ecological planting and environmental mitigation.

2.2.2 The details of construction methods, timing and phasing are broad at this stage and would be dependent on securing development consent and the discharge of associated requirements. The indicative construction programme is based on construction commencing in 2024, although some preliminary works may commence in 2023. The programme for the core airfield construction works would be of approximately five years duration enabling the altered northern runway and taxiways to be complete and fully operational in combination with the main runway in 2029. The indicative phases of the project are described in Chapter 5: Project Description of the PEIR.

2.3 Study Area Characteristics

Topography

2.3.1 Gatwick Airport is generally flat, at an average ground level of around 58 to 59 metres Above Ordnance Datum (AOD). However, areas around the North and South Terminals have ground levels ranging from approximately 56 metres to 58 metres AOD.

Local Watercourses

2.3.2 Gatwick Airport is located within the Upper Mole catchment within the River Thames River Basin District. The River Mole flows through the airport, south to north, passing under the main and existing northern runways in culvert and a syphon. Tributaries of the River Mole, including Burstow Stream, Crawter's Brook, the Gatwick Stream, Man's Brook and Westfield Stream all run through or close to the Project site. Most of these watercourses, including the River Mole, have been previously diverted. Main Rivers and Ordinary Watercourses in the vicinity of the Project are shown in Figure 2.1.1.

2.3.3 The Burstow Stream rises to the east of the South Terminal roundabout and flows northwards under the M23 spur before turning north-westwards skirting the east and north of Horley to join the Mole north west of the town, approximately 2 km north of Gatwick airport.

2.3.4 Crawter's Brook enters the airport boundary to the east of the industrial area of Lowfield Heath and has been previously diverted into an engineered channel, along the southern edge of the airside operational area. Its confluence with the River Mole is located just upstream of the culvert under both existing runways.

2.3.5 The Gatwick Stream runs along the eastern airport boundary, between the eastern end of the airside operational area and the London to Brighton mainline railway. It is culverted under the South Terminal before running north through Riverside Garden Park and joining the River Mole.

2.3.6 Man's Brook runs along a small part of the north-west airport boundary before discharging directly into the River Mole, west of the Boeing Hangar and Pond M.

2.3.7 Westfield Stream runs through Gatwick airport, north of the existing fire training ground, from its source to the west of the airfield. The watercourse comprises open channel sections with earth banks and a number of culverts with associated headwalls where the channel passes under obstructions such as access roads and airport boundary fences. The watercourse has previously been diverted to its current location discharging to the River Mole north of the existing Pond A.

Geology and Hydrogeology

2.3.8 The study area is underlain by made ground, superficial deposits and bedrock strata.

2.3.9 Made ground is widespread near the surface, particularly beneath airport buildings and associated infrastructure. This varies in thickness, composition and extent.

2.3.10 The superficial deposits comprise Alluvium, Head and River Terrace Deposits (RTD). The Alluvium and RTD are primarily associated with existing and former courses of the River Mole, Crawter's Brook and Gatwick Stream, to the west, centre and east of the airport. These deposits occur in broad, but mostly separated 'bands' beneath the airport. These are primarily orientated south to north, although toward the northern perimeter of the airport there is a band of Alluvium and RTD aligned east west, parallel with a former course of the River Mole. Away from the airport, to the north east of the A23, there is a wider expanse of RTD.

2.3.11 The Alluvium comprises clay, silt, sand and gravel and where present is likely to be relatively thin, perhaps up to 2 metres thick. The RTD comprises sand and gravel and is likely to be thicker, of the order of 5 metres. Both deposits are likely to thin toward their margins. Head deposits, comprising clay, silt, sand and gravel occur only in a small area to the centre of the airport.

2.3.12 For the large majority of the study area, these superficial deposits are underlain by the Weald Clay Formation. This comprises mudstone, with seams of clay-ironstone in the south east and west. Although absent from the far south and east of the study area, this formation is likely to be of significant thickness.

2.3.13 To the south east of the study area, the underlying bedrock is the Upper Tunbridge Wells Sand Formation. This comprises sandstone, siltstone and mudstone, but only occurs with very limited sub-crop within the extreme south east of the Project boundary (to the south and east of the A23 London Road/ Perimeter Road South).

2.3.14 The Alluvium and RTD, in combination, are classified by the Environment Agency as a Secondary A aquifer. Groundwater is likely to occur in these deposits although this is unlikely to comprise a continuous body of groundwater and there may be isolated pockets of groundwater, with both vertical and horizontal discontinuity.

2.3.15 Typically, groundwater levels within the superficial deposits are shallow, less than 1 metre deep in some locations, although this varies significantly (typically 0.8 metres to 3 metres, but up to 5 metres deep and perhaps deeper) across the study area.

2.3.16 Close by and adjacent to the main surface watercourses (River Mole, Gatwick Stream, Crawter's Brook) groundwater in the superficial deposits maybe in hydraulic continuity with the surface water.

2.3.17 The Weald Clay Formation is classified by the Environment Agency as Unproductive Strata and generally contains little groundwater, however, near surface weathering of this formation may allow some groundwater storage and flow, perhaps in hydraulic continuity overlying superficial deposits. Groundwater has been encountered at depths of around 10 metres within this formation.

2.3.18 The Upper Tunbridge Wells Sand Formation is classified as a Secondary A aquifer, although the mudstones within the formation are classified as unproductive strata. Locally, depth to groundwater is unknown, but layering in the aquifer may lead to some vertical stratification of water bodies within this formation.

Land Use

2.3.19 Gatwick Airport covers an area of approximately 760 hectares. The airport has two main passenger terminals – South Terminal, which is located on the eastern side of the airport and North Terminal on the north side. In addition to the two main passenger terminals it is characterised by substantial areas of built development comprising an airfield environment of stands, taxiways and runways which are separated by extensive grassed areas; the airport's road network; surface and decked car parking; and ancillary developments such as hotels, maintenance and cargo facilities.

3 Legislation and Policy

3.1 National Planning Policy

Airports National Policy Statement: new runway capacity and infrastructure at airports in the South East of England

3.1.1 NPSs set out the Government's objectives for the development of nationally significant infrastructure and are therefore relevant sources of planning policy against which applications for development consent are determined by the Secretary of State.

3.1.2 The Airports NPS (Department for Transport, 2018), although primarily provided in relation to a new runway at Heathrow Airport, remains a relevant consideration for other applications for airport infrastructure in London and the south east of England.

3.1.3 Paragraphs 5.147 to 5.171 of the Airports NPS refer to flood risk and set out the policies regarding climate change impacts, FRA requirements, flood risk management bodies and responsibilities, sustainable drainage systems and the application of the Sequential and Exception Tests.

3.1.4 Paragraph 5.154 states that:

'In preparing a flood risk assessment the applicant should:

- *Consider the risk of all forms of flooding arising from the development comprised in the preferred scheme, in addition to the risk of flooding to the project, and demonstrate how these risks will be managed and, where relevant, mitigated, so that the development remains safe through its lifetime;*
- *Take into account the impacts of climate change, clearly stating the development lifetime over which the assessment has been made;*
- *Consider the need for safe access and exit arrangements;*
- *Include the assessment of residual risk after risk reduction measures have been taken into account, and demonstrate that this is acceptable for the development;*
- *Consider if there is a need to remain operational during a worst case flood over the preferred scheme's lifetime; and*
- *Provide evidence for the Secretary of State to apply the Sequential Test and Exception Test, as appropriate.'*

3.1.5 These FRA requirements have been addressed within this report. Compliance with planning policy recommendations is set out in Section 8.

National Policy Statement for National Networks

3.1.6 The NPS for National Networks (Department for Transport, 2015) covers flood risk within paragraphs 5.90 to 5.115. These paragraphs refer to the same flood risk policies as the Airports NPS (Department for Transport, 2018) and add some specific considerations for linear infrastructure. These would be relevant to surface access (including highways) improvements works that are proposed as part of the Project. Paragraphs 5.102 to 5.104 of the NPS for National Networks (Department for Transport, 2014) state that:

'The Secretary of State should expect that reasonable steps have been taken to avoid, limit and reduce the risk of flooding to the proposed infrastructure and others. However, the nature of linear infrastructure means that there will be cases where:

- *Upgrades are made to existing infrastructure in an area at risk of flooding;*
- *Infrastructure in a flood risk area is being replaced;*
- *Infrastructure is being provided to serve a flood risk area; and*
- *Infrastructure is being provided connecting two points that are not in flood risk areas, but where the most viable route between the two passes through such an area.*

The design of linear infrastructure and the use of embankments in particular, may mean that linear infrastructure can reduce the risk of flooding in the surrounding area. In such cases, the Secretary of State should take account of any positive benefit to placing linear infrastructure in a flood-risk area.

Where linear infrastructure has been proposed in a flood risk area, the Secretary of State should expect reasonable mitigation measures to have been made, to ensure that the infrastructure remains functional in the event of predicted flooding.'

National Planning Policy Framework

3.1.7 The National Planning Policy Framework (NPPF) (Ministry of Housing, Community and Local Government, 2021) sets out the planning policies for England. It sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed. The main steps are designed to ensure that if there are better sites in terms of flood risk, or a proposed development cannot be made safe, it should not be permitted.

3.1.8 Paragraphs 159 to 169 set out flood risk policies to be followed by all proposed developments.

3.1.9 The National Planning Practice Guidance (NPPG) (Ministry of Housing, Communities and Local Government, 2019b) supports the NPPF and provides guidance across a range of topic areas, including flood risk.

3.2 Local Planning Policy and Guidance

3.2.1 Gatwick Airport lies within the administrative area of Crawley Borough Council and adjacent to the boundaries of Mole Valley District Council to the north west, Reigate and Banstead Borough Council to the north east and Horsham District Council to the south west. The administrative area of Tandridge District Council is located approximately 1.9 km to the east of Gatwick. Gatwick is located in the county of West Sussex and immediately adjacent to the bordering county of Surrey.

3.2.2 Relevant local planning policies applicable to flood risk, as well as supporting documents regarding flood risk are summarised in this section.

Crawley Local Plan 2015-2030

3.2.3 Crawley Local Plan, Crawley 2030, was adopted in December 2015. It forms the Council's development plan and sets out the planning policies under which development control decisions are taken. Policy ENV8 refers to flood risk considerations for development applications.

Policy ENV8: Development and Flood Risk

Development proposals must avoid areas which are exposed to an unacceptable risk from flooding and must not increase the risk of flooding elsewhere. To achieve this, development will:

i. be directed to areas of lowest flood risk having regard to its compatibility with the proposed location in flood risk terms, and demonstrating (where required) that the sequential and exceptions tests are satisfied;

ii. refer to the Environment Agency Flood Map for Planning and Crawley Strategic Flood Risk Assessment to identify whether the development location is situated in an area identified as being at risk of flooding;

iii. where identified in the SFRA, demonstrate through a Flood Risk Assessment how appropriate mitigation measures will be implemented as part of the development to ensure risk is made acceptable on site, and is not increased elsewhere as a result of the development;

iv. ensure that proposals on all sites of 1 hectare or greater are accompanied by a Flood Risk Assessment, to include detail of mitigation demonstrating how surface water drainage from the site will be addressed;

v. reduce peak surface water run-off rates and annual volumes of run-off for development through the effective implementation, use and maintenance of SuDS, unless it can be demonstrated that these are not technically feasible or financially viable;

Crawley Emerging Local Plan 2021-37

3.2.4 Crawley Borough Council is currently consulting on a draft Local Plan to reflect national policy updates and local change.

Policy EP1: Development and Flood Risk

3.2.5 Policy EP1 repeats the current Policy ENV8 and includes that development is not permitted within 8 metres of a main river and 12 metres from an ordinary watercourse without prior consent form the Environment Agency or within 3 metres of a Thames Water sewer system without their prior consent. Post construction council certification is required to ensure the drainage has bene constructed in line with the planning application.

Policy GI1: Green Infrastructure

3.2.6 Policy GI1 requires that large development proposals will be required to provide new and/or create links to green infrastructure, consider the use of Sustainable Drainage Systems (SuDS) and blue infrastructure, in part to reduce surface water runoff.

Crawley Borough Council Strategic Flood Risk Assessment 2020

3.2.7 Crawley Borough Council, as the local planning authority, is responsible for producing a SFRA as part of the evidence base that supports the development of its Local Plan.

3.2.8 Therefore, the Crawley SFRA (Crawley Borough Council, 2020) was published in 2020 and is a key background document to the Local Plan. It is intended to be used in conjunction with Local Plan Policy ENV8, in order to ensure that development is directed to the most sustainable location in flood risk terms. A key outcome of the SFRA process is to enable the application of the Sequential Test (see Section 3.4) and to provide an indication of the feasibility of the proposed development passing the Exception Test (see Section 3.5).

3.2.9 The SFRA document provides advice for areas of the borough that are susceptible to flood risk and outlines development management recommendations that should be considered in determining planning applications. These have been addressed within the Project and compliance is demonstrated in Section 8.3.

West Sussex County Council Local Flood Risk Management Strategy 2013

3.2.10 West Sussex County Council as Lead Local Flood Authority (LLFA) is required to set out how it will deliver local flood risk management under the Flood and Water Management Act 2010. The Local Flood Risk Management Strategy (LFRMS) (West Sussex County Council, 2014) summarises historical, current and future flood risk knowledge for West Sussex and defines flood risk management roles and responsibilities. It covers the period from 2013 to 2018 and its principal aim is to oversee and direct the reduction of flood risk for the Council's residents.

Reigate and Banstead Borough Council, Mole Valley Distrct Council and Tandridge District Council Level 1 Strategic Flood Risk Assessment 2017

3.2.11 This joint SFRA report has been prepared as a planning tool that will assist the Councils in their selection and development of sustainable development sites away from vulnerable flood risk areas in accordance with the NPPF (Ministry of Housing, Community and Local Government, 2019a). The SFRA is a supporting document to Councils' local plans; flood risk policies within local plans relevant to the Project are included in Table 8.2.1.

3.2.12 The SFRA includes an appraisal of all potential sources of flooding, provides mapping of the location and extent of functional floodplain, reports the standard of protection provided by existing flood risk management infrastructure and considers the potential increase of flood risk due to climate change. It also provides an assessment of flood warning and emergency planning

procedures and includes recommendations for future development considerations.

3.2.13 The area covered within this SFRA does not encroach on Gatwick itself but includes part of the study area as defined for this FRA. Therefore, if there are any residual effects within these neighbouring districts, the SFRA requirements and recommendations should be considered.

3.3 Vulnerability Classification

3.3.1 Table 2 of the Flood Risk and Coastal Change section of the NPPG (Ministry of Housing, Community and Local Government, 2019b) classifies the flood risk vulnerability of all land uses. In Table 3 of the same document (reproduced here as Table 3.3.1), these vulnerability classes are aligned against Flood Zones to indicate where a development is 'appropriate', where it should only be permitted if the Exception Test is passed and where it should not be permitted. The flood risk compatibility of the Project for its proposed location is considered in Table 5.9.1.

Table 3.3.1: Flood Risk Vulnerability Classification (reproduced from the NPPG, Table 3)

Flood Risk Vulnerability Classification		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zones	1	✓	✓	✓	✓	✓
	2	✓	Exception Test required	✓	✓	✓
	3a	Exception Test required	×	Exception Test required	✓	✓
	3b	Exception Test required	×	×	×	✓

✓ = 'appropriate'

× = 'not permitted'

3.4 The Sequential Test

3.4.1 The Sequential Test is defined in paragraphs 158-159 of the NPPF as follows:

'The aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.
If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in national planning guidance.'

3.4.2 The Sequential Test has been applied to the Project, refer to paragraphs 5.9.3 to 5.9.7.

3.5 The Exception Test

3.5.1 If a development is proposed that is not 'appropriate' as defined in Table 3 of the NPPG (and reproduced at Table 3.3.1), the Exception Test is used to demonstrate and ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

3.5.2 Paragraph 160 of the NPPF sets out the two elements that need to be satisfied for the Exception Test to be passed:

'For the exception test to be passed it should be demonstrated that:

a) The development would provide wider sustainability benefits to the community that outweigh flood risk; and

b) The development will be safe for its lifetime taking account of the vulnerability of its users without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.'

3.5.3 Compliance with the Exception Test is addressed in paragraphs 5.9.8 to 5.9.10 and Section 7.

3.6 Climate Change

3.6.1 There is clear scientific evidence that global climate change is happening now and cannot be ignored. Increases in rainfall depth or fluvial flows due to climate change will increase the probability of a given magnitude of flood. This means that a site currently located within a lower risk zone (Flood Zone 1 or 2) could in the future be re-classified as lying within a high-risk zone (Flood Zone 3a or 3b). This in turn could have implications for the type of development that is appropriate according to its vulnerability to flooding.

3.6.2 Therefore, any increase in surface water runoff or fluvial flooding as a result of the Project should be attenuated on-site and the capacity should be provided for the design flood event, including an appropriate allowance for climate change. According to the NPPG (Ministry of Housing, Communities and Local Government,

2019b), the design event is generally taken as the 1 per cent (1 in 100) annual exceedance probability (AEP[1]) event.

3.6.3 The Airports NPS (Department for Transport, 2018) refers to the NPPF and its supporting guidance as the key source of policies regarding climate change impacts on flood risk. Paragraph 5.168 also states that:

'The applicant should take into account the potential impacts of climate change using the latest Climate Change Risk Assessment, the latest UK Climate Projections, and other relevant sources of climate change evidence.'

3.6.4 The UK Climate Projections 2018 (UKCP18), (Met Office et. al., 2018) are a set of climate change projections that replace the previous set: UKCP09. These new projections have informed the update of the current guidance from the Environment Agency as to how the predicted impact of climate change should be considered as part of the spatial planning process, published in July 2021. The update incorporates new guidance for the consideration of future changes to peak river flow, the allowances for rainfall intensity are yet to be reviewed and potentially amended.

3.6.5 Due to project timescales this FRA adopts the climate change allowances published in February 2016 and last updated in July 2020 (Environment Agency, 2020) are the best national representation of how climate change is likely to affect flood risk for peak river flow and peak rainfall intensity available (from a policy and guidance perspective). It is anticipated that this FRA will be updated to support the ES and will incorporate the latest guidance (published in July 2021). A review of the latest guidance indicates that the requirements for peak river flow have reduced compared to those based on UKCP09 data, therefore the current assessment is considered to be conservative and mitigation requirements for the scheme are likely to reduce. The uplift factor to be applied is determined by the location, design life and vulnerability classification of the proposed development.

3.6.6 For this Project the design life and therefore the allowance for climate change varies. For the surface access works the adopted lifetime for the Project is 100 years (up to 2132) and for the rest of the works (airfield and associated elements) 40 years (up to 2069). It is considered that a longer design life would not be realistic given it is likely there will be further significant changes to the Airport in that timescale. Gatwick Airport has changed considerably during the past 40 years and this rate of change is anticipated to continue. Assessment of climate change allowances over a longer design life is therefore considered disproportionate.

3.6.7 The uplift factors to be applied for peak rainfall intensity in small urban catchments are indicated in Table 3.6.1.

Table 3.6.1: Predicted potential change of peak rainfall intensity

Applies to across all of England	Total potential change anticipated for 2015 to 2039	Total potential change anticipated for 2040 to 2069	Total potential change anticipated for 2070 to 2115 (and beyond)
Upper End	10%	20%	40%
Central	5%	10%	20%

3.6.8 When determining the potential impact of climate change on rainfall, the guidance states that both the 'Upper end' and 'Central' allowances as outlined in Table 3.6.1 should be considered, to understand the range of the impact.

3.6.9 Therefore, the 10 per cent and 20 per cent climate change allowances can be applied for peak rainfall intensity. However, as a conservative approach, the 20 per cent value has been used as the main design climate change allowance, while the 40 per cent has also been tested as an exceedance scenario (as a sensitivity analysis), in order to test the impact of a larger potential change as a result of climate change. Given their longer lifetime the surface access works incorporate a 40 per cent allowance applied to their design life to 2032.

3.6.10 The allowance to be made for the predicted impact of climate change on peak river flows is subject to the river basin district, in this case identified as the Thames River Basin. Table 3.6.2 details the applied uplift factors for the Thames River Basin, in line with the current Environment Agency climate change allowances.

Table 3.6.2: Recommended climate change allowance for peak river flow

Applies to Thames River Basin	Total potential change anticipated for 2015 to 2039	Total potential change anticipated for 2040 to 2069	Total potential change anticipated for 2070 to 2115
Upper End	25%	35%	70%
Higher Central	15%	25%	35%
Central	10%	15%	25%

3.6.11 According to relevant guidance (Environment Agency, 2016), the Higher Central and Upper End allowances should be used for Essential Infrastructure in Flood Zone 2, in this case 25 per cent and 35 per cent. When in Flood Zone 3, the Upper End allowance, in this case 35 per cent, should be used. For the purposes of this assessment, given that elements of the Project are in Flood Zone 3, the effects of core airfield works on fluvial flood risk have been assessed against the 35 per cent increase in peak river flow for the one per cent (1 in 100) AEP event. The 70 per cent climate change allowance has been tested as an exceedance scenario (as a sensitivity analysis), in order to assess the impact of a larger potential increase in peak river flow.

3.6.12 Again, given their longer lifetime the surface access elements have been assessed against a 70 per cent allowance. The use of the 35 per cent and 70 per cent climate change allowances for the design event(s) peak river flow (see Table 3.6.2) has been confirmed in discussions between GAL and the Environment Agency.

[1] Annual Exceedance Probability (AEP) refers to the chance that a flood event of a particular magnitude is experienced or exceeded during any one year.

4 Assessment Methodology

4.1 Scope of the Assessment

4.1.1 This FRA considers all sources of flooding including flooding to the Project site, as well as impacts elsewhere due to the development of the Project. The assessment of residual risk arising from exceedance events has been considered on the basis of higher climate change uplift factors being applied. This approach allows the assessment of a larger potential increase in flood risk due to climate change and provides insight on the risk of flooding to, and as a result of, the Project after 2069.

4.1.2 Tidal flooding has been scoped out of this assessment. The watercourses that flow through the study area are the River Mole and its tributaries and are ultimately a tributary of the River Thames. The River Mole confluence with the River Thames is upstream of the tidal extent of the Thames at Teddington Lock. The airport is approximately 35 km north of the nearest coastline and ground levels are generally above 55 metres AOD and therefore are not at tidal/coastal flood risk. No impact pathway has therefore been identified that could lead to an effect on flood risk.

4.2 Assumptions and Limitations

4.2.1 This FRA has been prepared as a preliminary information document and includes best available information at the time of writing. Determination of flood risk from all sources to the Project is based on published flood risk mapping as well as detailed hydraulic modelling results produced specifically for Gatwick Airport.

4.2.2 The Upper Mole Hydraulic Model has been produced in partnership with the Environment Agency to allow for assessment of fluvial flood risk in the study area. The model has been further developed since its original approval by the Environment Agency in order to incorporate recent changes to the airport infrastructure (including Larkins Road and Boeing Hangar) and refinements made upstream in Crawley by the Environment Agency. The 1D-2D model, which applies current best practice and makes use of quality reviewed local data, is considered to produce reliable model results. The model has been calibrated based on three historic events (between 2000 and 2002) and an additional 2013 event has been used as the verification event.

4.2.3 The Project design development is currently ongoing. Minor changes to the proposed works have been completed since hydraulic modelling was undertaken. However, these are not considered to affect the overall conclusion of the assessment on flood risk.

4.2.4 Any changes to ground levels due to proposed car parks (except those used as flood compensation areas) have not been incorporated in the model at this stage. However, the design of the proposed car parks is intended to ensure that no loss of floodplain occurs for each site.

4.2.5 The assessment of surface water flood risk was undertaken using a drainage and surface model built with the Infoworks™ ICM software.

4.2.6 In order to validate the model for its surface water flooding performance, an existing model was rebuilt and revalidated against an extensive flow survey of 32 monitors.

4.2.7 At this stage, the elevations of the development are not finalised, and therefore it is not possible to develop a full post development drainage model, and the post development model is therefore conceptual in nature. A more detailed assessment will be undertaken alongside detailed design. Therefore, the mapped surface water flood extents and depths that are included in supporting figures of this FRA should only be used as an indication of the scale of the change in surface water flooding. In particular, the alterations in ground levels within the airfield due to the Project have not been assessed as the model is still being prepared. Therefore, the exact locations of flooding for the development cannot be verified. The surface water flood extents and depths will be updated following the finished ground levels being available and will be taken into account within the FRA accompanying the application for development consent.

4.2.8 It has been assumed, at this stage, that the Project would introduce up to approximately 17.9 hectares of additional hardstanding areas within the airport boundary. That represents a 7% increase above the current development. This will be refined based on the final Project design for the FRA to accompany the application for development consent. Any changes to the Project will be incorporated into the updated FRA that supports the ES.

4.2.9 Overall, the fluvial and surface water hydraulic modelling results successfully allow consideration of the effectiveness of the proposed flood mitigation strategy. However, at this stage, the design of flood mitigation measures is subject to discussion with the LLFA and/or the Environment Agency. Therefore, details regarding their location and arrangements are subject to change.

4.2.10 Where a new surface water discharge to a Main River is proposed (eg the River Mole) or where existing discharge arrangements are altered, this would be subject to discussions with the Environment Agency.

4.2.11 GAL has developed a model of the wastewater network within its estate to assess the impact of the Project. This model has been utilised to determine the risk of wastewater flooding.

4.2.12 At this stage, groundwater and water supply flood risk have been assessed based on existing available information and previous known flooding incidents within the study area. Additionally, a qualitative assessment has been undertaken to inform the indication of areas that are likely to be vulnerable to groundwater flooding.

5 Existing Flood Risk

5.1 Basis of the Assessment

5.1.1 In accordance with the NPPG (Ministry of Housing, Community and Local Government, 2019b), an assessment of flood risk to the Project site has been undertaken based on the following sources of information.

- Flood risk information available from the Environment Agency website (Flood Map for Planning, Risk of Flooding from Surface Water, Reservoir Flood Risk Map, Historic Flood Map).
- Crawley Borough Council Strategic Flood Risk Assessment, 2020.
- West Sussex County Council Local Flood Risk Management Strategy, 2013.
- Groundwater Flooding Susceptibility Areas and Groundwater Flooding Confidence Areas mapping (British Geological Survey).

5.1.2 The Upper River Mole fluvial hydraulic model recently completed by GAL and the surface water drainage model have also been used to confirm existing flood risk to the site.

5.1.3 Overall, the risk of flooding from all relevant sources has been considered, covering:

- fluvial;
- surface water;
- sewer and water distribution infrastructure flooding;
- groundwater flooding;

- reservoirs failure; and
- flood defence failure.

5.2 Fluvial Flood Risk

5.2.1 Gatwick is located in the Thames River Basin District (RBD) and within the Upper Mole catchment. The River Mole flows through the airport, passing under the main and existing northern runways in culvert. Tributaries of the River Mole, including Crawter's Brook, the Gatwick Stream, Man's Brook and Westfield Stream all run through or adjacent to the Project site.

5.2.2 Therefore, fluvial flood risk is one of the main sources of flood risk to the Project.

5.2.3 This section provides an assessment of existing fluvial flood risk within the Project site. The assessment is based on a number of data sources including:

- Environment Agency Flood Zones; and
- Gatwick Upper Mole Hydraulic Model.

Environment Agency Flood Zones

Overview

5.2.4 The classification of Flood Zones is used as the basis on which the Sequential Test is applied. It identifies the probability of flooding in each Flood Zone. Flood Zones 1, 2 and 3a are defined by the Environment Agency, ignoring the presence of flood defences and without taking account of the possible impacts of climate change to the future probability of flooding. Flood Zone 3b should be defined by local planning authorities in agreement with the Environment Agency and should consider the presence of defences. Table 5.2.1 sets out the classification of Flood Zones in accordance with the NPPG (Ministry of Housing, Community and Local Government, 2019b).

Table 5.2.1: Environment Agency Flood Zones Definition

Flood Zone	Definition
Flood Zone 1 – Low Probability of Flooding	Land having a less than 1 in 1,000 AEP of river or sea flooding.
Flood Zone 2 - Medium Probability of Flooding	Land having between a 1 in 100 and 1 in 1,000 AEP of river flooding; or land having between a 1 in 200 and 1 in 1,000 AEP of sea flooding.
Flood Zone 3a - High Probability of Flooding	Land having a 1 in 100 or greater AEP of river flooding; or land having a 1 in 200 or greater AEP of sea flooding.
Flood Zone 3b – Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood (typically a 1 in 20 or greater AEP event). Local planning authorities should identify in their SFRAs, areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

5.2.5 In this case, the Crawley SFRA (Crawley Borough Council, 2020) includes the following approach regarding Flood Zone 3b: "*Flood Zone 3b, unlike other Zones, does show flood risk that takes account of the presence of existing flood risk management features and flood defences, as land afforded this standard of protection is not appropriately included as functional flood plain*".

5.2.6 The Gatwick Upper Mole Hydraulic Model, includes results for the 5 per cent (1 in 20) AEP event.

Assessment

5.2.7 The Environment Agency Flood Zones have been mapped in Figure 5.2.1. This demonstrates that there are areas of Flood Zone 3 (areas at risk of flooding in a 1 per cent (1 in 100) AEP event) and Flood Zone 2 (area at risk of flooding in between a 1 per cent and 0.1 per cent (1 in 100 to 1 in 1000) AEP event) within the Project site boundary. These are associated with the River Mole, Westfield Stream, Man's Brook and Crawter's Brook on the western and southern sides of the airport and with the Gatwick Stream on the eastern side.

5.2.8 Outside of the airport, there are extensive areas of Flood Zones 2 and 3 in which are situated a number of third party receptors for the Project, including residential areas and transport infrastructure that serves both Gatwick and the wider study area. These flood extents are generally associated with the River Mole and/or Gatwick Stream and, therefore, could potentially be affected by the Project.

Upper Mole Hydraulic Model

Overview

5.2.9 The Upper Mole Fluvial Modelling study was undertaken as a partnership between GAL and the Environment Agency. The purpose of the study was to develop a better understanding of flood risk in the area, particularly to Gatwick Airport, and provide updated flood risk information for the catchment. The objectives of the study were to develop an updated model which reflects the urban nature of the catchment, including Crawter's Brook and Gatwick Stream and the more rural nature of Man's Brook and the Upper Mole, and to calibrate this model against at least three historic high flow events.

5.2.10 The model was run for design events between 20 per cent (1 in 5) AEP and 0.1 per cent (1 in 1000) AEP, including climate change scenarios for the 1 per cent (1 in 100) AEP event of +35 per cent and +70 per cent. The 20 per cent (1 in 5) AEP flood event would often be adopted to determine the extents of Flood Zone 3b (refer to Figure 5.2.3). The Crawley SFRA 2020 confirms this approach but indicates that where 5 per cent data is not available, 1 per cent (1 in 100) AEP event results are used following a precautionary principle.

5.2.11 The study focuses on the Upper Mole catchment, up to its downstream extent to the west of Horley, in West Sussex. The main watercourses considered are the Upper Mole, Gatwick Steam, Crawter's Brook and Man's Brook.

5.2.12 Two models have been created. The first model represents the catchment without any formal defences as per the situation before the Upper Mole Flood Alleviation Scheme (FAS). This is the undefended scenario and was used as a calibration model. The second model represents the situation once the Upper Mole FAS had been completed. The Upper Mole FAS is an Environment Agency project, in partnership with GAL, designed to reduce flooding at Gatwick Airport and to nearby areas including Horley and Crawley. According to the Crawley Infrastructure Plan (Crawley Borough Council, 2021), the Upper Mole FAS has now been completed and comprises the following items:

- Raising of Tilgate Dam;
- Worth Farm storage area;
- Grattons Park stream enhancements; and
- Clay's Lake storage reservoir.

5.2.13 The study built a new 1D-2D hydrodynamic model of the catchment using Flood Modeller 1D and TUFLOW 2D software. This combined 1D-2D model was selected as the most suitable approach on the basis of the following.

- Using a single 1D model in combination with linked 2D domains on the floodplain allows for interactions between individual watercourses and structures to be accurately

modelled and mapped. This approach therefore represents an effective way to describe the complex flow routes expected through urbanised parts of the study area.

- The use of a 1D-2D linked model provides an accurate simulation of in-channel hydraulics, coupled with detailed out-of-bank representation of flood routes, depths, flows and velocities. The combined model therefore enables robust simulation of the effect of key hydraulic features (such as bridges, culverts, flood relief areas and flood defences) both in-bank and out-of-bank.
- A combined 1D-2D approach enables robust estimation of hazards in the floodplain, including the combined impact of coincident velocities and depths.

Assessment

5.2.14 According to results from the baseline scenario of the Upper Mole Fluvial Model recently completed by GAL, flooding occurs within the Project site boundary for the 1 per cent (1 in 100) AEP event. As with the Environment Agency Flood Zones, flooding is mainly associated with the River Mole and Crawter's Brook on the western and southern sides of the airport, and with the Gatwick Stream on the eastern side, around the South Terminal building. However, the actual flooding extents are significantly different to the Environment Agency Flood Zones. The flooding extent for the 1 per cent (1 in 100) AEP event based on the Upper Mole Hydraulic model is mapped against Flood Zone 3 in Figure 5.2.2. The differences between the two models and extents are discussed in more detail in paragraphs 5.2.19 to 5.2.22.

5.2.15 According to Figure 5.2.3, all areas of the Project site falling within flood extents for the 5 per cent (1 in 20) AEP event are directly related to watercourses and do not encroach in areas that would be developed for the Project except for a small area at the western end of the airport, where parts of the proposed Taxiway Juliet West Spur and along the edge of Taxiway Juliet fall into the 5 per cent (1 in 20) flood extent and the surface access works to the A23 at the northern terminal access roundabout and at the Longbridge roundabout.

5.2.16 The requirements for considering the potential future impacts of climate change on fluvial flooding are described in Section 3.6. Suitable climate change allowances are chosen based on the specified River Basin (in this case, the Thames River Basin), the vulnerability of the development and the lifetime of the Project. Based on that information a 35 per cent allowance for climate change has been applied within the baseline scenario of the Upper Mole Hydraulic Model. A 70 per cent climate change allowance has also been tested, as an exceedance scenario (as a sensitivity analysis). Results are illustrated in Figure 5.2.3.

5.2.17 For the 35 per cent allowance, extents are increased compared to the 1 per cent (1 in 100) AEP event in areas south of the main runway and areas around the North Terminal and adjacent infrastructure.

5.2.18 For the 70 per cent allowance, flooding extends to several proposed and existing elements in the northern part of the airport and flood extents also encroach on the south-east part of the airport, including on runways and taxiways.

Differences Between the Environment Agency Published Flood Zones and Gatwick Model

5.2.19 This section compares the Environment Agency Flood Zone Mapping with the Upper Mole Hydraulic Model baseline scenario results, as shown in Figure 5.2.2, in order to identify the differences that should be considered within this assessment.

5.2.20 The overall pattern of flooding is significantly different for the Upper Mole model and the Environment Agency Flood Zones, with the first indicating flood extents that are more confined and, in some cases, diverted from the Environment Agency flood extents. This can be explained considering the fact that the Upper Mole model has considered local flood defence schemes that were being constructed or had recently been built within the catchment.

5.2.21 The new model also better reflects the urban nature of the catchment, including Crawter's Brook and Gatwick Stream and the more rural nature of Man's Brook and the Upper Mole, and has been calibrated against historic high flow events. Therefore, it is considered that it provides a more realistic understanding of flood extents and depths within the catchment.

5.2.22 In summary, it is considered that the Upper Mole Hydraulic Model outputs offer a more realistic and informative approach to assessing fluvial flood risk to the Project. However, in most cases, the Environment Agency Flood Zones would offer the worst-case scenario for the assessment. Therefore, the assessment undertaken has been based on a combination of both models, bearing in mind that the Upper Mole model offers the most up-to-date approach where the undefended scenario has also been considered.

5.3 Surface Water Flood Risk

Existing Surface Water Management Strategy

5.3.1 There are currently eight surface water drainage catchments within the Project site that directly receive runoff as shown in Figure 5.3.1. Generally, four of these serve the main airfield, discharging to Pond A, Pond M, the Dog Kennel Pond and Pond D. During cold weather, de-icer is regularly used, which, together with other pollutants, enters the surface water drainage system. When there is sufficient storage capacity in the system, the four attenuation ponds provide a degree of treatment through aeration and settlement. Figure 2.1.1 includes the main attenuation features of the existing surface water drainage network.

5.3.2 Pond D receives the majority of runoff from Gatwick including that transferred from Pond A, Pond M, and the dirty side of Dog Kennel Pond. Runoff from the Pond D catchment drains to Pond D (lower) and is then raised by three Archimedes screws to Pond D (upper). In general, when runoff meets the required water quality standard of a biochemical oxygen demand (BOD) below 10 mg/l, water is discharged to the River Mole, via the attenuation ponds at a consented rate controlled by a series of vortex flow control devices and pumps. When water quality falls below the required standard, the ponds discharge to the polluted water pumped main which conveys runoff for further treatment and temporary storage at two Long Term Storage Lagoons (Old and New Lagoons) with storage capacities of 220,000 m^3 and 100,000 m^3 respectively and then ultimately to Crawley Sewage Treatment Works (STW), which is operated by Thames Water. There are restrictions placed on the peak flow that can be transferred to the STW under a trade effluent consent agreed with Thames Water. In very heavy rainfall events, contaminated water diluted by rainfall may be pumped directly to the River Mole from Pond D if the incoming runoff is greater than the capacity of Pond D and there is insufficient capacity in the pumping system that transfers it to the pollution storage lagoons.

5.3.3 Pond E, Pond F, and Pond G provide attenuation for car parks east of the Railway line, and discharge to the Gatwick Stream. The clean side of Dog Kennel pond provides attenuation for the car parks north of Larkins Road, and is pumped into the River Mole.

5.3.4 The assessment of existing surface water flood risk to the Project site has been based on the Environment Agency Risk of Flooding from Surface Water mapping as well as surface water drainage modelling produced by GAL.

Environment Agency Risk of Flooding from Surface Water Mapping

5.3.5 The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping has been used to make an overarching assessment of the existing surface water flood risk to the Project. It has been used to determine overall patterns of surface water flooding and therefore to steer the assessment of risks, impacts and mitigation measures that follow.

5.3.6 According to the Environment Agency RoFSW flood extents mapping, illustrated in Figure 5.3.2, surface water flooding occurs in several areas of the airport. Areas at high risk (greater that 3.3 per cent (1 in 30) AEP of flooding) are predominately associated with areas around existing watercourses or drainage features, although there are isolated pockets of high risk likely to be the result of rainfall filling local depressions rather than overland flow paths. Areas at medium risk (between 3.33 per cent and 1 per cent (1 in 30 and 1 in 100) AEP of flooding) are generally small and adjacent to the areas at high risk. A large area at medium risk is located near the River Mole and south of the existing main runway. This flooding is likely to occur due to the existing River Mole culvert's capacity being exceeded. There are larger areas predicted to be at low risk (between 1 per cent and 0.1 per cent (1 in 100 and 1 in 1000) AEP of flooding) within the airport, particularly to the south of the main runway and in proximity to existing terminal buildings.

Gatwick Surface Water Hydraulic Model

5.3.7 The assessment of surface water flood risk was undertaken using a drainage and surface model built with the InfoWorks™ ICM software. An existing model was rebuilt and revalidated against an extensive flow survey of 32 monitors.

5.3.8 At this stage, the finished elevations of the development are not finalised, and therefore it is not possible to develop a full post development drainage model, and the post development model is conceptual in nature. A more detailed assessment will be undertaken alongside detailed design.

5.3.9 Therefore, the mapped surface water flood extents and depths that are included in supporting figures of this FRA should only be used as an indication of the scale of the change in surface water flooding. In particular, the alterations in ground levels within the airfield due to the Project have not been assessed as the model is still being prepared. Therefore, the exact locations of flooding cannot be verified. The surface water flood extents and depths will be updated following the finished ground models being available and will be taken into account within the FRA accompanying the application for development consent.

5.3.10 It has been assumed, at this stage, that the Project would introduce up to approximately 17.9 hectares of additional hardstanding areas within the airport boundary. That represents a 7% increase above the current development. This will be refined based on the final Project design for the FRA to accompany the application for development consent. Any changes to the Project will be incorporated into the ES.

5.3.11 The model has been run for the baseline (existing condition) scenario as well as the with-Project scenario, including the proposed surface water mitigation measures. The baseline scenario is based on current land use, asset location and ground model data.

5.3.12 There are two critical return periods for the surface water drainage system at Gatwick. The first is a 30-minute summer event, which generates the maximum flood volume and extent in a convective type storm event across the entire airfield. Typically, a 60-minute or 30-minute storm event would be expected to be the critical event for a land area of hardstanding such as Gatwick. However, because Gatwick has a controlled outlet at Pond D, influencing flood risk in the North Terminal and apron during longer, higher volume, less intense rainfall events, a second 1440-minute winter event has also been used. The critical return periods will be reassessed when the with development model is built for the ES.

5.3.13 The model results of the baseline scenario for the 1 per cent (1 in 100) AEP event, including a 20 per cent climate change allowance have been mapped in Figure 5.3.3 and Figure 5.3.4 for the 30-minute and 1440-minute storm durations respectively.

5.3.14 It is apparent that the 30-minute duration is the worst-case scenario in terms of flood extent. This is likely to be due to flow control measures and attenuation ponds within Gatwick Airport that would restrain flow paths for longer events. Therefore, the 30-minute event with a 1 per cent (1 in 100) plus 20 per cent climate change AEP can be used to provide a comparison with the patterns illustrated in Environment Agency RoFSW extents. Generally, both extents seem to follow a similar pattern, with ponding mainly forming between taxiways, around runways and towards the South Terminal.

5.3.15 An area of surface water flooding included in the Environment Agency maps is located south of the existing main runway, around the River Mole. This area is not included in the GAL surface water modelling results. However, it is included in the Upper Mole Hydraulic Model extents as being at risk of fluvial flooding for the 1 per cent (1 in 100) AEP event.

5.3.16 Flood extents for the 1440-minute event with a 1 per cent (1 in 100) plus 20 per cent climate change AEP are much more confined and mainly located at the North Terminal.

5.3.17 The model has also been run for the 1 per cent AEP event, including a 40 per cent climate change allowance, as shown in Figures 5.3.3 and 5.3.4, in order to examine a potential larger impact of climate change to existing conditions. The extents of surface water flow paths and ponding areas are wider in some areas, but mostly follow the same pattern as the lower climate change allowance. This is due to topographical conditions and existing drainage infrastructure directing surface water flows within the airport.

5.4 Groundwater Flood Risk

5.4.1 Groundwater is present in the superficial deposits beneath the site. This may occur in relatively small discreet and discontinuous bodies, or, particularly adjacent to watercourses, may form more continuous groundwater bodies.

5.4.2 Groundwater levels respond to direct recharge from rainfall but also, adjacent to water bodies, may respond to changes in river and stream levels. The rate of this response and the 'outward' propagation of these levels from surface waters, may vary considerably across the site, depending upon the transmissivity and storage properties of the aquifer.

5.4.3 Groundwater levels in superficial deposits adjacent to watercourses are likely to mimic the water level response in those surface waters, although there may be a lag in, and attenuation of, the water level response.

5.4.4 There are relatively sparse data for groundwater levels, but where these are available, they suggest groundwater levels are close to the surface (and may be less than 1 metre depth). Annual groundwater level fluctuation may be of the order 0.5 metres - 1.5 metres, but this is based on a very limited data set, mostly away from the influence of surface watercourses.

5.4.5 Groundwater flooding may be defined as the emergence of groundwater at the ground surface or the rising of groundwater into underground infrastructure (such as basements) under

conditions where the normal range of groundwater level and flow is exceeded.

5.4.6 Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (superficial deposits flooding), or with unconfined aquifers ("clearwater" flooding).

5.4.7 Mapping developed by the British Geological Survey (BGS) identifies areas of groundwater flooding susceptibility, with associated mapping identifying the confidence level in the data used to develop the susceptibility mapping. The groundwater flooding susceptibility mapping correlates geological data and water level data held by BGS and has been included in Figure 5.4.1.

5.4.8 The mapping identifies that there is susceptibility to groundwater flooding throughout the areas underlain by superficial deposits (ie superficial deposits flooding), with a moderate level of confidence.

5.4.9 There is also identified susceptibility to groundwater flooding from the Tunbridge Wells Sand (clearwater flooding), but with a low level of confidence.

5.4.10 Given the normally recorded range of groundwater levels within the superficial deposits, which show shallow depth to groundwater, the mapped susceptibility to flooding is unsurprising, however this does not necessarily mean groundwater flooding will occur (ie as per the definition, groundwater flooding is associated with groundwater levels above "the norm").

5.4.11 Based on the Crawley SFRA there have been only two occurrences of groundwater flooding recorded in the Crawley Borough Council administrative area. These are not located near the airport. The SFRA identifies groundwater flood risk as being low for the Crawley Borough Council administrative area as a whole and that there is no conclusive evidence of elevated susceptibility to groundwater flooding within the Borough.

5.4.12 There are anecdotal reports of flooding of basements and other buried infrastructure in parts of the site which may be the result of the inundation of shallow groundwater. Furthermore, there is anecdotal evidence of surcharging of sewers (eg in pipework to Crawley STW) discharges by infiltrating groundwater. However, these events, if they have occurred, do not necessarily constitute groundwater flooding.

5.4.13 Although groundwater levels beneath Gatwick Airport may be at shallow depth, there is no conclusive evidence of groundwater flooding occurring at the airport. Although it is not possible to fully quantify, it is concluded that the current risk from groundwater flooding at the airport site is low.

5.5 Flood Risk from Reservoir Failure

5.5.1 According to the Environment Agency Risk of Flooding from Reservoirs Maximum Outline data[2], much of the western side of the airport would be at risk of flooding in the event of failure of the Ifield Mill Pond, while the eastern side, including sections of both terminal buildings, would be at risk from a failure of the pollution lagoons adjacent to Crawley STW. The reservoir flood risk flood extents are illustrated in the map shown in Figure 5.5.1. However, as large, raised reservoirs, these structures are maintained and operated in accordance with the Reservoirs Act (1975) and therefore the risk of failure is considered very low due to their monitoring and inspection regime.

5.5.2 A number of flood storage reservoirs have also been created as part of the Upper Mole Flood Alleviation Scheme on tributaries of the Gatwick Stream to the south and east of Crawley. These appear to be included in the Environment Agency Risk of Flooding from Reservoirs mapping, available online[2].

5.5.3 GAL undertook a study in 2019 to assess the potential failure of the two storage lagoons to the east of Crawley STW (see Figure 2.1.1). The hydraulic modelling produced flood depth and hazard mapping that could result from the potential failure of each lagoon. A worst-case scenario was assumed that each lagoon would be full (impounded water would be at crest level) and that the pumps sending water to them from Pond D would continue to operate. Three breach locations were tested and the results are included in Figure 5.5.1. They indicate that the resultant flow path would travel northwards primarily through the airport car parks to the east of the London to Brighton mainline railway. The flow path does not cross the railway and would pass under the M23 spur via the B0236 bridge and then towards the residential areas to the north of the motorway. The A23 and M23 would not be flooded. In the unlikely event of a breach of the lagoons during construction, the project elements that would be affected would be those that are east of the railway line, principally the Surface Access works to the South Terminal, works to the car parks located in this area and the hotel and office provision after 2032.

5.5.4 The residual risk of failure of the Gatwick Stream Flood Storage Area has not been considered as part of the current assessment but will be assessed for the updated FRA that will support the ES. However, similarly to other structures that fall under the auspices of the Reservoirs Act, the strict inspection and maintenance regime results in a very low likelihood of failure.

5.6 Sewer/Water Distribution Infrastructure Flooding

5.6.1 Gatwick Airport has a complex water distribution and sewerage network that should be considered as a potential source of flood risk.

5.6.2 The failure of sewerage or water distribution infrastructure within or upstream of the Project site could result in flooding, although the risk of this is likely to be low given the maintenance and monitoring activities undertaken by Gatwick Airport to avoid this.

5.6.3 The hydraulic model built by GAL to assess the impact of the Project on the wastewater network has not identified any locations predicted to flood based on current and future flows as a result of the Project.

5.6.4 At the time of writing of this FRA it was reported that part of the Thames Water network, located in Horley, periodically has reached its capacity, causing flows to back up to the airport.

5.6.5 The Crawley SFRA (2020) includes a specific section on recorded sewer or water distribution infrastructure flooding events based on the Thames Water Sewer Flooding History Database. This records that there have been 102 instances of flooding in postcodes covered by the Crawley SFRA although some may be outside the boundary as the postcodes cover a wider area. For the Postcode area covering Gatwick Airport (RH6 0), only one incident is recorded and this may be outside the area of the airport as the postcode area covers a much larger area of land.

[2] Long term flood risk information. Available from: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

Overall, the risk of sewer flooding at the Project site is considered to be low.

5.7 Risk of Flood Defence Failure

5.7.1 According to the Environment Agency Flood Map for Planning, the Project is partly located in an area benefiting from flood defences. As described in Section 5.2, the Upper Mole Fluvial Model has considered local flood defence schemes that were being constructed or had recently been built within the catchment. Both the defended and undefended scenarios have been modelled and compared to understand the risk associated with flood defence failure.

5.7.2 The mitigation for the scheme has been developed based on the defended scenario (continued operation of existing flood defences). However, the Flood Threat Plan being developed by GAL will provide a management system of how to ensure the safety of airport operatives and passengers in the event of a flood defence failure.

5.8 Historic Flooding

5.8.1 There is a history of flooding from different sources at the airport, most notably in the December 2013 flood event, which led to major air traffic disruption.

5.8.2 According to the West Sussex LFRMS (West Sussex County Council, 2013):

'Historically the River Mole and its tributary the Gatwick Stream have come out of bank and flooded, and there are a number of recorded incidents that have damaged property.'

5.8.3 In September 1968, the airport was closed for several days due to flooding of the main runway. According to the Crawley SFRA (Crawley Borough Council, 2020), in 2000 over 70 properties in Crawley and Maidenbower were flooded during the reported 6.67 per cent (1 in 15) AEP event. Gatwick Airport was also affected by this fluvial event, as Gatwick Stream exceeded the capacity of the culvert alongside the South Terminal building. This caused flooding along the A23 and into the South Terminal. The most recent fluvial flood within the catchment occurred in December 2013 when high river levels caused the loss of three airfield electrical substations and led to significant disruption, particularly to Gatwick North Terminal (McMillan, 2014). The flooding event was the culmination of unprecedented levels of rainfall over proceeding weeks and months. River flows in three waterways in the immediate vicinity of the airport were at record levels.

5.8.4 There are limited reports of surface water flooding within the catchment, however given the level of urbanisation in parts of the catchment it seems likely that some localised surface water flooding would occur. Part of the cause of the December 2013 flooding is classed as surface water, as rainfall caused the North Terminal basement to be flooded, damaging a number of systems and causing disruption to the airport (McMillan, 2014).

5.8.5 Figure 5.8.1 illustrates the Environment Agency Historic Flood Map for the Project study area.

5.9 Flood Risk Compatibility of the Project

5.9.1 Table 5.9.1 categorises the different types of land uses of the Project elements, as described in the PEIR Chapter 5: Project Description, according to their vulnerability to flood risk. It then aligns these vulnerability classes against Flood Zones (based on Table 3 of the NPPG) to determine where development is 'appropriate', where it should only be permitted if the Exception Test is passed and where it should not be permitted. For Flood Zone 2, compatibility has been assessed based on the Environment Agency published Flood Zones. However, for Flood Zones 3a and 3b, compatibility has been assessed based on the Gatwick Upper Mole model as it offers the most up to date basis for the assessment and due to the fact that the Environment Agency Flood Zones do not specifically delineate Flood Zone 3b.

5.9.2 Table 5.9.1 indicates the flood zone compatibility of the Project elements, indicating whether they are deemed 'appropriate' or if they need to pass the Exception Test.

Table 5.9.1: Project Elements Vulnerability and Flood Zone Compatibility

Project Element Type	Vulnerability Classification	Flood Zone Compatibility			
		FZ1	FZ2	FZ3a	FZ3b
Runways Taxiways Terminals Piers and Stands Internal Access Routes and Surface Access (including highway improvements)	Essential Infrastructure	✓	✓	Exception Test Required	Exception Test Required
Waste Management Facilities	Highly Vulnerable	✓	Exception Test Required	✖	✖
Hotel and Commercial Facilities	More Vulnerable	✓	✓	Exception Test Required	✖

Project Element Type	Vulnerability Classification	Flood Zone Compatibility			
		FZ1	FZ2	FZ3a	FZ3b
Fire Training Ground Hangars Maintenance Facilities Car Parking	Less Vulnerable	✓	✓	✓	×
Flood Control Infrastructure Flood Storage Areas	Water Compatible	✓	✓	✓	✓

✓ = 'appropriate'

× = 'not permitted'

The Sequential Test

5.9.3 The Sequential Test, as described in Section 3.4, ensures that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The flood zones, as defined by the Environment Agency Flood Map for Planning, provide the basis for the test to be applied. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision-making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas at high probability of river and sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

5.9.4 According to the Environment Agency Flood Zones (Figure 5.2.1), the majority of the altered northern runway and proposed taxiways located in the western part of the airport fall within Flood Zone 2. Existing infrastructure, including runways and taxiways as well as the South and North Terminals also fall within Flood Zone 2 and partly, Flood Zone 3. Both the existing main runway and the proposed altered northern runway are located outside of Flood Zone 3, but there are small strips of taxiways, both existing and proposed, around the western end of the airfield that fall within Flood Zone 3.

5.9.5 In applying the Sequential Test, it should be considered that the adopted approach has been to make best use of existing infrastructure. This is a strategic decision by the Airports Commission but also an approach to minimise wider environmental impacts by Gatwick.

5.9.6 The Airports Commission: Final Report (Airports Commission, 2015) concluded that a new runway at Heathrow would be the most beneficial long-term expansion solution for London airports and did not propose to take forward the proposal of a new runway in Gatwick Airport at this time. A number of alternative options for the runway and other Project elements have been considered (see PEIR Chapter 3: Need and Alternatives Considered). The final selection for the location of these options has taken account of various factors, including flood risk. Therefore, it can safely be assumed that alternative locations for the Project, outside of Flood Zone 2 and 3 are not available and that the Sequential Test would be passed.

5.9.7 Table 5.9.1 shows that the Exception Test needs to be applied for some elements of the Project.

The Exception Test

5.9.8 The Exception Test is described in Section 3.5. Essentially, there are two parts to the Exception Test that require the applicant to demonstrate that a proposed development will provide wider sustainability benefits to the community that outweigh flood risk and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reducing flood risk overall.

5.9.9 The first part of the Exception Test will be considered through the planning and EIA processes and within the Sustainability Statement that will accompany the application for development consent. Gatwick's sustainability policy goals and objectives lie at the heart of the Project sustainability framework. In addition, the framework reflects both the objectives used by the Government in the Airports NPS (Department for Transport, 2018) and the sustainability priorities relevant to the host local authorities within the context of local aspects. More information on wider aspects of sustainability can be found within the PEIR, with a brief description of Gatwick's ongoing sustainability objectives included in Chapter 5: Project Description.

5.9.10 The second part of the Exception Test is addressed in Section 7, where it is demonstrated how a flood mitigation strategy is in place that would ensure the Project remains safe throughout its lifetime and does not increase flood risk elsewhere.

6 Flood Risk due to the Project

6.1 Introduction

6.1.1 The development of the Project could itself affect flood risk within the wider study area, if no mitigation was in place. This section describes how and where flood risk would be increased due to the Project, with regards to types of flooding that have the potential to be affected by new development. These include fluvial, surface water, groundwater and sewer/ water distribution infrastructure flood risk. The Project would not increase the likelihood of reservoir and/ or flood defence failure, or change the magnitude of impact, if these occurred. Therefore, these types of flooding have been scoped out of this assessment.

6.2 Fluvial Flood Risk

6.2.1 According to the Environment Agency Flood Zones and the Upper Mole Hydraulic Model results, areas downstream and upstream of Gatwick are also at risk of fluvial flooding and hence, further development within the airport has the potential to influence flood risk upstream and downstream.

6.2.2 This section provides an assessment of the Project's effect on fluvial flood risk, assuming no mitigation would be in place. This assessment is based on the comparison of flood extents and flood depths between the baseline 1 per cent (1 in 100) AEP event including a 35 per cent climate change allowance and the with-Project results for the same event, Figure 6.2.1, and the comparison of flood extents and flood depths between the baseline 1 per cent (1 in 100) AEP event including a 70 per cent climate change allowance and the with-Project results, Figure 6.2.2.

6.2.3 Where differences are indicated between the two scenarios, these are discussed in the context of the magnitude of change of flood depth as well as the vulnerability of the potential receptor/ land use.

6.2.4 According to Figure 6.2.1, the with-Project scenario would result in an increase in flood depths south of the existing main runway, including in areas outside of the airport boundary, around the River Mole (>10 mm and up to 50 mm increase) and Crawter's Brook (mainly up to 100 mm flood depth increase), where a number of industrial properties are located. Moreover, flood depths would increase within the airport (>100 mm), around the western part and an area in the north, where the proposed Taxiway Lima extension is located. Figure 6.2.2. shows that the 1 percent (1 in 100) AEP event including a 70 per cent climate change allowance would result in more significant flooding south of the main runway, on the east side of the End Around Taxiway East, in and immediately north of Taxiway Lima, and west of the Longbridge roundabout. There is some increased betterment south of the runway, in Crawter's Brook and west of Taxiway Lima.

6.2.5 The surface access improvements would result in the loss of floodplain at Longbridge Roundabout and to the south of the A23, north-east of North Terminal as a result of the construction of an embankment for the A23 flyover. These would result in an increase in flood risk if no mitigation was provided by the Project.

6.2.6 An increased risk of flooding would also result around the Riverside Garden Park area from the Gatwick Stream and would affect residential properties within Horley. Therefore, it is essential that a flood mitigation strategy is developed as part of the Project. This is described in Section 7.

6.3 Surface Water Drainage Flood Risk

6.3.1 This section provides an assessment of the Project's impact on local surface water flood risk. At this stage, detailed design of the drainage system has not been undertaken, and finished ground levels of the development are still being finalised. Therefore conceptual modelling has been undertaken to examine the effects that the Project would have on surface water flows and an evaluation of the storage required to prevent any increase in discharge rates from the development has been undertaken.

6.3.2 The Project includes the addition of up to approximately 17.9 hectares of hardstanding area and new roof area within the airport and would therefore increase surface water runoff. Furthermore, the introduction of new infrastructure has the potential to block or divert existing surface water flow paths through landform changes, potentially increasing flood risk elsewhere.

6.3.3 Existing surface water flow paths and ponding areas show the patterns of surface water flooding within the airport. Assuming no changes to the drainage system and no mitigation strategy, the addition of impermeable area would exacerbate flood risk within areas already at risk and flooding would be expected to extend to adjacent low-lying areas.

6.3.4 This assessment therefore highlights the need for the development of a flood mitigation strategy that would mitigate surface water flood risk within the airport (refer to Section 7).

6.4 Groundwater Flood Risk

6.4.1 Some elements of the Project include structures or other elements that are likely to penetrate into shallow groundwater. These may have a local impact on groundwater flow paths and levels in their immediate vicinity.

6.4.2 Furthermore, some buried services (such as cabling ducts) may be susceptible to impacts from high groundwater levels (whether or not these are due to groundwater levels higher than the norm).

6.4.3 These risks may be addressed by adopting appropriate design practices, for example by adopting resilience measures. These measures may be passive (using sealing materials to exclude the entry of groundwater) or active (by building in sumps and pumping arrangements) and overall it is considered that the risk from groundwater flooding would not be adversely affected by the Project, and the risk from groundwater flooding would remain low.

6.5 Sewer/ Water Distribution Infrastructure Flooding

6.5.1 During the operational phase of the Project, peak daily passenger numbers would increase, introducing additional loading to the foul sewerage system of the airport. This could have a potential long-term impact on sewer flood risk. However, modelling of this increase, undertaken for the PEIR (Chapter 11: Water Environment), has shown that the sewerage system would not be significantly affected by the Project. The foul sewerage system (with mitigation) would have adequate capacity to accommodate the increase in flows expected to be caused by the Project.

6.5.2 Additional water distribution infrastructure would also have to be installed as part of the Project, in order to accommodate new buildings and infrastructure. However, this would be new infrastructure and would be considered to be at low risk of failing and causing flooding. In the case that parts of the existing water distribution network are replaced as part of the Project, this could provide an overall betterment in terms of flood risk.

6.6 Flood Risk During Construction

6.6.1 The precise location and layout of construction compounds would be determined by the Principal Contractor. However, at this stage, the principal expected compounds have been described and mapped in the PEIR Chapter 5: Project Description. In terms of flood risk, the location of construction compounds would be compared against the 1 per cent (1 in 100) AEP event flood extents, with a 25 per cent allowance for climate change as the compound would only be in place during years within the 2015-2039 period referenced in Table 3.6.2.

6.6.2 The satellite airfield construction compound, which would be located adjacent to the River Mole, falls within the 1 per cent (1 in 100) AEP floodplain. However, this compound has been considered in the timing of the construction of compensatory floodplain storage (see Section 7.2) and the proposed mitigation adequately replaces that lost to ensure no increase in flood risk. At this stage, other proposed construction compounds are expected to be located outside of the extent of the 1 per cent AEP +25 per cent event.

6.6.3 Overall, construction methods are necessarily broad at this stage. It is assumed that a construction flood management plan (FMP) and appropriate drainage strategy would be developed to ensure all flood risks related to construction activities would be mitigated or safely managed within the Project boundary. This FRA provides information that can be used as a basis when preparing the construction FMP in order to ensure that people and infrastructure remain protected from identified flood risks to the Project site.

7 Flood Mitigation Strategy

7.1 Introduction

7.1.1 As described in Section 6.2, the Project would encroach on existing floodplain areas and therefore result in a net reduction in flood storage that would require mitigation. There are also additional areas of pavement and other changes that alter surface water runoff. Therefore, a flood mitigation strategy has been developed as part of the Project, focused on fluvial and surface water flood risk.

7.1.2 The overall approach for fluvial flood risk mitigation has been to maximise the compensatory flood storage capacity within the airport. For surface water flood risk, the approach is focused on providing additional attenuation storage and flow control measures where possible.

7.2 Fluvial Flood Mitigation Strategy

7.2.1 A number of flood mitigation measures have been proposed as part of the Project, to ensure it would remain safe from flooding throughout its lifetime and would not increase flood risk elsewhere. All mitigation measures proposed for inclusion within the Project have been mapped in Figure 7.2.1 and are described in this section.

7.2.2 All the embedded fluvial mitigation measures of the Project are represented in the Upper Mole Hydraulic Model for the with-Project, with-mitigation scenario, which provides the basis for assessment of the mitigation strategy.

7.2.3 All of the proposed flood mitigation measures are planned to be constructed during the early years of the project to ensure that mitigation is provided in advance of the associated encroachment and loss of floodplain, including the temporary construction compound (see Section 6.6.2).

Proposed Fluvial Flood Mitigation Measures

7.2.4 Preliminary designs for the flood compensation areas, relocated Pond A and the River Mole reconfiguration are included in Annex 1. These are likely to evolve as the Project design progresses, but they do provide an indication of the intended features.

Floodplain Compensation Areas

7.2.5 The Project would encroach on existing floodplain areas and therefore result in a net reduction in flood storage that would need to be compensated for. The overall approach has been to maximise the compensatory flood storage capacity of the airport as close to where it has been lost due to the Project. This would be achieved with the development of new Flood Compensation Areas (FCAs) to ensure there is no increase in flood risk arising from the Project. The proposed FCAs have been mapped in Figure 7.2.1 and include; the Museum Field FCA (including east of Museum Field FCA) which is located north of the proposed relocated fire training ground and west of the River Mole; car park X FCA, located south of the main runway and adjacent to Crawter's Brook; and the east of Gatwick Stream FCA, located south of the Crawley STW.

Pond A Relocation and River Mole Reconfiguration

7.2.6 The proposed extension of the airfield encroaches on the existing Pond A, which would therefore require relocation or replacement. It has been proposed that Pond A is relocated directly to the north of its existing location. The volume of the relocated Pond A would take into account any additional storage requirements due to the introduction of new impermeable area as part of the Project.

7.2.7 The proposed relocation of Pond A north of its existing location, also requires the realignment of the River Mole such that the Pond would lay on the left bank of the river, to allow gravity drainage from the catchment serving the western airfield.

Syphons

7.2.8 The new taxiway levels are governed by the need to tie into existing taxiway or runway levels, potentially impacting on areas of floodplain. Areas of lost floodplain storage would result not only from the new taxiways, but also by hydraulically isolating part of a floodplain where the taxiway crosses it. This would be addressed by connecting both sides of the floodplain with syphon structures under the taxiways. This approach has been adopted due to the areas of lost floodplain that would be difficult to compensate for within the vicinity of where the floodplain is lost. There are two proposed syphons, as shown in Figure 7.2.1.

Assessment of Proposed Fluvial Mitigation

7.2.9 The Gatwick Upper Mole Hydraulic Model has been run for the with-mitigation scenario in order to determine the effectiveness of the proposed mitigation strategy in keeping all Project elements safe for their lifetime and in mitigating all flooding to third parties due to the Project. This assessment allows for a judgement to be made on whether the second part of the Exception Test can be passed (refer to paragraphs 5.9.8 to 5.9.10).

7.2.10 Figure 7.2.2 illustrates flood extents within Gatwick, for the mitigated, with Project scenario, for the 5 per cent (1 in 20) and 1 per cent (1 in 100) AEP fluvial event, as well as the 1 per cent (1 in 100) AEP event including 35 per cent and 70 per cent climate change allowances. This illustrates that the proposed runways and new taxiways would not be at risk of flooding during the design event (1 per cent (1 in 100) AEP event, including a 35 per cent climate change allowance). However, some Project elements, including the edge of the end around taxiway next to Taxiway Yankee, the edge of the reconfigured Taxiway Zulu, the edge of the fire training ground and Crawter's Field car park, which is located south east of the main runway, would fall within flood extents for the 1 per cent (1 in 100) AEP event including 35 per cent climate change design event for the airfield. These areas of flooding are not expected to affect the ability of the airport to remain operational and safe. The planned response to an event of this magnitude will be laid out in the Gatwick Flood Threat Plan to ensure continued safe operation.

7.2.11 At the fire training ground, flood depths would be <200 mm for the design event (1 per cent (1 in 100) AEP event including a 35 per cent climate change allowance) and the flood extents are very localised and would not block any access and egress routes. The facility would not be expected to be used during extreme flooding events. Therefore, the facility would remain safe for its lifetime.

7.2.12 Similarly, for the end around taxiway and Taxiway Zulu, flood depths would be <200 mm (mainly <100 mm), and these parts of the airfield are not expected to be required to remain operational during the design flood event. Therefore, there would be no safety risk to users of the airfield.

7.2.13 Finally, for Crawter's Field Car Park, flood depths for the design event would be mainly <400mm. The car park would be expected to remain closed in extreme flooding events, and users would be informed of the risk of flooding. Overall, the majority of the car park area would experience no flooding or flooding up to 300 mm for the design event. Access and egress routes would not be blocked during such an event and there are no dry islands that would represent a significant risk for users.

7.2.14 Figure 7.2.3 illustrates the difference in fluvial flood depths between the baseline and with-scheme, with-mitigation scenarios, for the 1 per cent (1 in 100) AEP event, including a 35 per cent allowance for climate change, allowing for a more detailed assessment of potential impacts. It shows that there are much greater areas benefiting from the development of the Project compared to the areas where flood risk is increased. The most obvious new areas of flooding are intentional and are associated with the proposed FCAs; Museum Field, Car Park X and the Gatwick Stream FCA (see Figure 7.2.1). Another flood depth increase shown is located at the north-west edge of the proposed fire training ground. However, the fire training ground facility would not be classified as 'Essential Infrastructure' and would not have to remain fully operational during such an extreme event. In any case, the flood extents are located on the edge of the facility and are not expected to affect its ability to remain operational, and therefore, this is acceptable from an Exception Test perspective.

7.2.15 Directly south of the fire training ground there is a narrow strip of increased flood depths. However, this area remains unused and does not encroach on any infrastructure and therefore, the change is not considered to result in a significant effect.

7.2.16 The South Terminal building would be at risk of flooding during the 1 per cent (1 in 100) AEP event including a 35 per cent climate change allowance, as for the baseline scenario (less than 10 mm betterment). However, dry access and egress routes from above flood levels, via high-link bridges and multi-storey car parks are in place for the terminal buildings.

7.2.17 Similarly, for the 5 per cent (1 in 20) AEP event, Figure 7.2.4 illustrates the difference in fluvial flood depths compared to the baseline scenario. As for the 1 per cent (1 in 100) AEP event, Figure 7.2.4 shows that the only areas where flood depths would be increased are associated with the proposed FCAs, the area on the edge of the fire training ground and the small undeveloped area directly south of the fire training ground. For all other areas flood depths would be reduced significantly.

7.2.18 Overall, there would be large areas with reduced fluvial flood risk within Gatwick Airport and the wider study area after the development of the Project with the mitigation measures proposed and it is estimated that approximately 100 residential properties in the area of Horley would benefit from the Project (ie

>10 mm reduction in peak flood depth for the 1 per cent (1 in 100) AEP event, including a 35 per cent allowance for climate change). An additional 40 industrial properties would also be likely to benefit.

7.2.19 Small areas of increase in flood depths would be located within the airport boundary and would not affect its ability to remain operational during times of flood, or to operate safely. The runways would remain operational for the design event (ie the 1 per cent (1 in 100) AEP event, including a 35 per cent allowance for climate change). For the terminal buildings, flooding would be equivalent to existing. For taxiways and supporting airport infrastructure, flood risk would be reduced or equivalent to existing, with the exception of small areas of locally increased flood risk. These areas have been described in paragraphs 7.2.10 to 7.2.16, where it is shown that these would not result in safety or operational risks. There would be no increase in flooding to third parties due to the Project.

7.2.20 The mitigation measures included to address changes in fluvial flood risk on the airfield would also provide mitigation for the surface access elements of the Project. Given its longer lifetime the impact of the surface access proposals on fluvial flood risk have considered the design event to be the 1 per cent (1 in 100) AEP event, including a 70 per cent allowance for climate change. Figure 7.2.5. demonstrates that the fluvial mitigation measures would also ensure that there would be no increase in fluvial flood risk beyond the airport boundary for this event (other than the floodplain compensation areas that would be deliberately designed to flood safely).

Exceedance Scenario

7.2.21 The 1 per cent (1 in 100) AEP event, including a 70 per cent climate change allowance, has been tested as an exceedance scenario for the airfield (as a sensitivity analysis) and results are mapped in Figure 7.2.5. It is shown that flood risk is not increased by the Project outside the Project boundary and that there is betterment to third parties (flood depths decreased by up to 100 mm in some areas). Flooding within Gatwick Airport is locally increased compared to the design event (1 per cent (1 in 100) AEP event including a 35 per cent climate change allowance), affecting some taxiways and stands but not the existing and proposed main runways or terminal buildings. Safe access and egress routes as described in paragraph 7.2.16. would not be affected by flooding and available for use.

7.2.22 As a further, worst case scenario, the impact of failure of the flood defences has been assessed to understand the potential impacts. Figure 7.2.6. shows the Mitigated with Project Scenario (1 per cent AEP +35 per cent climate change) together with the Undefended with Project 1 per cent AEP +35 per cent climate change and +70 per cent with climate change scenarios. In the +35% climate change scenario, the impacts of increased flood from flood defence failure are restricted to the airport for which management response procedures will be implemented. There is one area East of the Railway that is at risk of flooding from the failure of defences. In the +70 per cent climate change scenario, there are small additional areas south of the runway, across the runway at the eastern end which may represent an operational risk, but it is likely that aircraft operation would be stopped in this scenario. Small areas of additional risk are on the Gatwick Stream east of the railway, near the Longbridge roundabout and to the edge of the River Mole south of the airport. Safe access and egress routes as described in paragraph 7.2.16 would not be affected by flooding.

7.3 Surface Water Drainage Mitigation Strategy

Proposed Surface Water Drainage Measures

7.3.1 A surface water drainage strategy has been developed as part of the Project. The objective of the strategy has been to make best use of the existing surface water management network, while providing additional attenuation facilities and/ or floodplain compensation where needed and reconfiguring existing infrastructure where that would provide wider flood risk benefits.

South West zone attenuation tank and pumping station

7.3.2 A new surface water attenuation tank and pump station is proposed south of the existing runway. This underground attenuation tank and pumping station will be sized based on the final design of the Project and will ensure new impermeable area from the runway and taxiways within the existing Pond M Catchment is controlled to greenfield runoff rates. This is shown in Figure 7.3.1. This pumping station will discharge into Pond M, which has a controlled discharge rate.

Pond A discharge control improvements

7.3.3 Pond A currently has a free outfall to the River Mole, with no designed discharge control. The Northern Runway fringes will impinge on Pond A, meaning that it will reduce in area, reducing its potential volume. However, the new outlet control will ensure that Pond A acts as surface water attenuation. Figure 7.3.2. shows the conceptual design of Pond A.

7.3.4 Table 7.3.1 summarises the additional storage provided by the Project.

Table 7.3.1: Additional Storage (m^3) Provided by the Development

Storage	Baseline	Project
Pond A	0	16,000
New Pumping Station	0	2,800
Dog Kennel Pond Clean Side	525	525
Pond Mclean Side	19,268	19,268
Pond D (Lower)	20,400	20,400
Total Storage	39,668	55.668

Surface Access Improvements Drainage Strategy

7.3.5 The surface access improvements proposed as part of the Project would include North Terminal and South Terminal roundabout works and works to improve capacity at the Longbridge roundabout and to provide better integration with the North Terminal roundabout improvements. As part of these works, it is proposed that a drainage network is installed, consisting of carrier drains, filter drains, ditches and attenuation ponds, along with flow control arrangements to limit discharges to watercourses. Therefore, surface water drainage runoff from new areas of highway would be restricted to pre-development rates, and where possible, greenfield runoff rates. This would ensure no increase in flood risk as a result of these works. Further details of the surface access outline drainage design are included in Annex 2.

7.3.6 The proposed works would locally encroach on areas currently at risk of surface water ponding. However, this would be safely managed by the road drainage network associated with the highway works. No major surface water flow paths would be expected to be interrupted as part of the surface access improvements proposed.

Assessment of Proposed Surface Water Mitigation

7.3.7 Figures 7.3.3 and 7.3.4 illustrate the surface water flood extents for the 1 per cent (1 in 100) AEP event, including a 20 per cent and a 40 per cent climate change allowance, applied to both a short duration (30 minutes) and a long duration (1440 minutes) event for the with mitigation scenario. The 20 per cent allowance defines the design event for the Project, while the 40 per cent allowance has been tested as an exceedance scenario.

7.3.8 Similar to the baseline scenario, the short duration presents the worst case in terms of flood extents. Overall, it is shown that for the short duration event, several areas of local ponding encroach on proposed and existing runways and taxiways.

7.3.9 Figures 7.3.5 and 7.3.6 illustrate the difference in surface water flood depths between the baseline and with-Project scenarios and for the 1 per cent (1 in 100) AEP event, including a 20 per cent climate change allowance, for the 30-minute duration event and the 1140-minute duration event.

7.3.10 According to Figure 7.3.5, overall surface water flow paths would not significantly change or be interrupted by the Project and the level of risk would remain similar to existing. There are some local areas of betterment (10 mm to 50 mm flood depth decrease) on existing taxiways around the terminal buildings. However, surface water flood depths are shown to increase for the short duration 1 per cent (1 in 100) AEP event, including a 20 per cent allowance for climate change, at some localised areas of runways, taxiways and stands at the western part of the airport. In most cases the increase of flood depths would be <50 mm or even <10 mm, and in all cases is <100mm.

7.3.11 According to Figure 7.3.6, for the longer duration event (1440 minutes) there is a minor beneficial impact to surface water flood depths around North Terminal after the development of the project (<1 mm betterment), except for a very localised area of increase, at Pier 4 and adjacent stands, that would not be expected to impact airport operations.

7.3.12 However, as discussed in Section 4, the model has not been validated for surface water flooding performance and therefore, care must be taken with the model outputs with respect to above ground surface water flooding. In particular, the alterations in ground levels within the airfield due to the Project have not been assessed as the model is currently undergoing further development. Therefore, the exact locations of flooding cannot be verified at this time. However, the proposed runways and taxiways would be raised and therefore, flooding would not occur at the locations that the flood extents currently indicate. Areas for air traffic would be designed with suitable drainage to prevent surface water flooding of the type shown in Figure 7.3.5. Any increases would be anticipated to be localised and restricted to grassed areas outside of general use.

7.3.13 Overall, considering the localised nature of these effects as well as the uncertainties of the surface water model, it is not anticipated that surface water flooding would affect the ability of the airport to remain functional during such an event.

7.3.14 For the exceedance scenario, ie the 1 per cent (1 in 100) AEP event, including a 40 per cent allowance for climate change, the model shows that there would be betterment or negligible change at all locations that previously experienced flooding, for both durations modelled (see Figures 7.3.7 and 7.3.8), except for a very localised area of increase near the North Terminal that would not be expected to impact airport operations (Figure 7.3.8).

7.3.15 At this stage, and given the above assessment of effects (ie the 1 per cent (1 in 100) AEP event, including a 40 per cent climate change allowance) after taking into account the proposed mitigation measures, it is considered that the Project would not adversely impact surface water flood risk or increase surface water flooding elsewhere. However, during detailed design and after the surface water model has been validated, areas within the airport that are highlighted here as potentially flooded should be further investigated and further mitigation should be provided where necessary. The risk of potential pipe/ culvert blockages has not been considered within this assessment and should be taken into account when the detailed surface water drainage design is developed.

Pre- and Post-development Discharge Rates and Volumes

7.3.16 The Crawley SFRA (Crawley Borough Council, 2015) states that surface water runoff from the site should not be increased due to proposed developments and should be reduced where possible. Similarly, the Airports NPS (Department for Transport, 2018) includes the requirement that:

'The surface water drainage arrangements for any project should be such that the volumes and peak flow rates of surface water leaving the site are no greater than the rates prior to the project, taking into account climate change, unless specific off-site arrangements are made and result in the same net effect.'

7.3.17 The proposed and existing runoff volumes and maximum discharge rates are included in Table 7.3.2 and Table 7.3.3 for the 1 per cent (1 in 100) AEP event, including a 20 per cent allowance for climate change and for the 30-minutes duration. These rates assume free discharge at all locations. For the same event and for the longer, 1440-minutes, duration, results are included in Table 7.3.4 and Table 7.3.4. The runoff rates and volumes have been calculated for three discharge locations; Pond A, Pond M and Pond D. These ponds discharge to the same watercourse (River Mole) within approximately 3km and therefore the total discharge values are of interest, rather than individual pond discharges. This is because any minor localised increase in the vicinity of the discharge points would not be anticipated to increase flood risk to receptors as the watercourse generally floods onto grassed areas of Gatwick Airport during fluvial flood events in these locations. However, in order to pass the Exception Test and comply with the above-mentioned Airports NPS requirement, total discharge volumes and runoff rates should not be increased.

7.3.18 For the short duration (30 minutes) it is shown that total peak runoff rates would be reduced by 0.4 per cent, and the volume would increase by 1%. With respect to the volume increase it is considered that such a limited increase in surface water discharge rates and volumes could be managed by increasing the attenuation capacity of some proposed features during future design stages. Modelling results would be validated and re-run after the mitigation strategy is finalised to confirm this.

Table 7.3.2: Pre- and post- development volume of discharge for the 1% (1 in 100) AEP event, including a 20 per cent climate change allowance, for a 30-minute storm duration

Volume (m^3)	Discharge Locations			
	Pond A	**Pond M**	**Pond D**	**Total**
Pre-development	1,299	9,768	69,946	81,013
Post-development	1,440	11,887	68,703	82,030
Difference	141	2119	-1,243	1,017
Difference (%)	11%	22%	-2%	1%

Table 7.3.3: Pre- and post-development runoff rate for the 1% (1 in 100) AEP event, including a 20 per cent climate change allowance, for the 30-minutes duration

Peak runoff rate (m^3/s)	Discharge Locations			
	Pond A	**Pond M**	**Pond D**	**Total**
Pre-development	0.75	0.20	1.70	2.65
Post-development	0.72	0.22	1.70	2.64
Difference	-0.03	0.02	0	-0.01
Difference (%)	-4%	10%	0	-0.4%

7.3.19 For the long duration (1440 minutes) event it is shown that total peak runoff rates would be reduced by 28 cent, and the volume would reduce by 9%.

7.3.20 For the long duration (1440 minutes) it is shown that total discharge volumes and peak runoff rates would be decreased by 9 per cent and 28 per cent respectively.

7.3.21 Overall, the level of change noted here is not considered significant and subject to the described additional mitigation being provided it is considered that the Project would successfully pass the second part of the Exception Test, ie remain safe for its lifetime and not increase flood risk elsewhere.

Table 7.3.4: Pre- and post- development volume of discharge for the 1% (1 in 100) AEP event, including a 20 per cent climate change allowance, for the 1440-minutes duration

Volume (m^3)	Discharge Locations			
	Pond A	**Pond M**	**Pond D**	**Total**
Pre-development	27,357	27,192	176,739	231,288
Post-development	4,342	30,011	175,243	209,596
Difference	-23,015	2,819	-1,496	-21,692
Difference (%)	-84%	10%	-1%	-9%

Table 7.3.5: Pre- and post-development runoff rate for the 1% (1 in 100) AEP event, including a 20 per cent climate change allowance, for the 1440-minutes duration

Peak runoff rate (m^3/s)	Discharge locations			
	Pond A	Pond M	Pond D	Total
Pre-development	1.087	0.44	1.71	3.237
Post-development	0.12	0.51	1.71	2.34
Difference	-0.97	0.07	0	-0.90
Difference (%)	-89%	16%	0%	-28%

7.4 Construction Phasing Mitigation

7.4.1 Hydraulic modelling has been undertaken to understand the potential flood risk impacts during the construction phases of the Project. There are four mitigation construction phases that have been assessed with the Upper Mole Hydraulic Model, as shown in Table 7.4.1. These phases are different to the PEIR assessment dates and were created based on the construction sequence of works that could impact the floodplain, as well as the timing of proposed mitigation measures.

7.4.2 Table 7.4.1 also includes a high level estimate of the impact of each phase on available floodplain storage, including:

- The volume of floodplain that would be lost during each phase as a result of the new infrastructure or construction compounds within the floodplain.
- The volume of 'formal' floodplain compensation provided in designated compensation areas.
- The volume of additional 'informal' floodplain storage on the airfield site within areas not designed as floodplain compensation areas but which experience deeper flooding as a result of the Project.
- The floodplain that remains available but with reduced connectivity and therefore lower peak water levels for an equivalent flood event due to the Project.

7.4.3 Results are illustrated for the 1 per cent (1 in 100) AEP event including a 25 per cent climate change allowance for phase 1 and the design year, and for the 1 per cent (1 in 100) AEP event including a 25 per cent climate change allowance for phases 2, 3 and 4. These values only refer to floodplain lost/ gained within Gatwick Airport; downstream betterment has not been included in the estimate.

Assessment of flood risk during construction

7.4.4 Figure 7.4.1 shows the difference in flood depths (compared to the baseline scenario) during phases 1 and 2, for the 1 per cent (1 in 100) AEP event, including a 25 per cent climate change allowance. This adopted climate change allowance follows Environment Agency guidance for the predicted increase in peak river flows to 2039 (see Table 3.6.2). Small areas of increased flooding (10mm-50mm) are shown immediately south of the runway but they are surrounded by significantly larger areas of betterment (10mm-50mm and greater than 100mm). Two other small areas of increased flooding occur just north of Taxiway Juliet and near the River Mole which are again surrounded by much larger areas of betterment and do not interfere with operation of the airport. There would be several areas of betterment (10 mm to 100 mm betterment), both inside the airport and off-site.

7.4.5 For phases 3 and 4 (see Figures 7.4.2 and 7.4.3), results are shown for the 1 per cent (1 in 100) AEP event including a 25 per cent allowance and are similar to phases 1 and 2

Table 7.4.1: Mitigation construction phases

Construction phases	Primary works impacting floodplain	Proposed mitigation in place prior to construction within the floodplain	Event		Loss of Floodplain (m^3)	Floodplain Compensation		Change in Floodplain Storage (m^3)
				Direct	Due to Lost connectivity	Formal	Informal	
Phases 1 & 2: 2024-2028	▪ Satellite airfield construction compound ▪ Juliet West Taxiway ▪ End Around Taxiways (Compound remains in place)	Museum Field FCA and River Mole diversion plus car park X FCA RET9 and RET10 Syphons	1% + 25%cc	23,500	300	155,000	2,500	+133,700
Phase 3: 2029-2032	▪ Surface access works	As above	1% + 25%cc	40,000	14,500	155,000	3,000	+ 103,500
Phase 4: Up to 2038 (Design Year)	▪ Compound removed ▪ Further mitigation required due to climate change adaptation	As above plus east of Gatwick Stream FCA	1% + 25%cc	81,000	28,000	162,500	5,000	+58,500

Note: Syphons RET 9 and RET 10 will be constructed to ensure full connectivity which will result in no loss of floodplain. However, the flood plain compensation has been calculated and presented assuming the reduced connectivity (ie without any impact from the Syphons) as a conservative approach.

8 Planning and Development Considerations

8.1 National Planning Requirements

Table 8.1.1: National Planning Requirements and Project Compliance

Summary of requirement	How and where this is considered in the FRA
Airports NPS	
Considering the risk of all forms of flooding to the Project or arising from the Project and demonstrating how these risks will be managed and, where relevant, mitigated, so that the Project remains safe through its lifetime.	Section 5 of this FRA considers all risk of flooding to the Project, with the exception of tidal flooding which has been scoped out (see Section 4.1). In addition, Section 6 describes how the Project would impact fluvial, surface water, groundwater and sewer/ water distribution infrastructure flood risk if no mitigation was in place. Section 7 demonstrates how these risks would be managed with appropriate flood mitigation measures and how the Project would remain safe for its lifetime without increasing flood risk elsewhere.
Taking into account the impacts of climate change, clearly stating the Project lifetime over which the assessment is made.	The Project lifetime is defined as 40 years to 2069 for the airfield works and 100 years to 2132 for surface access elements (see Section 3.6). Climate change impacts have been assessed and included in fluvial and surface water flood risk assessment. Relevant guidance that has been followed within this FRA is described in Section 3.6.
Assessing any residual risks after risk reduction measures have been taken into account and demonstrating how these are acceptable for the Project.	Potential residual risks are discussed in Section 7, where it is demonstrated that these will be managed successfully and will not increase flood risk to the Project or third parties within the study area.
Considering if there is a need to remain operational during a worst-case flood event during the Project's lifetime and the need for safe access and exit arrangements.	For this assessment, the design event for the airfield elements of the Project from fluvial flood risk is the 1 per cent (1 in 100) AEP event, including a 35 per cent allowance for climate change and for rainfall (for drainage design) 1 per cent (1 in 100) AEP event, including a 20 per cent allowance for climate change. It has been demonstrated within this FRA that the runways would remain operational for such an event, as both the main and northern runways would not be flooded. In terms of the terminal buildings and their surrounding areas, existing flooding would potentially have an operational impact, however, flood risk is not adversely impacted from the Project. Dry access and egress routes from above flood levels, via high-link bridges and multi-storey car parks are in place for the terminal buildings. As the surface access elements will have a longer lifetime the embedded allowance for climate change is greater than that for the airfield elements. For the surface access elements, the fluvial design event is the 1 per cent (1 in 100) AEP event, including a 70 per cent allowance for climate change. The highways drainage design has been based on a 1 per cent (1 in 100) AEP event plus 40 per cent climate change allowance for rainfall intensity. The new highways would not be flooded under such an event and the Project would not increase flood risk to other parties. Increases on the airfield would be safely managed by GAL's emergency response plan.
Providing evidence for the Secretary of State to apply the Sequential Test and Exception Test, via a suitable flood risk assessment.	Evidence to apply the Sequential Test have been included in paragraphs 5.9.3 to 5.9.7. Application of the Exception Test is included in paragraphs 5.9.8 to 5.9.10 and Section 7.
The surface water drainage arrangements for any project should be such that the volumes and peak flow rates of surface water leaving the site are no greater than the rates prior to the proposed project, taking into account climate change, unless specific off-site arrangements are made and result in the same net effect.	The pre- and post- development discharge volumes and peak runoff rates are included and discussed in Section 7. These are based on the 1 per cent (1 in 100) AEP event, including a 20 per cent climate change allowance. Where discharge rates are shown to increase, it is anticipated that any increase will be mitigated through the proposed drainage strategy. For the surface access elements the highways drainage design has been based on a 1 per cent (1 in 100) AEP event plus 40 per cent climate change allowance for rainfall intensity given its longer lifetime than the airfield elements. Increases in discharge due to increases carriageway impermeable areas would be attenuated to ensure no increase in peak outflow and no increase in flood risk.
NPS for National Networks	
Requirements of the Airports NPS mentioned above are also included in the NPS for National Networks.	As above

Summary of requirement	How and where this is considered in the FRA
Where linear infrastructure has been proposed in a flood risk area, the Secretary of State should expect reasonable mitigation measures to have been made to ensure that the infrastructure remains functional in the event of predicted flooding.	Where surface access improvements are proposed, these are accompanied by a proposed drainage strategy (see Annex 2) that includes the introduction of carrier drains, filter drains, ditches and attenuation ponds, along with flow control arrangements. Therefore, surface water runoff would be safely managed and restricted to pre-development or greenfield values, subject to detailed design. Moreover, the Project and proposed mitigation measures would decrease flood depths in the vicinity of the area where surface access improvements are proposed. Therefore, these are expected to remain functional during the 1 per cent (1 in 100) AEP event, including a 70 per cent allowance for climate change.

8.2 Local Planning Requirements

Table 8.2.1: Local Planning Requirements and Project Compliance

Policy	Summary of requirement	How and where this is considered in the FRA
Crawley 2030: Crawley Borough Local Plan 2030		
Policy ENV8	Developments should be directed to areas at low flood risk, considering the suitability of their intended use for the area and demonstrating that the Sequential Test and, where require, the Exception Test can be passed.	Evidence to apply the Sequential Test have been included in paragraphs 5.9.3 to 5.9.7. Application of the Exception Test is included in paragraphs 5.9.8 to 5.9.10 and Section 7.
	The Environment Agency Flood Map for Planning should be used to assess flood risk to the area and a site-specific flood risk assessment should demonstrate how appropriate mitigation measures will ensure flood risk is acceptable for the site and will not be increased elsewhere.	Environment Agency Flood Zones (as shown in Flood Map for Planning at the time of writing of this FRA, May 2021) have been mapped and used for the assessment of fluvial flood risk. The proposed flood mitigation strategy is described in Section 7.
	Peak surface runoff rates and annual volumes of runoff should be reduced through the effective implementation, use and maintenance of SuDS, unless it can be demonstrated that these are not technically feasible or financially viable.	The proposed surface water drainage strategy and associated discharge volumes and rates have been described in Section 7.3 of this report.
Reigate and Banstead Borough Local Plan 2005		
Policy Ut4: Flooding	Development (including redevelopment) in floodplains should be avoided and appropriate flood protection and mitigation measures should be considered as part of development in areas at risk of flooding.	Where development in floodplains is proposed as part of the Project, this would be compensated for via the introduction of new floodplain compensation areas, providing, where possible, level-to-level compensation.
Reigate and Banstead Borough Development Management Plan 2019		
Policy CCF2: Flood Risk	Development proposals must not increase the existing and future flood risk elsewhere. Proposals should seek to secure opportunities to reduce both the cause and impact of flooding for existing and proposed development.	The proposed flood mitigation strategy is described in Section 7, demonstrating that the Project would not increase flood risk elsewhere and, where possible, decrease overall flood risk.
	Where SuDS are proposed, schemes should include appropriate arrangements for the ongoing maintenance for the lifetime of the development.	At this preliminary stage, a detailed maintenance strategy has not been proposed. However, guidance from the SuDS Manual, CIRIA C753 (CIRIA, 2015) is to be followed for the effective maintenance of the proposed surface water drainage systems. Maintenance activities would be dependent on the final drainage strategy, subject to detailed design and manufacturer's recommendations. It is anticipated that maintenance activities would be the responsibilities of Gatwick and would be included within general airport maintenance arrangements.
Horsham District Planning Framework 2015		
Strategic Policy 38: Flooding	Where there is the potential to increase flood risk, proposals must incorporate the use of SuDS where technically feasible or incorporate water management measures that reduce the risk of flooding and ensure that flood risk is not increased elsewhere. New developments should undertake detailed	As above

Policy	Summary of requirement	How and where this is considered in the FRA
	assessments to consider the most appropriate SuDS methods for each site. Drainage techniques that mimic natural drainage patterns and manage surface water as close to its source as possible are required, where technically feasible.	
Tandridge District Council Local Plan Part 2 – Detailed Policies		
Policy DP21: Sustainable Water Management	Development proposals should seek opportunities to reduce both the cause and the impact of flooding, ensuring the discharge of surface water runoff is restricted to pre-development values.	As above

8.3 SFRA Recommendations

8.3.1 The Crawley SFRA (Crawley Borough Council, 2020) states that all development falling within Flood Zone 3 should be conditioned in accordance with the development management considerations included in Table 8.3.1.

Table 8.3.1 Crawley Borough Council Strategic Flood Risk Assessment Development Management Recommendations and Project Compliance

Crawley Borough Council SFRA Recommendation	How and where this is considered in the FRA
All proposed future development within Zone 3a High probability will require a detailed Flood Risk Assessment (FRA).	Detailed Flood Risk Assessment has been produced.
Floor levels must be situated above the 1% (100 year) predicted maximum flood level plus climate change, incorporating an allowance for freeboard.	Figure 7.2.2 shows that for the 1 per cent (1 in 100) AEP event, including a 35 per cent allowance for climate change, proposed runways, taxiways and associated infrastructure are not at significant risk of fluvial flooding. Existing taxiways, stands and buildings would experience flood depths equivalent to current situation (<0.01 mm decrease in flood risk). For new taxiways, consideration has been given to elevating taxiway levels above the peak floodplain levels of the baseline event, including an allowance for uncertainty of 300 mm.
Dry access is to be provided (above flood level) to enable the safe evacuation of residents and/or employees in case of flooding. In exceptional circumstances where this is not achievable, safe access must be provided at all locations, defined in accordance with the Defra/EA research project FD2320[1]. It is essential to ensure that the nominated evacuation route does not divert evacuees onto a 'dry island' upon which essential supplies (ie food, shelter and medical treatment) will not be available for the duration of the flood event.	For terminal buildings, dry access and egress routes from above flood levels are in place, via high-link bridges and multi-storey car parks.
Basements are not to be utilised for habitable purposes. All basements must provide a safe evacuation route in time of flood, providing an access point that is situated above the 1% AEP peak design plus climate change flood level.	The Project does not include basements that are intended for habitable purposes. Several new pumping stations and substations are proposed as part of the Project that may include elements up to 10 m below ground level and may need to be accessed for maintenance purposes. Dry access and exit points would be provided. However, these pumping stations would not be accessed frequently. The proposed waste management, motor transport maintenance and surface transport facilities would also include elements below ground level (up to 5 m). However, flood extents for the design event mentioned above do not encroach on these facilities.
Implement SuDS to ensure that runoff from the site (post redevelopment) is not increased and is where possible reduced. Any SuDS design must take due account of groundwater and geological conditions.	At this preliminary stage, proposed designs have been produced at a high-level and have not considered groundwater or geological conditions. However, further design development will be based on site-specific conditions and survey results.
Ensure that the proposed development does not result in an increase in maximum flood levels within adjoining properties. This may be achieved by ensuring (for example) that the existing building footprint is not increased, and/or compensatory flood storage is provided within the site (or upstream)[2].	Where the Project would encroach on existing floodplain, floodplain compensation is provided as close to the where it has been lost. It is shown in Figure 7.2.3, that there are no flood impacts to third parties due to the Project for the design event. In several areas, betterment is provided as a result of the Project.

Crawley Borough Council SFRA Recommendation	How and where this is considered in the FRA
A minimum 8 m buffer zone must be provided to 'top of bank' within sites immediately adjoining the main river corridor. This requirement may be negotiated with the Environment Agency in heavily constrained locations.	This Project and its associated flood mitigation strategy propose works being undertaken within Main River channels, including the realignment of the River Mole. Discussions with the Environment Agency will continue throughout the EIA process to mitigate the impacts.

[1] FD2320 "Flood Risk Assessment Guidance for New Development" (Defra/EA, 2005)

[2] Compensatory flood storage should be located as close as practically possible to the proposed development.

9 Summary and Conclusions

9.1.1 This FRA represents Appendix 11.9.1 to the PEIR Chapter 11: Water Environment and is a preliminary assessment of flood risk for the Project. It also includes the assessment of potential flood effects on external receptors due to the Project and describes the flood mitigation strategy proposed as part of the Project to mitigate these risks.

9.1.2 Fluvial flooding is the main source of flooding to the Project. When determining the Project location, the adopted approach has been to make best use of existing runways and airport infrastructure. Therefore, the levels of flood risk are equivalent to existing and it is anticipated that the Sequential Test (refer to paragraphs 5.9.3 to 5.9.7) would be successfully passed.

9.1.3 Part of the proposed, as well as existing, taxiways fall within Flood Zone 3. According to Table 5.9.1, the Exception Test would have to be passed for these elements to be deemed suitable for development in Flood Zone 3. Based on the provision of wider sustainability benefits, the first part to the Exception Test would be passed (refer to paragraphs 5.9.8 to 5.9.10).

9.1.4 Hydraulic modelling results show that the Project would also increase the risk of flooding to other areas if no mitigation was in place. Therefore, flood mitigation measures have been proposed, mainly in the form of Flood Compensation Areas (FCAs). These mitigation measures have been incorporated into the Gatwick fluvial hydraulic model and it has been shown that the Project would remain safe for its lifetime without increasing flood risk elsewhere.

9.1.5 Surface water flooding is also a key source of flooding for the Project. However, in most cases surface water flow paths and ponding areas are small in extent and do not encroach on proposed elements of the Project. The development of the Project would introduce new impermeable areas and could also increase surface water flooding if no mitigation was in place. Therefore, a surface water management strategy has been proposed and incorporated into the Gatwick surface water hydraulic model in order to assess their effectiveness.

9.1.6 At this stage, the finished elevations of the development are not finalised, and therefore it is not possible to develop a full post development drainage model. A more detailed assessment will be undertaken alongside detailed design. However, it has been shown that the Project would decrease peak runoff rates offsite. Change in flood risk to the Gatwick property itself will be re-evaluated alongside detailed drainage design for the development.

9.1.7 Therefore, it is considered that the Exception Test would successfully be passed for the Project.

9.1.8 At this stage, it has not been possible to fully quantify groundwater flood risk to the Project site; however, it is considered that the current risk from groundwater flooding at the airport site is low. Any groundwater flood risk that could occur elsewhere due to the Project would be addressed by adopting appropriate design practices. Overall, it is considered that the risk from groundwater flooding would not be adversely affected by the Project and risk from groundwater flooding would remain low.

9.1.9 The risk of flooding from other sources, including reservoirs, water distribution infrastructure and sewers, is considered medium to low. The reference to "medium" is because whilst there is lack of recorded sewer/ water distribution infrastructure flooding events and the Gatwick maintenance regime would be expected mitigate any issues that could lead to flooding, there are some known problems relating to flows backing up to the airport from the Horley Thames Water network.

9.1.10 Overall, the Sequential and, where required, Exception Tests have been applied to the Project. It has been shown that there are no alternative sites for the Project which would have a lower risk of flooding than the proposed location, that the development would be safe for its lifetime and that, once further mitigation is applied, there would be no increase in flood risk to third parties.

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11 Glossary

11.1 Glossary of Terms

Table 11.1.1: Glossary of Terms and List of Acronyms

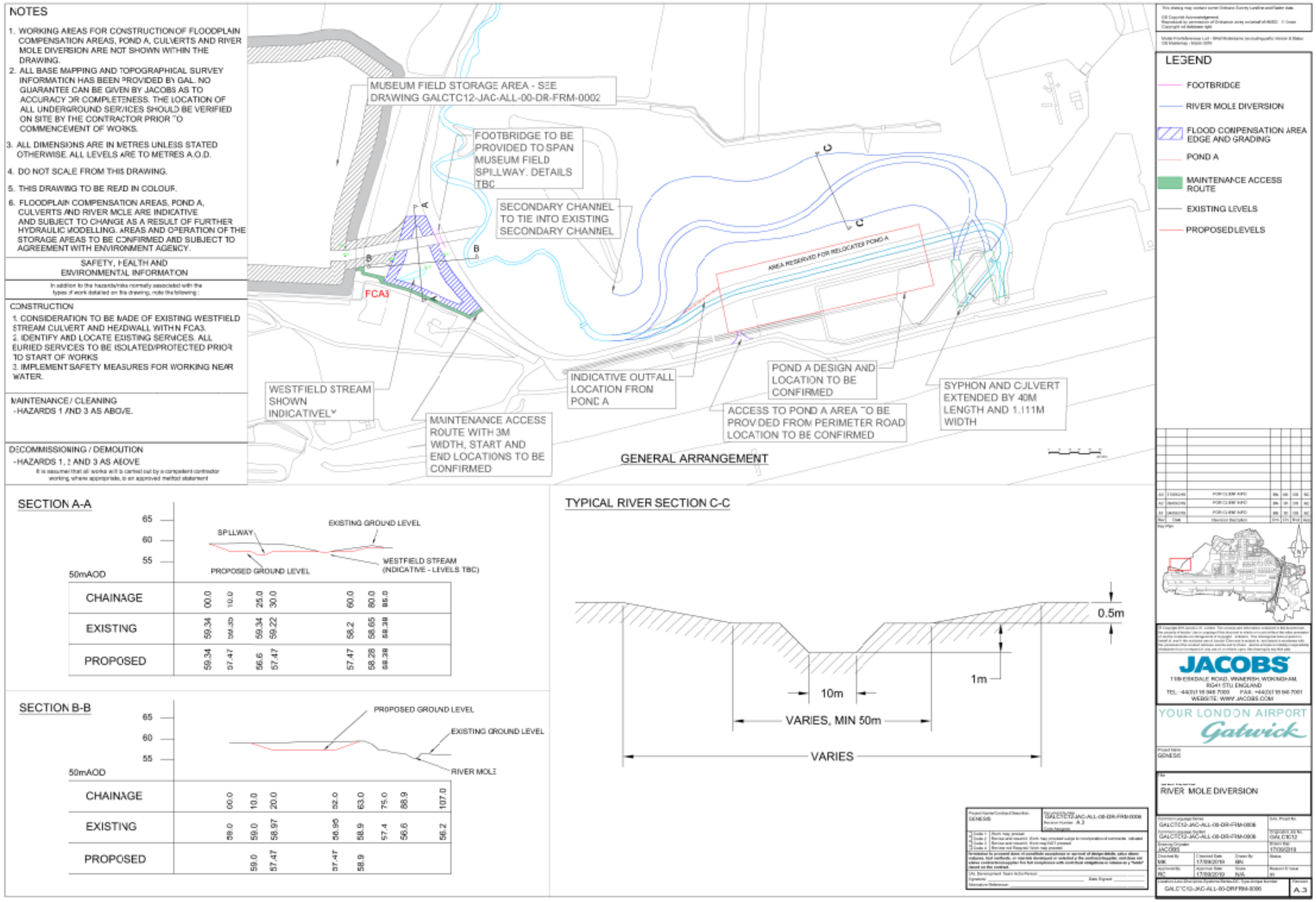
Term	Description
AEP	Annual Exceedance Probability, eg 1 per cent AEP is equivalent to 1 in 100 probability of flooding occurring in any one year (or, on average, once in every 100 years).
AOD	Above Ordnance Datum
BGS	British Geological Survey
BOD	Biochemical Oxygen Demand
Defra	Department for Environment, Food and Rural Affairs. The government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities in the UK. Among its responsibilities, Defra publishes guidance on, for example, flood modelling approaches and approaches to accounting for climate change in flood studies.
Development	The carrying out of building, engineering, mining or other operations, in, on, over or under land, or the making of any material change in the use of a building or other land.
DCO	Development Consent Oder
Environment Agency (EA)	The Environment Agency is a non-departmental public body, established in 1995 and sponsored by DEFRA. Its responsibilities relate to the protection and enhancement of the environment in England. Environment Agency
EIA	Environmental Impact Assessment
ES	Environmental Statement
Exception Test	The Exception Test should be applied if, following application of the Sequential Test, it is not possible for the development to be located in Flood Zones with a lower probability of flooding. For the Exception Test to be passed it must be demonstrated that:

Term	Description
	▪ The development provides wider sustainability benefits to the community that outweigh flood risk; and ▪ That the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible will reduce flood risk overall.
FWMA	Flood & Water Management Act. Part of the UK Government response to Sir Michael Pitt's Review on the Summer 2007 floods, the aim of which (partly) is to clarify the legislative framework for managing surface water flood risk in England.
FCA	Flood Compensation Area. Land which provides a volume of floodplain that compensates for the loss of floodplain elsewhere, where practicable to an equal volume as that lost and on a level-to-level basis.
Flood Map for Planning (Rivers and Sea)	Nationally consistent delineation of 'high', 'medium' and 'low' probability of fluvial and tidal flooding, published on a quarterly basis by the Environment Agency.
Flood Zone 1 Low Probability (FZ1)	NPPG Flood Zone, defined as areas outside Zone 2 Medium Probability. This zone comprises land assessed as having a less than 1 in 1,000 annual exceedance probability of river or sea flooding (<0.1 per cent) in any year.
Flood Zone 2 Medium Probability (FZ2)	NPPG Flood Zone which comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual exceedance probability of river flooding (1 per cent – 0.1 per cent) or between a 1 in 200 and 1 in 1,000 annual exceedance probability of sea flooding (0.5 per cent - 0.1 per cent) in any year.
Flood Zone 3a High Probability (FZ3a)	NPPG Flood Zone which comprises land assessed as having a 1 in 100 or greater annual exceedance probability of river flooding (>1 per cent) or a 1 in 200 or greater annual exceedance probability of sea flooding (>0.5 per cent) in any year.
FMP	Flood Management Plan
FRA	Flood Risk Assessment. A site-specific assessment of flood risk. This is a statutory report for submission with planning applications in England.
Functional Floodplain (Flood Zone 3b) (FZ3b)	NPPG Flood Zone, defined as areas in which water has to flow or be stored in times of flood.
GAL	Gatwick Airport Limited
Groundwater Flooding	Emergence of groundwater at the ground surface or the rising of groundwater into underground infrastructure (such as basements) under conditions where the normal range of groundwater level and flows is exceeded.
LLFA	Lead Local Flood Authority. Unitary Authorities or County Councils responsible for developing, maintaining and applying a strategy for local flood risk management in their areas and for maintaining a register of flood risk assets. Also, responsible for managing local flood risk (flooding from surface water, groundwater and ordinary watercourses).
LFRMS	Local Flood Risk Management Strategy. LLFAs produce Local Flood Risk Management Strategies as part of their duty to manage local flood risk under the Flood and Water Management Act 2010.
LPA	Local Planning Authority. A local planning authority is the local authority or council that is empowered by law to exercise statutory town planning functions for a particular area of the UK.
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers. N.B. Main River designation is not necessarily an indication of size, although it is often the case that they are larger than Ordinary Watercourses.
NPPF	National Planning Policy Framework.
	National planning policy published by the Government, most recently in July 2021. It replaces most of the previous Planning Policy Statements, including that regarding flood risk (PPS25).
NPPG	National Planning Practice Guidance. Supporting guidance to the NPPF, published by the Government in March 2014 and updated since as an online resource, available at: (http://planningguidance.planningportal.gov.uk/). It replaces previously published Government guidance, including that regarding flood risk.
NPS	National Policy Statement
Ordinary Watercourse	All watercourses that are not designated Main Rivers, and which are the responsibility of Local Authorities or, where they exist, Internal Drainage Boards. Note that Ordinary Watercourse does not imply a "small" river, although it is often the case that Ordinary Watercourses are smaller than Main Rivers.
PEIR	Preliminary Environmental Investigation Report
RBD	River Basin District
Residual Risk	A measure of the outstanding flood risks and uncertainties that have not been explicitly quantified and/or accounted for as part of the design process.
RoFSW	Risk of Flooding from Surface Water
RTD	River Terrance Deposits
Sequential Test	A national planning policy requirement that seeks to steer new development to areas with the lowest probability of flooding. In demonstrating that the requirements of the sequential test have been met, proposals should refer to the NPPF and Planning Practice Guidance, and the Environment Agency Flood Zones.
SFRA	Strategic Flood Risk Assessment. There are two levels of SFRA. All local planning authorities need to carry out a Level 1 assessment at least and it may be necessary to expand the scope of this assessment to a more

Term	Description
	detailed Level 2 assessment. A Level 1 SFRA should provide sufficient detail to apply the Sequential Test. A Level 2 SFRA should build on the information in the Level 1 assessment and include sufficient information for the Exception Test to be applied. Where a Level 2 SFRA is produced, the Sequential Test should also be applied to identify sites with the lowest risk of flooding within Flood Zones 2 and 3.
STW	Sewage (waste/foul water) treatment works
SuDS	Sustainable Drainage System. Term covering the whole range of sustainable approaches to surface drainage management. These are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible.

Annex 1

Fluvial Mitigation Measures Indicative Designs


NOTES
1. WORKING AREAS FOR CONSTRUCTION OF FLOODPLAIN COMPENSATION AREAS, POND A, CULVERTS AND RIVER MOLE DIVERSION ARE NOT SHOWN WITHIN THE DRAWING.
2. ALL BASE MAPPING AND TOPOGRAPHICAL SURVEY INFORMATION HAS BEEN PROVIDED BY GAL. NO GUARANTEE CAN BE GIVEN BY JACOBS AS TO ACCURACY OR COMPLETENESS. THE LOCATION OF ALL UNDERGROUND SERVICES SHOULD BE VERIFIED ON SITE BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.
3. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE. ALL LEVELS ARE TO METRES A.O.D.
4. DO NOT SCALE FROM THIS DRAWING.
5. THIS DRAWING TO BE READ IN COLOUR.
6. FLOODPLAIN COMPENSATION AREAS, POND A, CULVERTS AND RIVER MOLE ARE INDICATIVE AND SUBJECT TO CHANGE AS A RESULT OF FURTHER HYDRAULIC MODELLING. AREAS AND OPERATION OF THE STORAGE AREAS TO BE CONFIRMED AND SUBJECT TO AGREEMENT WITH ENVIRONMENT AGENCY.
SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following :
CONSTRUCTION
1. CONSIDERATION TO BE MADE OF EXISTING WESTFIELD STREAM CULVERT AND HEADWALL WITHIN FCA3.
2. IDENTIFY AND LOCATE EXISTING SERVICES. ALL BURIED SERVICES TO BE ISOLATED/PROTECTED PRIOR TO START OF WORKS
3. IMPLEMENT SAFETY MEASURES FOR WORKING NEAR WATER.
MAINTENANCE / CLEANING
- HAZARDS 1 AND 3 AS ABOVE.
DECOMMISSIONING / DEMOLITION
- HAZARDS 1, 2 AND 3 AS ABOVE
It is assumed that all works will is carried out by a competent contractor working, where appropriate, to an approved method statement
MUSEUM FIELD STORAGE AREA - SEE DRAWING GALCTC12-JAC-ALL-00-DR-FRM-0002
FOOTBRIDGE TO BE PROVIDED TO SPAN MUSEUM FIELD SPILLWAY. DETAILS TBC
SECONDARY CHANNEL TO TIE INTO EXISTING SECONDARY CHANNEL
AREA RESERVED FOR RELOCATED POND A
FCA3
WESTFIELD STREAM SHOWN INDICATIVELY
INDICATIVE OUTFALL LOCATION FROM POND A
POND A DESIGN AND LOCATION TO BE CONFIRMED
ACCESS TO POND A AREA TO BE PROVIDED FROM PERIMETER ROAD LOCATION TO BE CONFIRMED
SYPHON AND CULVERT EXTENDED BY 40M LENGTH AND 1.111M WIDTH
MAINTENANCE ACCESS ROUTE WITH 3M WIDTH, START AND END LOCATIONS TO BE CONFIRMED
GENERAL ARRANGEMENT
LEGEND
FOOTBRIDGE
RIVER MOLE DIVERSION
FLOOD COMPENSATION AREA EDGE AND GRADING
POND A
MAINTENANCE ACCESS ROUTE
EXISTING LEVELS
PROPOSED LEVELS
SECTION A-A
65
60
55
50mAOD
SPILLWAY
EXISTING GROUND LEVEL
PROPOSED GROUND LEVEL
WESTFIELD STREAM (INDICATIVE - LEVELS TBC)
CHAINAGE 00.0 10.0 25.0 30.0 60.0 80.0 85.0
EXISTING 59.34 59.35 59.34 59.22 58.2 58.65 58.38
PROPOSED 59.34 57.47 56.6 57.47 57.47 58.28 58.38
SECTION B-B
65
60
55
50mAOD
PROPOSED GROUND LEVEL
EXISTING GROUND LEVEL
RIVER MOLE
CHAINAGE 00.0 10.0 20.0 52.0 63.0 75.0 88.9 107.0
EXISTING 59.0 59.0 58.97 56.95 58.9 57.4 56.6 56.2
PROPOSED 59.0 57.47 57.47 58.9
TYPICAL RIVER SECTION C-C
0.5m
1m
10m
VARIES, MIN 50m
VARIES
JACOBS
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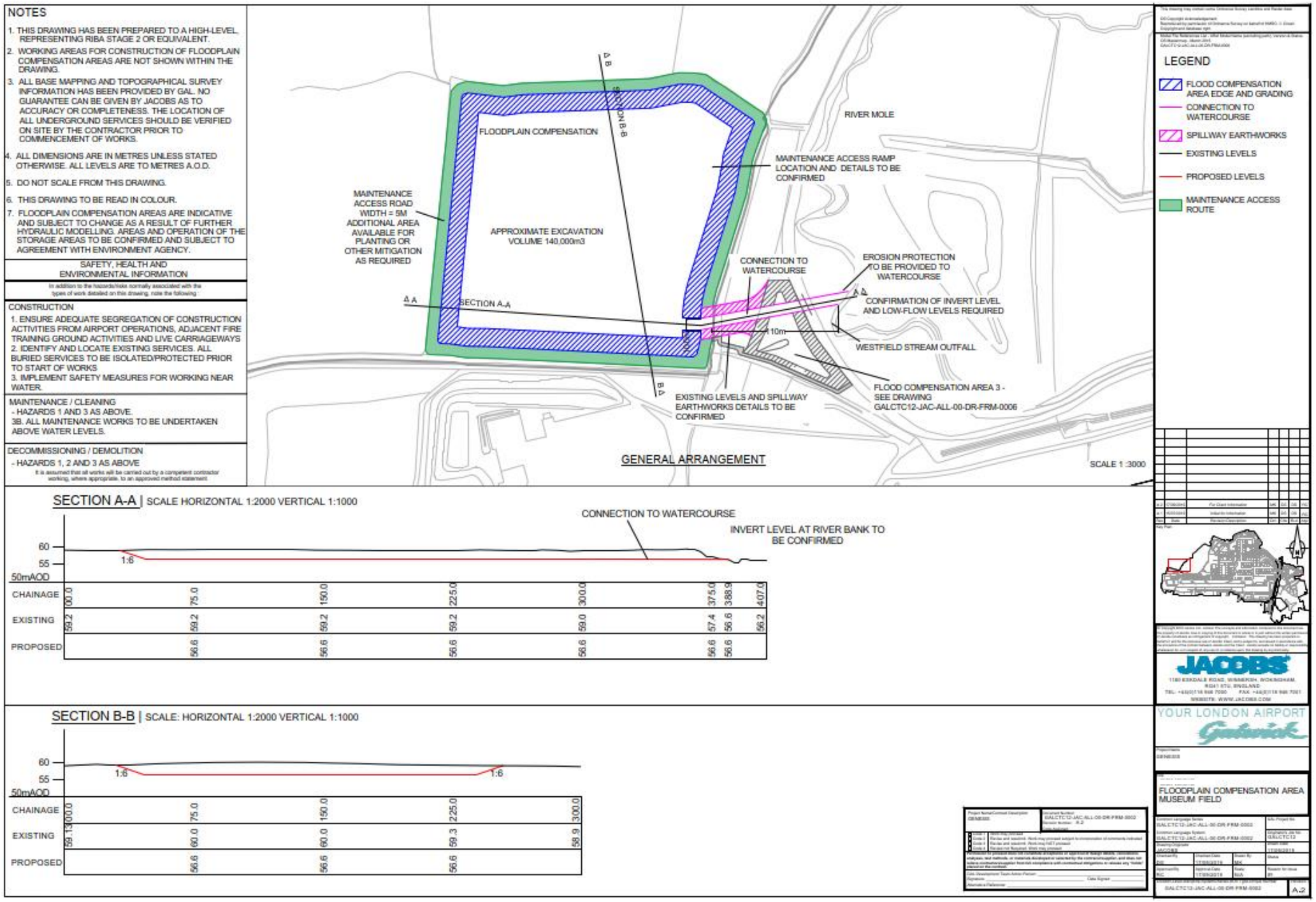
YOUR LONDON AIRPORT Gatwick
GENESIS
RIVER MOLE DIVERSION
GALCTC12-JAC-ALL-00-DR-FRM-0006
A3


NOTES
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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
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CONSTRUCTION
1. ENSURE ADEQUATE SEGREGATION OF CONSTRUCTION ACTIVITIES FROM AIRPORT OPERATIONS, ADJACENT FIRE TRAINING GROUND ACTIVITIES AND LIVE CARRIAGEWAYS
2. IDENTIFY AND LOCATE EXISTING SERVICES. ALL BURIED SERVICES TO BE ISOLATED/PROTECTED PRIOR TO START OF WORKS
3. IMPLEMENT SAFETY MEASURES FOR WORKING NEAR WATER.
MAINTENANCE / CLEANING
- HAZARDS 1 AND 3 AS ABOVE.
3B. ALL MAINTENANCE WORKS TO BE UNDERTAKEN ABOVE WATER LEVELS.
DECOMMISSIONING / DEMOLITION
- HAZARDS 1, 2 AND 3 AS ABOVE
It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement
A
B
SECTION B-B
FLOODPLAIN COMPENSATION
RIVER MOLE
MAINTENANCE ACCESS RAMP LOCATION AND DETAILS TO BE CONFIRMED
MAINTENANCE ACCESS ROAD WIDTH = 5M ADDITIONAL AREA AVAILABLE FOR PLANTING OR OTHER MITIGATION AS REQUIRED
APPROXIMATE EXCAVATION VOLUME 140,000m3
CONNECTION TO WATERCOURSE
EROSION PROTECTION TO BE PROVIDED TO WATERCOURSE
A
SECTION A-A
CONFIRMATION OF INVERT LEVEL AND LOW-FLOW LEVELS REQUIRED
10m
WESTFIELD STREAM OUTFALL
EXISTING LEVELS AND SPILLWAY EARTHWORKS DETAILS TO BE CONFIRMED
FLOOD COMPENSATION AREA 3 - SEE DRAWING GALCTC12-JAC-ALL-00-DR-FRM-0006
GENERAL ARRANGEMENT
SCALE 1 :3000
LEGEND
FLOOD COMPENSATION AREA EDGE AND GRADING
CONNECTION TO WATERCOURSE
SPILLWAY EARTHWORKS
EXISTING LEVELS
PROPOSED LEVELS
MAINTENANCE ACCESS ROUTE
SECTION A-A | SCALE HORIZONTAL 1:2000 VERTICAL 1:1000
CONNECTION TO WATERCOURSE
INVERT LEVEL AT RIVER BANK TO BE CONFIRMED
60
55
50mAOD
1:6
CHAINAGE 0.0 75.0 150.0 225.0 300.0 375.0 388.9 407.0
EXISTING 59.2 59.2 59.2 59.2 59.0 57.4 56.6 56.2
PROPOSED 56.6 56.6 56.6 56.6 56.6 56.6
SECTION B-B | SCALE: HORIZONTAL 1:2000 VERTICAL 1:1000
60
55
50mAOD
1:6
1:6
CHAINAGE 0.0 75.0 150.0 225.0 300.0
EXISTING 59.13 60.0 60.0 59.3 58.9
PROPOSED 56.6 56.6 56.6
JACOBS
1180 EskDALE ROAD, WINNERSH, WOKINGHAM, RG41 5TU, ENGLAND
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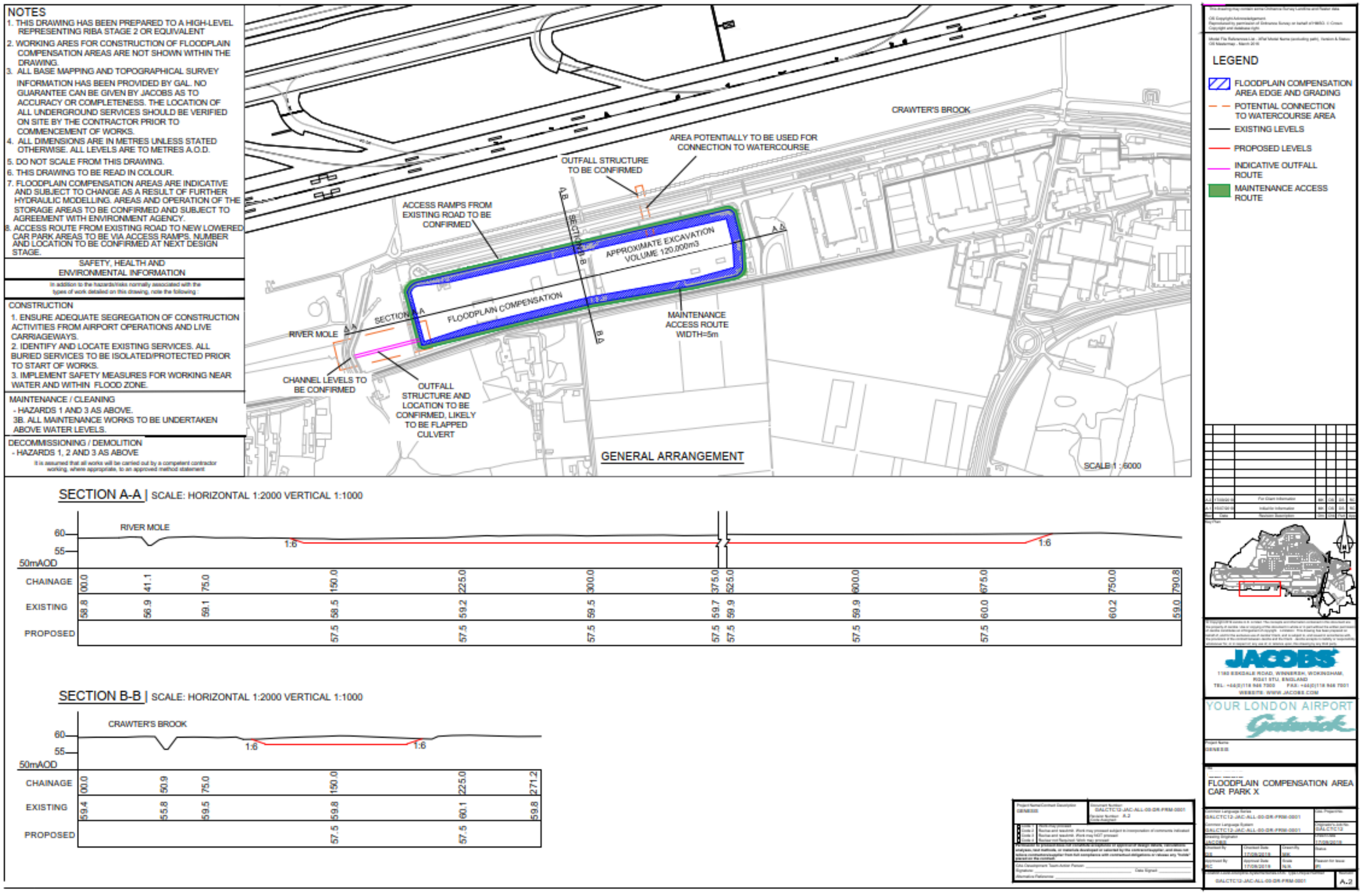
FLOODPLAIN COMPENSATION AREA MUSEUM FIELD
GALCTC12-JAC-ALL-00-DR-FRM-0002
A2


NOTES
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8. ACCESS ROUTE FROM EXISTING ROAD TO NEW LOWERED CAR PARK AREAS TO BE VIA ACCESS RAMPS. NUMBER AND LOCATION TO BE CONFIRMED AT NEXT DESIGN STAGE.
SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following :
CONSTRUCTION
1. ENSURE ADEQUATE SEGREGATION OF CONSTRUCTION ACTIVITIES FROM AIRPORT OPERATIONS AND LIVE CARRIAGEWAYS.
2. IDENTIFY AND LOCATE EXISTING SERVICES. ALL BURIED SERVICES TO BE ISOLATED/PROTECTED PRIOR TO START OF WORKS.
3. IMPLEMENT SAFETY MEASURES FOR WORKING NEAR WATER AND WITHIN FLOOD ZONE.
MAINTENANCE / CLEANING
- HAZARDS 1 AND 3 AS ABOVE.
3B. ALL MAINTENANCE WORKS TO BE UNDERTAKEN ABOVE WATER LEVELS.
DECOMMISSIONING / DEMOLITION
- HAZARDS 1, 2 AND 3 AS ABOVE
It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement
CRAWTER'S BROOK
AREA POTENTIALLY TO BE USED FOR CONNECTION TO WATERCOURSE
OUTFALL STRUCTURE TO BE CONFIRMED
ACCESS RAMPS FROM EXISTING ROAD TO BE CONFIRMED
SECTION B-B
APPROXIMATE EXCAVATION VOLUME 120,000m3
SECTION A-A
FLOODPLAIN COMPENSATION
MAINTENANCE ACCESS ROUTE WIDTH=5m
RIVER MOLE
CHANNEL LEVELS TO BE CONFIRMED
OUTFALL STRUCTURE AND LOCATION TO BE CONFIRMED, LIKELY TO BE FLAPPED CULVERT
GENERAL ARRANGEMENT
SCALE 1 : 6000
LEGEND
FLOODPLAIN COMPENSATION AREA EDGE AND GRADING
POTENTIAL CONNECTION TO WATERCOURSE AREA
EXISTING LEVELS
PROPOSED LEVELS
INDICATIVE OUTFALL ROUTE
MAINTENANCE ACCESS ROUTE
SECTION A-A | SCALE: HORIZONTAL 1:2000 VERTICAL 1:1000
RIVER MOLE
60
55
50mAOD
1:6
1:6
CHAINAGE 00.0 41.1 75.0 150.0 225.0 300.0 375.0 525.0 600.0 675.0 750.0 790.8
EXISTING 58.8 56.9 59.1 58.5 59.2 59.5 59.7 59.9 59.9 60.0 60.2 59.0
PROPOSED 57.5 57.5 57.5 57.5 57.5 57.5 57.5
SECTION B-B | SCALE: HORIZONTAL 1:2000 VERTICAL 1:1000
CRAWTER'S BROOK
60
55
50mAOD
1:6
1:6
CHAINAGE 00.0 50.9 75.0 150.0 225.0 271.2
EXISTING 59.4 55.8 59.5 59.8 60.1 59.8
PROPOSED 57.5 57.5
JACOBS
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GENESIS
FLOODPLAIN COMPENSATION AREA CAR PARK X
GALCTC12-JAC-ALL-00-DR-PRM-0001
A.2

NOTES

1. THIS DRAWING HAS BEEN PREPARED TO A HIGH-LEVEL, REPRESENTING RIBA STAGE 2 OR EQUIVALENT AND IS SUBJECT TO HYDRAULIC MODELING RESULTS.
2. WORKING AREAS FOR CONSTRUCTION OF FLOODPLAIN COMPENSATION AREAS ARE NOT SHOWN WITHIN THE DRAWING.
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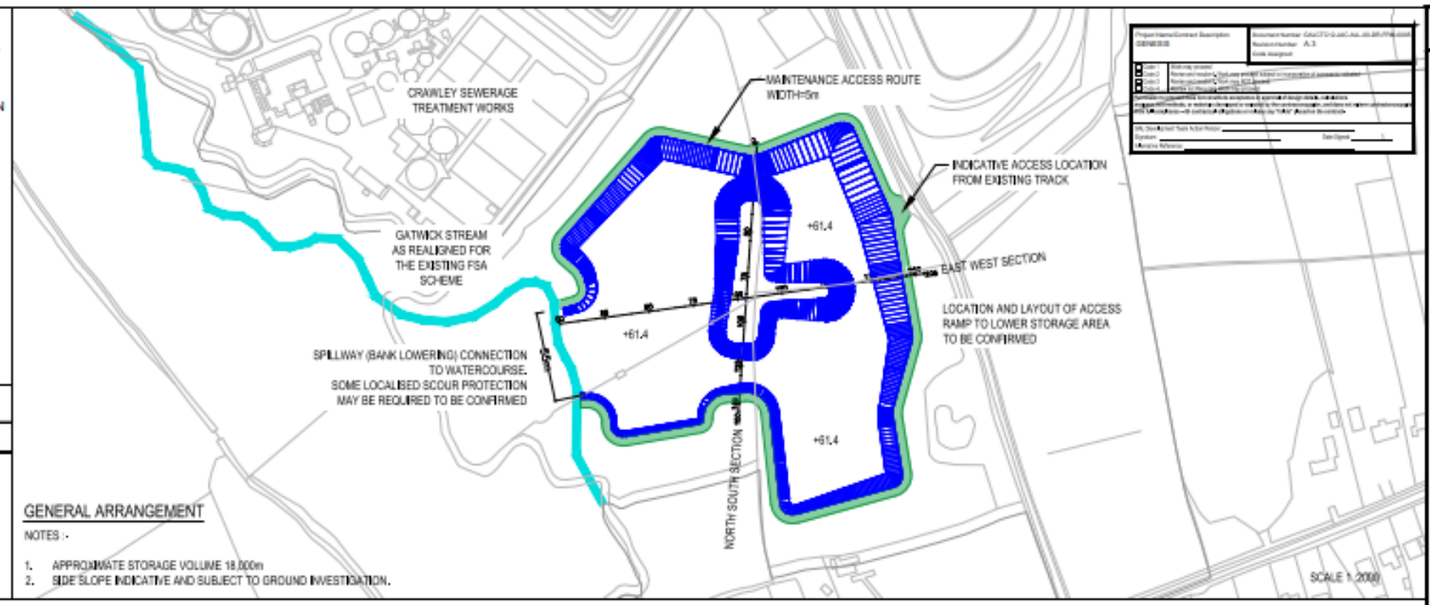
SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

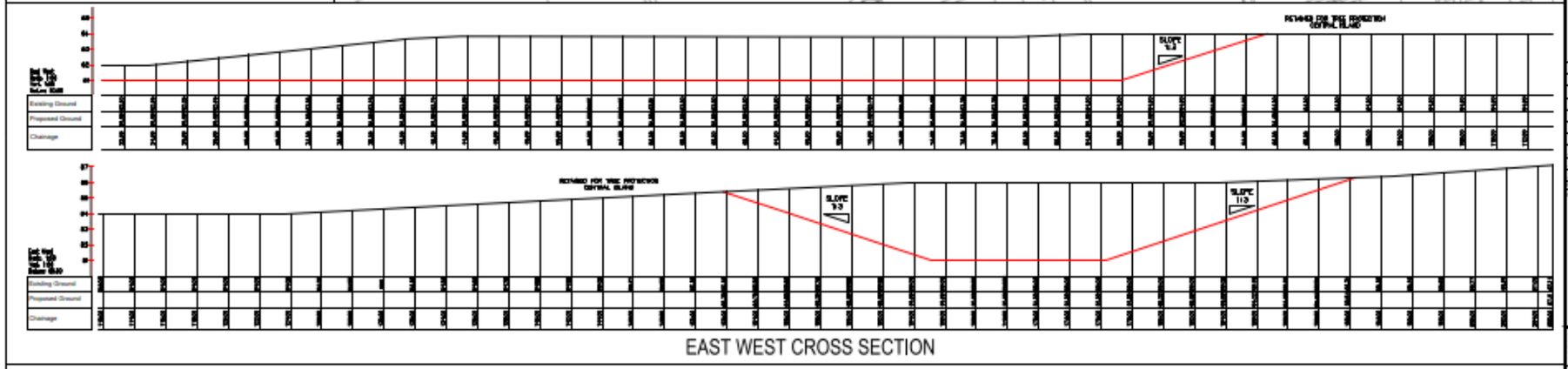
1. IDENTIFY AND LOCATE EXISTING SERVICES. ALL BURIED SERVICES TO BE ISOLATED/PROTECTED PRIOR TO START OF WORKS.
2. IMPLEMENT SAFETY MEASURES FOR WORKING NEAR WATER.



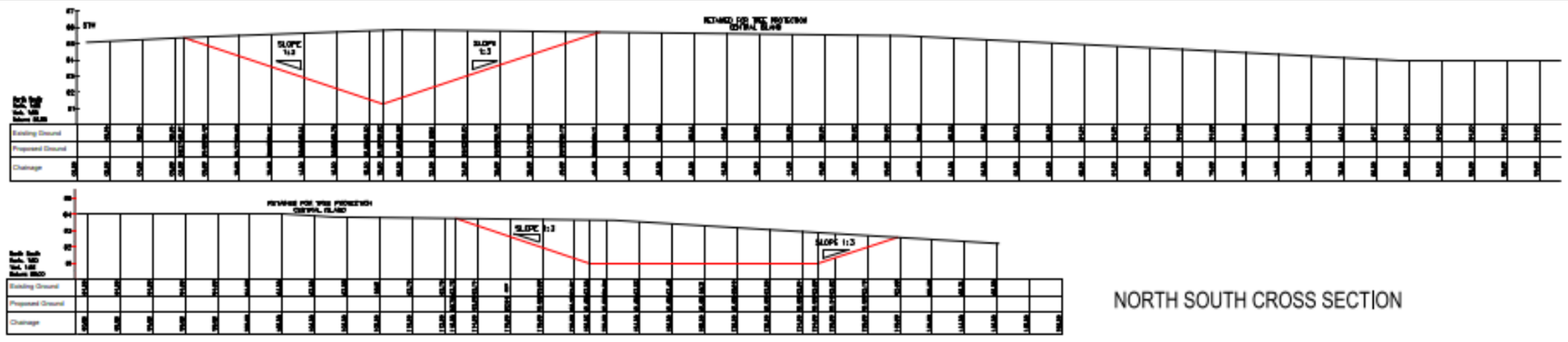
GENERAL ARRANGEMENT

NOTES :-

1. APPROXIMATE STORAGE VOLUME 18,000m
2. SIDE SLOPE INDICATIVE AND SUBJECT TO GROUND INVESTIGATION.



EAST WEST CROSS SECTION



NORTH SOUTH CROSS SECTION

LEGEND

- GATWICK STREAM
- FLOODPLAIN COMPENSATION AREA EDGE AND GRADING
- MAINTENANCE ACCESS ROUTE
- EXISTING LEVELS
- PROPOSED LEVELS

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YOUR LONDON AIRPORT Gatwick

FLOODPLAIN COMPENSATION AREA
GATWICK EAST FSA 2 OPTION 2

GALCTC12-JAC-ALL-00-DR-FRM-0005 A.3

Annex 2

Surface Access Drainage Summary

Introduction

11.1.1 The project at Gatwick Airport to make the best use of their runways ('the Project') incorporates improvements to surface access that are planned to manage the expected increase in passenger numbers and associated movements in and out of the airport. These improvements are planned to be constructed between 2029 and 2032.

11.1.2 The improvements to surface access incorporate three elements:

- South Terminal Roundabout Improvements (constructed between 2029-2030)
- North Terminal Roundabout Improvements (2029-2032)
- Works to Longbridge Roundabout (2030-2032)

11.1.3 The surface access improvements do include encroachment into the River Mole and Gatwick Stream floodplains that are mitigated via the provision of compensatory floodplain storage as part of the Project. These measures would be installed in advance of any encroachment as part of the surface access works. Further information on this element is included in the main body of the Flood Risk Assessment.

Existing Drainage

South Terminal Roundabout

11.1.4 The southern terminal roundabout has three arms, M23 motorway (on the east), Airport Way (on the west) and Airport Ring Road (on the south). Highways England are the highway authority.

11.1.5 Information is available for the existing highway drainage in Highways England's asset records (HADDMS) (see Figure 11-1). The existing surface runoff is mainly collected by kerb and gully system and combined kerb drainage (CKD) as visible in aerial photography and outlined in HADDMS.

11.1.6 The existing highway east of the B2036 Balcombe Road overbridge outfalls to a tributary of the Burstow Stream via an attenuation pond (Pond 8-5 in Figure 11-1) on the north side of the M23 Spur approximately 950 metres to the east of the roundabout.

11.1.7 Aside from one gully at the overbridge, there are no connections from the motorway drainage to the Burstow Stream tributary.

11.1.8 The roads west of the B2036 Balcombe Road overbridge outfall to the Gatwick Stream approximately 600 metres west of the existing roundabout. Based on available records this is via a 675 metre diameter surface water pipe that starts on the north side of the M23 Spur immediately east of the existing roundabout, crosses the Spur from north to south, and then elbows east around the south side of the roundabout and then under the Airport ring road. It then runs from east to west parallel to the A23 Airport Way along the south side and crosses under the railway line and outfalls to the Gatwick Stream. Available as built record drawings indicate that this pipe may be a Public Sewer, however this is not yet confirmed. The Sewerage Undertaker in this area is Thames Water.

11.1.9 The record drawings for the original road construction (dated 1972) also indicate provision for connection from an attenuation basin for "BAA" immediately to the east of the railway line. There is now a large pond (Pond F) at this location, so it reasonable to assume that this is a facility serving the airport and does not fulfil an attenuation function for the highway drainage systems.

North Terminal Roundabout

11.1.10 Limited information is available for the existing highway drainage (0-20% in HADDMS), see Figure 11-2. The gullies appear to outfall to existing ditches for the slip roads connecting the north terminal roundabout to A23 London road. The ditches appear to fall towards the River Mole. Therefore, existing drainage assumed to discharge to River Mole (section possibly discharges through Gatwick Stream). The proposed drainage is also proposed to outfall to same watercourse as existing site.

Longbridge Roundabout

11.1.11 The existing roundabout and road levels are approximately 57 to 56 mAOD. The roads appear to fall away from the roundabout. The existing level of the watercourse passing underneath the bridge on Brighton Road is approximately 52 mAOD.

11.1.12 There is very limited available information on the highway drainage at this stage. The highway authority responsible for maintaining the existing highway drainage systems is West Sussex County Council for the A23 and Surrey County Council for the Longbridge roundabout and the other three associated roads, ie Brighton Road, A217 and Povey Cross Road.

11.1.13 The runoff for the central island and the south and western side of the existing junction is collected by kerb and gully systems. The eastern limbs are served by CKD. The dedicated slip lane on the eastern side of the junction is an underbridge with a parapet. This slip lane is served by iron shallow bridgedeck type units (Figure 11-3).

11.1.14 The site is bounded on the east side by the River Mole which passes underneath a bridge on Brighton Road (see Figure 11-3). It is assumed that the runoff from the roundabout, Brighton Road and A23 south approach outfall to the River Mole to the east and south east.

Surface Access Improvement Works

11.1.15 Full details of the surface access improvements are included in Chapter 5 of the PEIR: Project Description.

South Terminal Roundabout Improvements

11.1.16 The proposed improvements to the south terminal roundabout will incorporate a flyover which would carry the M23 Spur Motorway/Airport Way over the existing roundabout. Access to the terminal, car parking and hotels/offices would be maintained as existing whilst four slip roads would be provided to link the existing roundabout circulatory to the elevated section. The existing drainage culvert under the M23 Spur Road will be extended to accommodate the new slip roads.

North Terminal Roundabout Improvements

11.1.17 In order to provide for the predicted growth in passengers associated with the Project, a grade-separated junction design is required. The outline concept for this junction is to replace the existing roundabout with a signalised junction arrangement. This would provide extra capacity for movements to and from the airport and would separate airport and non-airport traffic, reducing conflict in peak periods, thereby reducing congestion. As part of this solution, an elevated flyover would be built to carry traffic between Airport Way (from South Terminal and the M23) and the A23 towards Horley. Additional improvements would be made to Gatwick Way to accommodate an increase in traffic flow towards Northgate Road.

11.1.18 The flyover structure is anticipated to require three separate spans to cross at-grade carriageways and is expected to comprise a typical steel beam superstructure with a concrete slab deck on concrete abutments and piers, with piled foundations. The overall structure would be approximately 200 metres long. Retaining walls would be required to separate adjacent links at different levels or gradients.

Works to Longbridge Roundabout

11.1.19 The Longbridge junction is an existing signalised roundabout to the north of Gatwick Airport and becomes congested at peak times. Increases in traffic associated with future growth of the airport would further increase congestion and delays at the junction.

11.1.20 To increase capacity at the Longbridge roundabout and future proof the junction for further growth an enlarged signalised roundabout layout has been progressed that would widen the ICD and central island of the roundabout, providing wider circulatory lane widths and improved deflection to facilitate increased traffic demand and accommodate turning movements of HGV's. Additionally, increased stacking capacity has been applied to the arms of the junction.

Drainage Design Proposals

Calculation of Greenfield Runoff Rate

11.1.21 The control of runoff from sites is prescribed in the joint Defra and Environment Agency Flood and Coastal Erosion Risk Management R&D Programme document: Rainfall runoff management for developments Report –SC030219. The Institute of Hydrology IH124 (Institute of Hydrology, Report 124, Flood Estimation for Small Catchments, 1994) method has been adopted to estimate greenfield runoff). The results of this calculation have been checked against the 'greenfield runoff estimation for sites' online tool found at www.uksuds.com. The key parameters are summarised in Table 11.1.2.

Table 11.1.2: Calculation of Greenfield Runoff

Catchment	NT	ST	LB
Hydrological Region	6		
Soil Type (S)	4 – Heavy Clay		
Annual Rainfall (SAAR) (mm)	760	760	754
Soil Runoff Coefficient (SPR)	0.47		
Mean annual peak flow per unit area (QBar/A) (l/s/ha)	5.3		
QBar/A x 0.85 1 year (l/s/ha)	4.52		4.06
QBar/A x 2.3 30 year (l/s/ha)	12.23		12.08
QBar/A x 3.19 100 year (l/s/ha)	16.96		16.75

Allowance for Climate Change

11.1.22 In accordance with Environment Agency requirements the volume of attenuation storage required to achieve greenfield runoff rates has been sized to accommodate the 1 per cent AEP event plus a 40 per cent increase in rainfall intensity to accommodate the predicted impact of climate change.

South Terminal Roundabout - East

11.1.23 It is assumed that the Project would maintain the existing outfalls and principal catchment areas. Consequently areas east and west of the Balcombe Road overbridge would continue to be treated as separate sub catchments.

11.1.24 The existing outfall to the watercourse next to pond no 8-5 would be maintained. The additional paved area drained by the Project would be 0.5ha which would require an estimated attenuation volume of 500m^3 to achieve a greenfield runoff rate.

11.1.25 It is assumed that any attenuation storage would be provided within the pipe network near the connection to existing systems and upstream of the existing pond. The current assumption is that the storage would be provided in the form of tank sewers within the road cross-section (see image below). Alternatively, off-line geocellular storage outside the carriageway can be proposed if land is available. It is estimated that a box culvert of 2m x 2m; 125m long would be required.

11.1.26 There would be opportunities to modify the existing basin to remove the need for this storage. For example, it could be possible to replace the existing control which is thought to be a pipe or orifice plate (150mm diameter or less) with a proprietary device such as a Hydrobrake that would provide more efficient usage of the existing storage volume in the pond. This may enable the surface water management requirements of the LLFA to be met without the need for new storage infrastructure in the upstream network.

South Terminal Roundabout - West

11.1.27 The existing outfall to Gatwick Stream via the Public Sewer would be maintained. The additional paved area drained would be 2.16ha requiring an estimated storage volume of 2,200m^3 to achieve greenfield runoff rates.

11.1.28 The surface water collection systems from the highway would be discharged to a perimeter drainage ditch to the north of the proposed road embankment.

11.1.29 This ditch would have a conveyance function but may be enlarged to serve a storage function. At this stage, the storage volume within the ditch has been discounted for the purposes of these calculations. The ditch will convey the runoff into a new attenuation pond (with 2,200m^3 attenuation capacity) adjacent to Balcombe Road. The attenuation pond will possess a flow control on its outfall to limit the discharge flows to the 1-year greenfield runoff rate of 9.76l/s. The outfall pipe will connect to the existing Public Sewer at the north side of the roundabout.

North Terminal Roundabout

11.1.30 The drainage proposals at North Terminal roundabout will drain the combined existing and proposed highways layout of 4.39ha to greenfield rates to the Gatwick Stream and River Mole. The layout will consist of four separate catchments each with their own attenuation storage (tanks or ponds) as indicated in Figure 11-5. The estimated attenuation storage volumes required are summarised in Table 11.1.3.

Table 11.1.3: North Terminal Roundabout Catchment Characteristics and Attenuation Volumes

Catchment	1	2	3	4
Area (ha)	0.56	2.09	1.23	0.53
1yr Storm Peak Outflow Rate (l/s)	2.53	9.44	5.56	2.39
Minimum Attenuation Volume Required (m^3)	404	1505	882	381
Maximum Attenuation Volume Required (m^3)	564	2103	1234	532
Adopted Attenuation Volume Required (m^3)	600	2100	1300	600

Longbridge Roundabout

11.1.31 The surface area of the proposed upgraded Longbridge Roundabout is estimated to be 15,200m^2 (1.52 hectares) that includes an increase in impermeable area of 1,800m^2 (0.18 hectares) compared with the current layout. The preferred solution is for all storm water runoff to be collected for all proposed works (1.520ha) discharged at greenfield runoff rate to the River Mole. The discharge rate will be 6.78l/s being the 1-year greenfield run off rate for a 1.520ha site that would require a volume of attenuation of between 1,096m^3 and 1,531m^3 attenuation – for the purposes of high-level design this has been assumed as 1,600m^3 including the allowance for climate change.

11.1.32 Four catchments are proposed at Longbridge roundabout, each with a separate outfall and avoiding new cross-drains under live carriageways, as shown in Figure 11-6. The characteristics and the estimated attenuation volumes including climate change required to achieve greenfield runoff rates are included in Table 11.1.4.

Table 11.1.4: Longbridge Roundabout Drainage Catchment Characteristics and Attenuation Volumes

Catchment	1	2	3	4
Area (ha)	0.29	0.76	0.23	0.25
1yr Storm Peak Outflow Rate (l/s)	2.00	3.39	2.00	2.00
Minimum Attenuation Volume Required (m^3)	184	584	136	151
Maximum Attenuation Volume Required (m^3)	261	766	194	215
Adopted Attenuation Volume Required (m^3)	300	800	200	200

11.1.33 The estimated storage volumes required will be provided by two new attenuation ponds to the north of the roundabout that would outfall to the River Mole and two attenuation tanks that would drain to existing ditches that are assumed to receive existing highways runoff.

Conclusions

11.1.34 The surface access works to be undertaken as part of the Project would require an increase in impermeable area to accommodate the expected increase in passenger numbers and associated movements in and out of the airport. Surface access improvement works will be required at three locations:

- South Terminal Roundabout
- North Terminal Roundabout
- Longbridge Roundabout

11.1.35 The additional runoff that would result from the increased impermeable areas would be stored in new facilities and attenuated to achieve greenfield runoff rates. The storage facilities have been sized to accommodate the 1 per cent AEP event plus an allowance for climate change of +40 per cent in accordance with Environment Agency requirements.

Figure 11-1: Existing South Terminal Roundabout Highways Drainage Layout

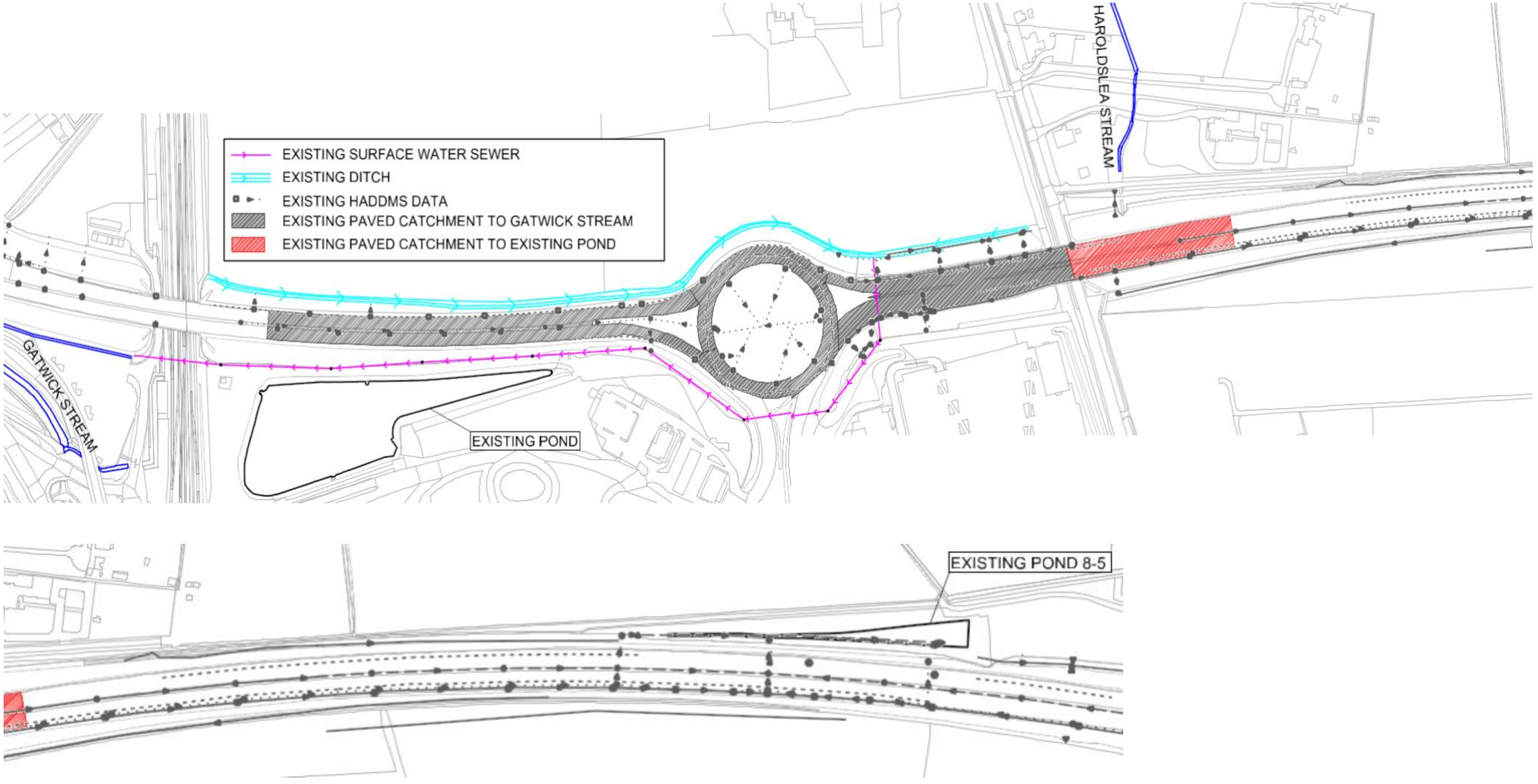

Figure 11-2: Existing North Terminal Roundabout Highways Drainage Layout

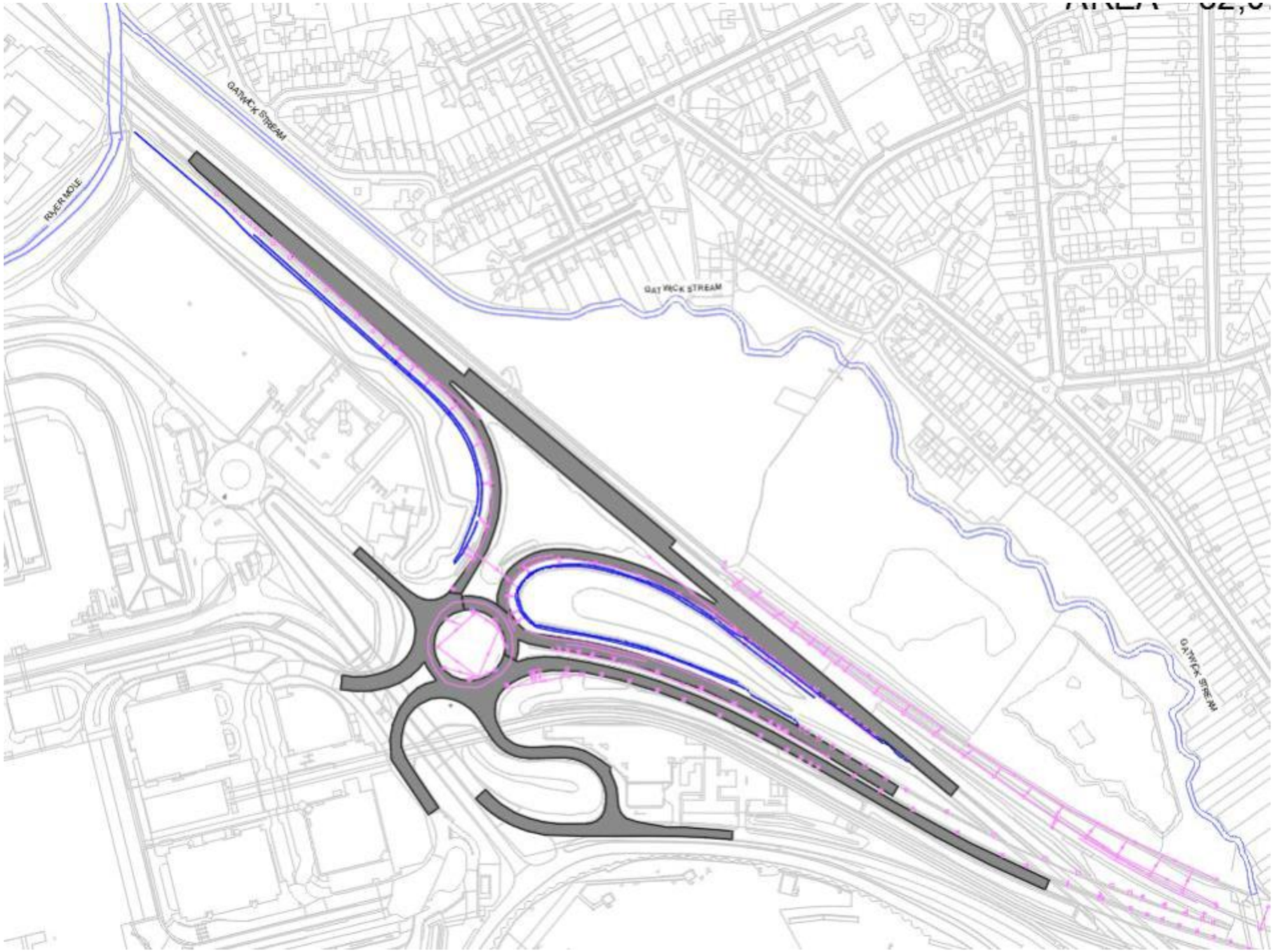

Figure 11-3: Existing Longbridge Roundabout Highways Drainage Layout

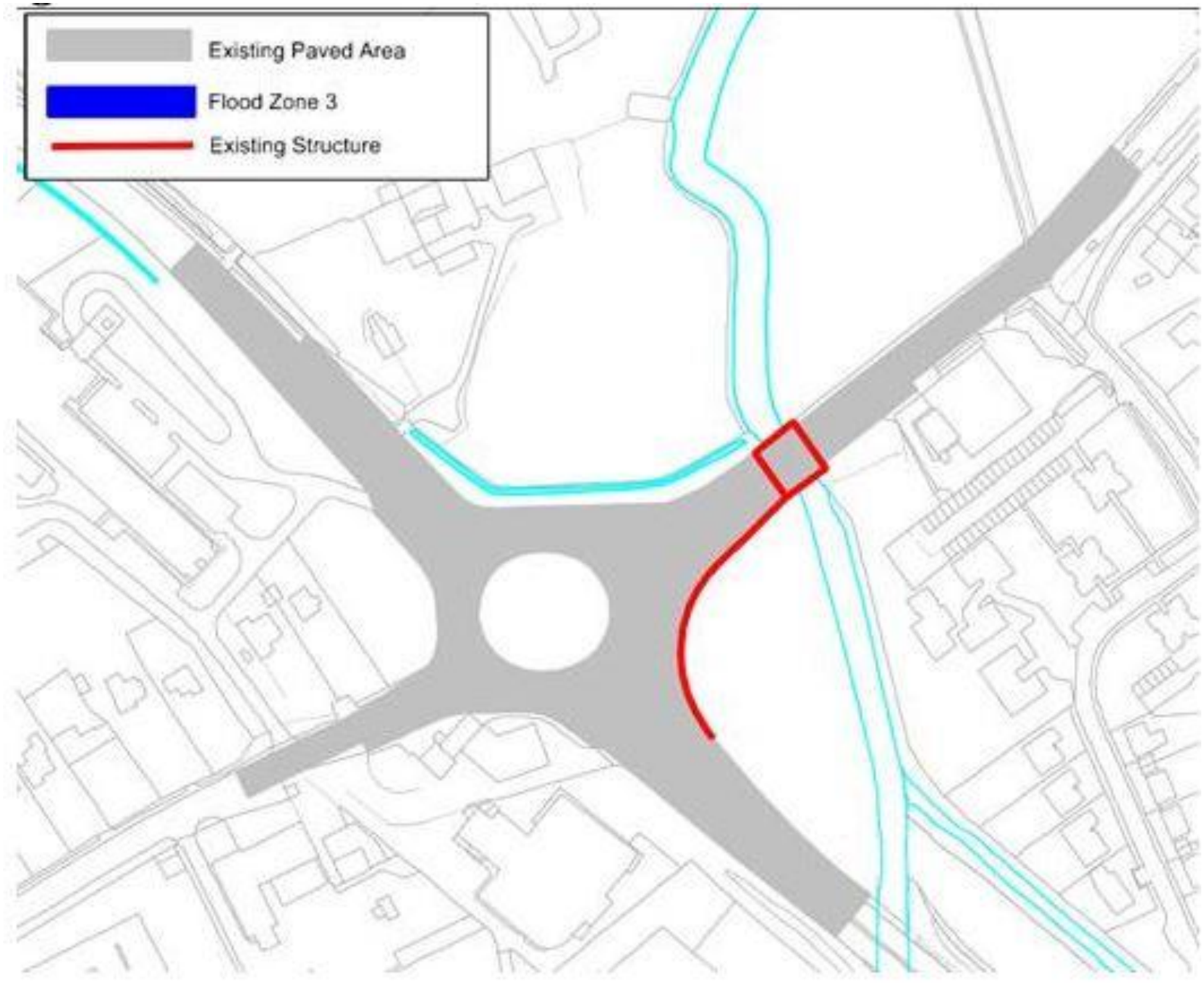

Figure 11-4: Indicative Proposed South Terminal Roundabout Drainage Layout

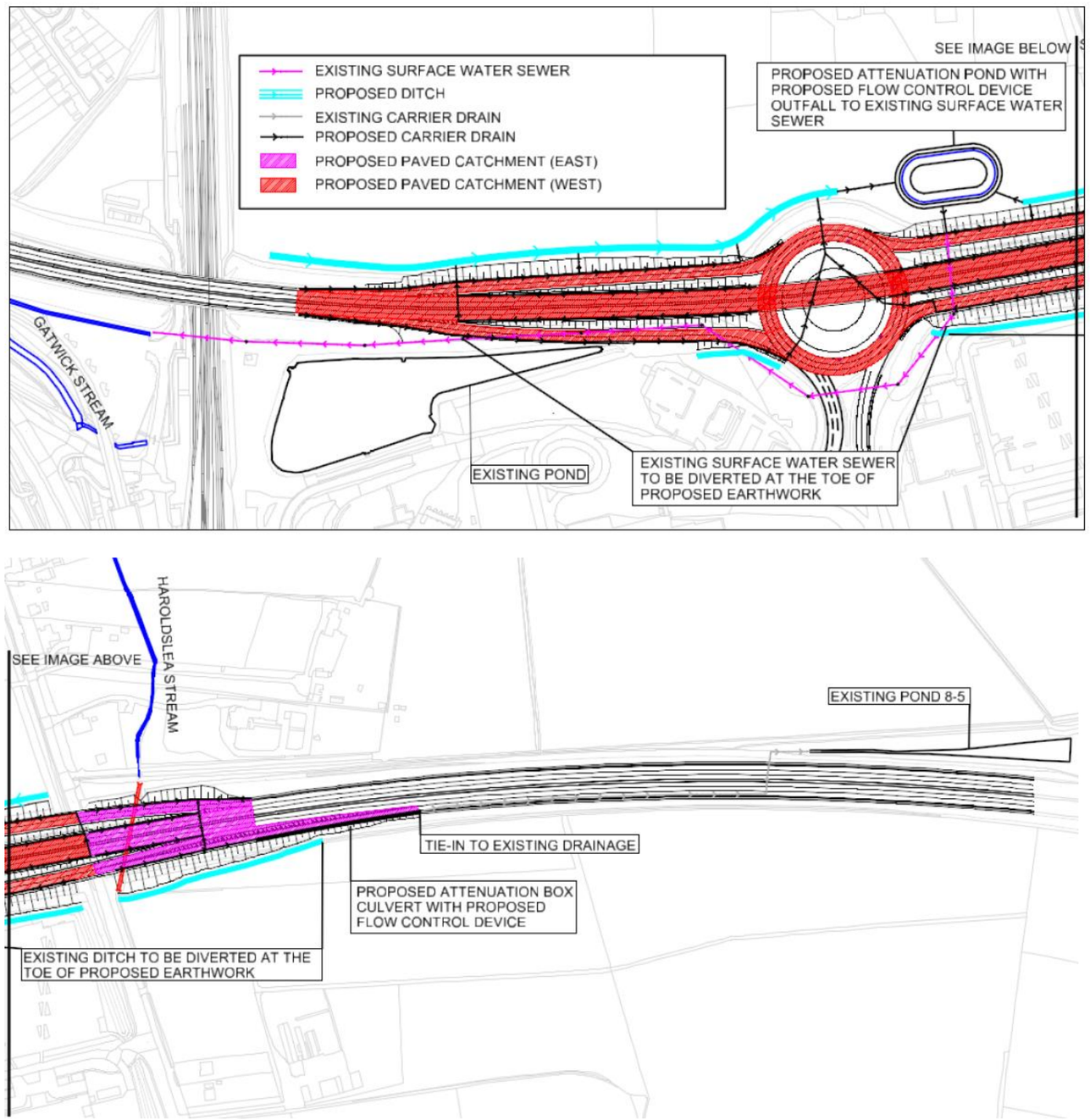

Figure 11-5: Indicative North Terminal Roundabout Drainage Layout

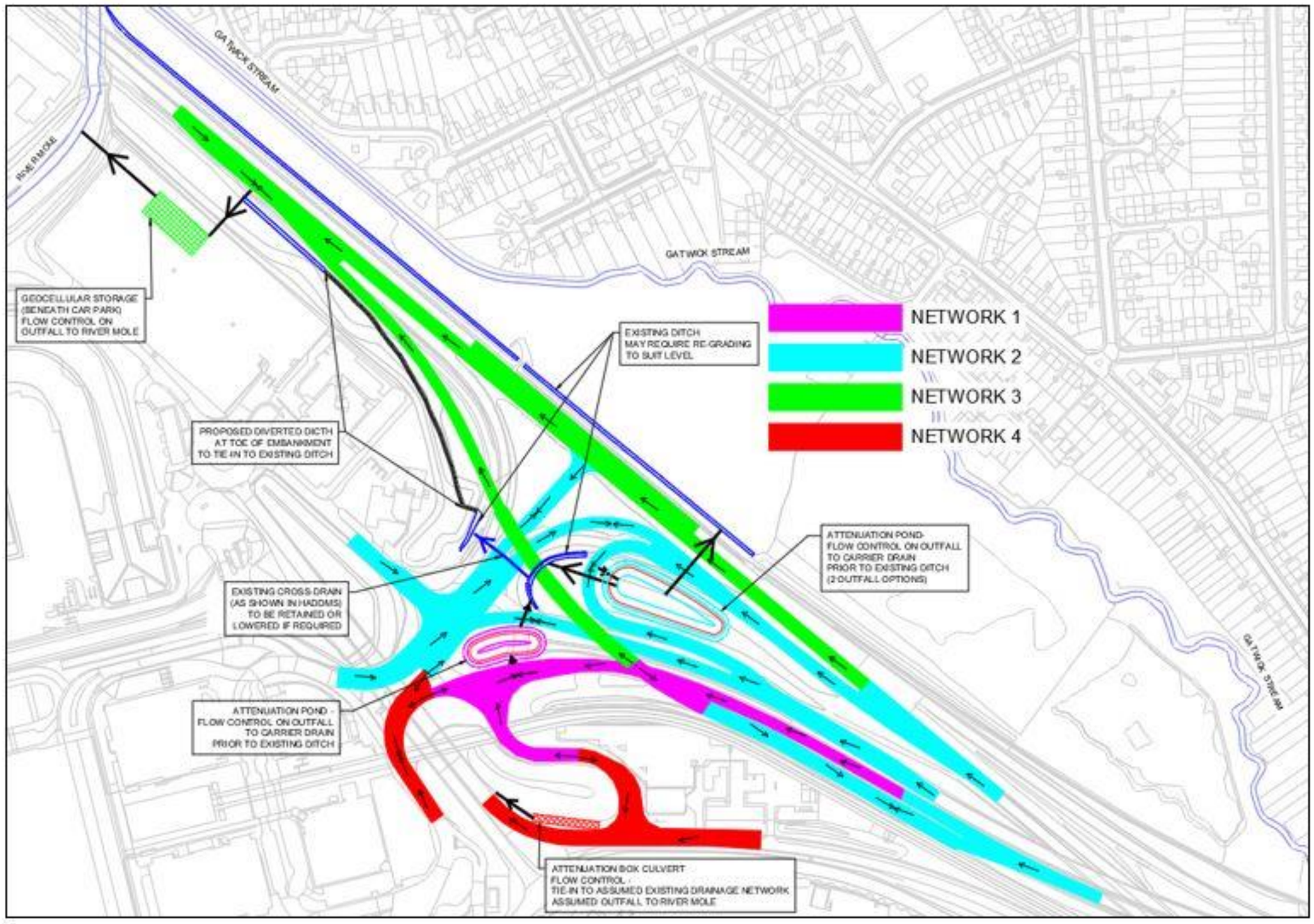

Figure 11-6: Indicative Longbridge Roundabout Drainage Layout