Appendix 8.2

FLOOD RISK, DRAINAGE AND SEQUENTIAL ASSESSMENT (INCLUDING TOPOGRAPHIC AND BATHYMETRIC DATA)

HILLINGDON WATER SPORTS FACILITY AND ACTIVITY CENTRE
BROADWATER LAKE, MOORHALL ROAD, HAREFIELD, UB9 6PE

FLOOD RISK, DRAINAGE AND SEQUENTIAL ASSESSMENT

Final Report v2.1
August 2025

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Report Title	**Hillingdon Water Sports Facility and Activity Centre** **Broadwater Lake, Moorhall Road, Harefield, UB9 6PE** Flood Risk, Drainage and Sequential Assessment Final Report v2.1
Client	London Borough of Hillingdon
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List of Abbreviations

AEP	Annual Exceedance Probability	GSPZ	Groundwater Source Protection Zone
AOD	Above Ordnance Datum	ha	Hectare
ASGWF	Areas Susceptible to Groundwater Flooding	IDB	Internal Drainage Board
bgl	Below Ground Level	km	Kilometres
BGS	British Geological Survey	LFRMS	Local Flood Risk Management Strategy
BRE	Building Research Establishment	LiDAR	Light Detection and Ranging
BSI	British Standards Institute	LLFA	Lead Local Flood Authority
CC	Climate Change	LPA	Local Planning Authority
CCMA	Coastal Change Management Area	l/s	Litres per Second
CDA	Critical Drainage Area	m	Metres
CFMP	Catchment Flood Management Plan	m^2	Square Metres
CIRIA	Construction Industry Research and Information Association	m^3	Cubic Metres
		NFM	Natural Flood Management
CRT	Canal and River Trust	NGR	National Grid Reference
DEFRA	Department for Environment, Food and Rural Affairs	NPPF	National Planning Policy Framework
		NVZ	Nitrate Vulnerable Zone
EA	Environment Agency	OS	Ordnance Survey
FCERM	Flood and Coastal Erosion Risk Management	PFRA	Preliminary Flood Risk Assessment
		PPG	Planning Practice Guidance
FFL	Finished Floor Level	RBD	River Basin District
FMP	Flood Management Plan	RBMP	River Basin Management Plan
FMfP	Flood Map for Planning	RFI	Request for Information (to the EA)
FRA	Flood Risk Assessment	RMA	Risk Management Authority
FRDA	Flood Risk and Drainage Assessment	RoFSW	Risk of Flooding from Surface Water
FRDSA	Flood Risk, Drainage and Sequential Assessment	SFRA	Strategic Flood Risk Assessment
		SMP	Shoreline Management Plan
FRMP	Flood Risk Management Plan	SoP	Standard of Protection
FRSA	Flood Risk and Sequential Assessment	SSSI	Site of Special Scientific Interest
FRSSA	Flood Risk Sequential Site Assessment	SuDS	Sustainable Drainage System
FWA	Flood Warning Area	SWMP	Surface Water Management Plan
FWEP	Flood Warning and Evacuation Plan	WFD	Water Framework Directive
FWMA	Flood and Water Management Act		
FWS	Flood Warning System		

1 INTRODUCTION

1.1 Background

Until recently, the Hillingdon Outdoor Activity Centre (HOAC) operated at a 18.2 ha site in Dews Lane, approximately 1.5 km south of Broadwater Lake. The HOAC closed in October 2020 due to the construction of the HS2 rail link.

The High-Speed Rail (London - West Midlands) Act 2017 includes a requirement for HS2 to fund relocation of the HOAC to an alternative site which is suitable for its needs. Various sites throughout the Borough of Hillingdon were reviewed by Hillingdon Council against the necessary criteria required for a water sports and activity centre. The Council concluded that a site at Broadwater Lake ("the site") was the only site that is suitable, and deliverable, and meets the necessary criteria for water sports and outdoor activities.

1.2 Purpose of Report

Weetwood Services Ltd ('Weetwood') has been instructed by the London Borough of Hillingdon (LBH) to prepare a FRDSA report to accompany a full planning application for the proposed Hillingdon Watersports Facility and Activity Centre (HWFAC) at Broadwater Lake, Moorhall Road, Harefield, UB9 6PE ("the site").

A planning application for the following proposal was submitted to the London Borough of Hillingdon in November 2023 (Ref. 2382/APP/2023/2906):

"Redevelopment of the site to create the Hillingdon Watersports Facility and Activity Centre including demolition of existing Broadwater Lake Sailing Club (BSC) clubhouse at the north of the lake and erection of a building including changing facilities, meeting rooms, storage, Workshop and seasonal worker accommodation (sui generis), activity shelters; installation of pontoons and concrete slipways; boat shed; equipment storage huts; boat parking and racking areas; camping area; outdoor activity areas; ecological enhancement throughout the site; new pedestrian routes through the peninsula; landscaping including new woodland, dense vegetation screens and boundary treatment; new access and access road; localised dredging and land reclamation; relocation of existing sailing area and creation of floating reedbeds within the lake; coach drop off and turning area; vehicle parking; cycle parking; and associated works.." ("the submitted scheme").

The planning application was accompanied by a FRDSA prepared by Weetwood in September 2023 (Ref. 5784/FRDSA/Final/v1.0/2023-09-28).

Within its consultation letter dated 12 January 2024 (Ref. NE/2023/136465/01), the EA raised a number of technical matters that formed a basis for objection to the proposals on flood risk grounds. The Greater London Authority (GLA) also provided "Stage 1 Comments" on flood risk, surface water drainage, and water efficiency by way of a Memo dated 12 December 2023. Two technical notes (referenced in **Section 1.6**) were prepared to address the matters raised by the EA and GLA and were submitted to the LPA.

1.3 About this Version of the Report

In response to feedback from consultees across a range of technical disciplines, the submitted scheme has been revised. The revised outlined in detail in **Section 2.2** of this report.

In respect of flood risk, the most significant change from the submitted scheme is the removal of the proposal to extend the northern part of the peninsula. In the revised scheme, a small area (3,582 sq m) of land reclamation is proposed to the northeast of the peninsula to form a beach for dinghy storage, with slipways and pontoons. The proposal is a 12,532 sq m reduction of reclaimed land compared to the submitted scheme.

The assessment of flood risk has been updated using the best and latest available flood risk information, and a revised drainage scheme prepared to suit the revised scheme. The assessment incorporates, where appropriate, the content of the two technical notes referenced above and in **Section 1.6**.

In addition, following feedback from LBH, the sequential assessment of alternative sites has been revised to include a number of additional potential alternative sites.

The assessment presented in this report has been undertaken in accordance with the requirements of the NPPF and PPG, and associated EA guidance.

1.4 Structure of the Report

The report is structured as follows:

Section 1 Introduction and report structure
Section 2 Provides background information relating to the application site
Section 3 Presents national and local flood risk and drainage planning policy
Section 4 Assesses the potential risk of flooding to the application site
Section 5 Presents a sequential assessment of potential alternative sites to address the flood risk Sequential Test
Section 6 Presents an illustrative surface water drainage scheme
Section 7 Presents an illustrative foul water drainage scheme
Section 8 Presents a summary of key findings and the recommendations

1.5 Relevant Documents and Planning Policy

The assessment has been informed by the following documents, policy and information:

- National Planning Policy Framework, Ministry of Housing, Communities and Local Government, Updated 7 February 2025, https://www.gov.uk/ government/publications/national-planning-policy-framework--2;
- Planning Policy Guidance Section 7 - Flood Risk and Coastal Change, Ministry of Housing, Communities and Local Government, Updated on 25 August 2022, https://www.gov.uk/ guidance/flood-risk-and-coastal-change;
- Preparing a Flood Risk Assessment - Standing Advice, EA, Updated 23 August 2024, https://www.gov.uk /guidance/flood-risk-assessment-standing-advice;
- Using Modelling for Flood Risk Assessments, EA, 12 December 2023, https://www.gov.uk/guidance/ using-modelling-for-flood-risk-assessments#when-to-consider-using-modelling
- Thames River Basin Management Plan, EA, December 2022
- Flood Risk Assessments - Climate Change Allowances, Government, Updated 27 May 2022, https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances;
- The London Plan, Greater London Authority, March 2021
- Guidance on the Code of Practice for Property Flood Resilience (C790B), CIRIA, November 2020;
- Design and Construction Guidance: Sewerage Sector Guidance Appendix C, Water UK, Approved Version 2.0, March 2020;
- London Borough of Hillingdon Local Plan; Part 2, Hillingdon Council, adopted January 2020
- West London Strategic Flood Risk Assessment, London Boroughs of Barnet, Brent, Ealing, Harrow, Hillingdon and Hounslow, April 2018
- Sustainable Drainage: Design and Evaluation Guide, Hillingdon Council, 2018
- Local Flood Risk Management Strategy 2015, Hillingdon Council, February 2016
- BRE Digest 365 Soakaway Design, BRE, February 2016
- The SuDS Manual (C753), CIRIA, December 2015;
- National standards for sustainable drainage systems (SuDS), DEFRA, 19 June 2025;
- Flows and Loads - 4 Sizing Criteria, Treatment Capacity for Sewage Treatment Systems Code of Practice, British Water, November 2014;
- Rainfall Runoff Management for Developments (Ref. SC030219), DEFRA/EA, October 2013;
- London Borough of Hillingdon Local Plan; Part 1, Hillingdon Council, adopted November 2012
- Thames Estuary 2100 Plan, Environment Agency, November 2012
- Preliminary Flood Risk Assessment, Hillingdon Council, April 2011
- Thames Catchment Flood Management Plans, EA, December 2009
- Surface Water Management Plan: Evidence Base, Hillingdon Council, *Undated*
- Surface Water Management Plan: Options and Action Plan, Hillingdon Council, *Undated*
- HR Wallingford Greenfield Runoff Tool, www.uksuds.com;

- EA Flood Map for Planning dataset ,https://flood-map-for-planning.service.gov.uk;
- EA Long-Term Flood Risk datasets, https://www.gov.uk/check-long-term-flood-risk;
- Soilscapes, Soil and AgriFood Institute, Cranfield University, www.landis.org.uk/soilscapes;
- National Geoscience Data Centre's Single Onshore Borehole Index, https://www.bgs.ac.uk/products /onshore/SOBI.html;
- BGS Mapping of Surface Geology, https://www.bgs.ac.uk/map-viewers/geoindex-onshore/;
- MAGIC, Natural England, https://magic.defra.gov.uk/.

1.6 Consultation Information and Documentation

The following is a list of consultation documentation and technical documents issued through the planning application process. The technical content of the consultation documentation has, where appropriate, been incorporated into this report.

- Clarification Note - Flood Risk and Drainage, 20 February 2024, Final v1.1, Weetwood, Ref. 5784/CN-GLA/Final/v1.1/2024-02-20;
- Clarification Note - Flood Risk Details, 9 February 2024, Final v1.0, Weetwood, Ref. 5784/CN/Final/v1.0/2024-02-09;
- EA Flood Risk Information RFI, Ref: HNL294490/AS, January 2023 (**Appendix C**);
- EA Correspondence, EIR2025/15871AS, 9 July 2025.

1.7 Third Party Surveys, Drawings and Assessments

The assessment has been informed by the following third party surveys, drawings and assessments:

- Overall Landscape Masterplan, Colour-UDL, Doc. Ref. HWSFAC-COL-00-XX-DR-L-1109, 26 September 2024 (Rev 07; 3 July 2025) (**Appendix A**);
- Proposed Landscape Layout - Peninsula, Colour-UDL, Doc. Ref. HWSFAC-COL-XX-XX-DR-L-1120, 19 September 2024 (Rev 12; 3 July 2025) (**Appendix A**);
- Proposed Landscape Layout – Access Road, Colour-UDL, Doc. Ref. HWSFAC-COL-00-XX-DR-L-1110, 2 September 2024 (Rev 05; 3 July 2025) (**Appendix A**);
- Extent of Dredging Proposal and Cut, Colour-UDL, Doc. Ref: HWSAC-COL-ZZ-XX-DR-L-6362 Rev P07, 23 September 2024 (**Appendix B**).
- Topographic Survey, Encompass Surveys - Survey undertaken in May 2023 (**Appendix C**);
- Phase II Geotechnical and Geo-Environmental Report, Geo Integrity, April 2023 (submitted separately);
- Alternative Site Assessment, London Borough of Hillingdon, Undated (submitted separately);
- Thames Water public sewer record (**Appendix I**).

1.8 Explanatory Note on Flood Probability

This report refers to the likelihood of a flood event occurring in terms of an AEP expressed as a percentage. This terminology is consistent with the definition of flood zones presented in Table 1 of the PPG (refer to **Section 4.3** of this report).

The AEP is the reciprocal of the return period which describes the rarity of an event in terms of its statistical reoccurrence interval in years. For example, a '1 in 30 year flood' has a 1/30 = 0.033 (3.3%) probability of occurring or being exceeded in any one year, whilst a '1 in 100 year flood' has a 1/100 = 0.010 (1.0%) probability of occurring or being exceeded in any one year.

AEP	AEP (expressed as a %)	Return Period (years)	Alternative Expression
1.000	100.0%	1	1 in 1
0.500	50.0%	2	1 in 2 (QMED)
0.435	43.5%	2.3	1 in 2.3 (QBAR)
0.100	10.0%	10	1 in 10
0.050	5.0%	20	1 in 20
0.033	3.3%	30	1 in 30
0.020	2.0%	50	1 in 50
0.010	1.0%	100	1 in 100
0.005	0.5%	200	1 in 200
0.001	0.1%	1,000	1 in 1,000

2 SITE DETAILS AND PROPOSED DEVELOPMENT

2.1 Site Location and Description

The 79.96 ha site is located to the north of Moorhall Road at Ordnance Survey National Grid Reference TQ 0443 8953, as shown in **Figure 1**.

The site comprises Broadwater Lake, an approximately 62 ha body of water, with a number of small islands bordered by trees and scrub.

The south of the lake includes a 6.5 ha of land referred to as "the peninsula" (**Figure 2**). This area was formerly utilised as a gravel washing/processing plant with a silt lagoon and a tip for inert quarry wastes. The peninsula is occupied by various structures relating to aggregate extraction including a weighbridge, aggregate hoppers and pad foundations.

Since the quarry was decommissioned the silt lagoon, peninsula edges and areas of remaining natural ground have colonised with woodland. There is also an area of separate standing water (referred to as "the lagoon") to the east of the peninsula.

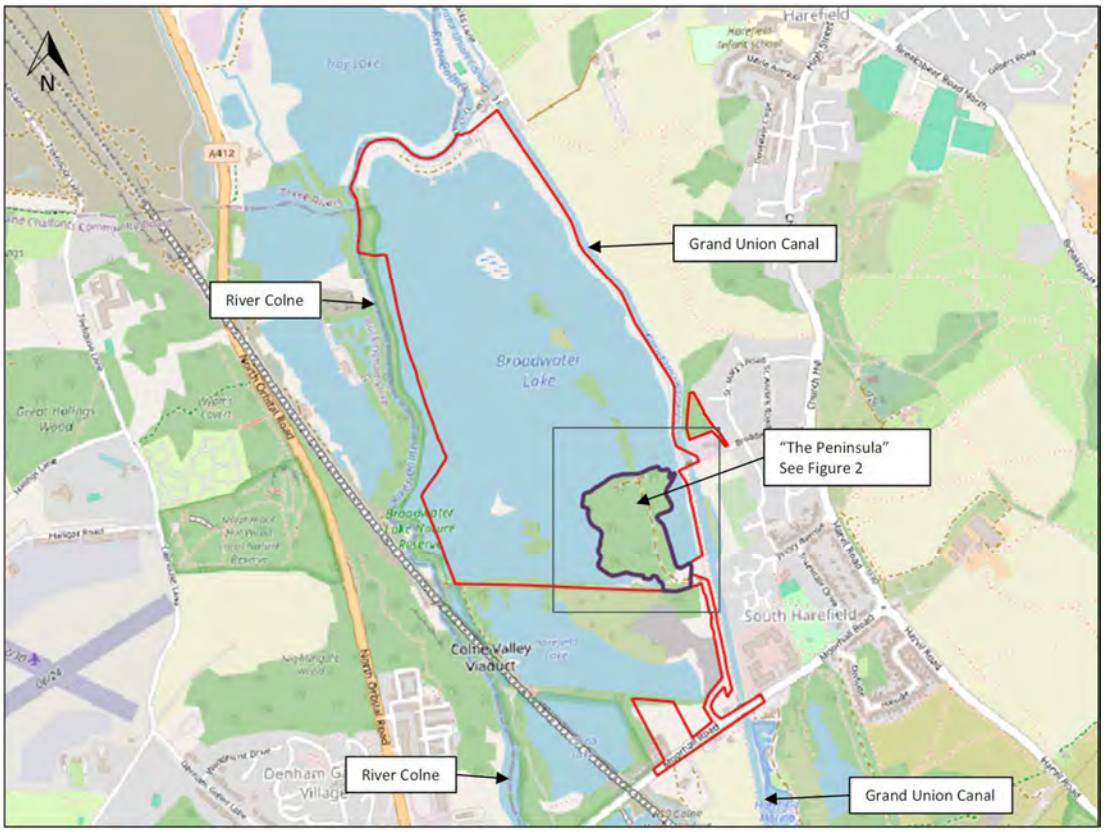


Figure 1: Site Location

The northern shore of Broadwater Lake is current occupied by the Broadwater Sailing Club and Broadwater Rowing Club (a number of small buildings).

Access to the peninsula is provided via an access track off Moorhall Road to the south. The site includes a small parcel of land located to the west of the junction of the access track and Moorhall Road (the "south parcel"). The south parcel comprises a mix of vegetation.

Finally the site includes a brick and iron bridge across the Grand Union Canal (see **Figure 2**).

Figure 2: The Peninsula

2.2 Proposed Development

The proposed development comprises a new watersports facility and activities centre that will provide a new base for HOAC, Broadwater Sailing Club and Broadwater Rowing Club.

The planning application submitted in November 2023 sought permission for the following development:

"Redevelopment of the site to create the Hillingdon Watersports Facility and Activity Centre including demolition of existing Broadwater Lake Sailing Club (BSC) clubhouse at the north of the lake and erection of a building including changing facilities, meeting rooms, storage, Workshop and seasonal worker accommodation (sui generis), activity shelters; installation of pontoons and concrete slipways; boat shed; equipment storage huts; boat parking and racking areas; camping area; outdoor activity areas; ecological enhancement throughout the site; new pedestrian routes through the peninsula; landscaping including new woodland, dense vegetation screens and boundary treatment; new access and access road; localised dredging and land reclamation; relocation of existing sailing area and creation of floating reedbeds within the lake; coach drop off and turning area; vehicle parking; cycle parking; and associated works."

The submitted scheme entailed extensive works to Broadwater Lake including the creation of a 16,114 sq m extension to the peninsula, removal of existing islands, and other modifications to lakeside habitats. Localised dredging of the lake was also proposed to increase the depth to facilitate sailing from the proposed launch locations.

A variation to the scheme under the existing planning application is now proposed. The revised scheme comprises the following:

- Significant reduction in reclaimed land;
- Relocation of buildings from west and northwest of peninsula, to east of peninsula;
- Water activities to start on sheltered beach to northeast of peninsula;
- Reduced areas within main building;
- Reduced areas of workshop and boat storage sheds;
- Reduced activity shelter provision across the site;

- Improved accessible and inclusive design across the site;
- Increased first aid, safety and medical facilities on the site;
- Revised car parking and drop-off strategy;
- Revised dinghy storage strategy, external, across the site; and
- Amended building heights across the site.

A schematic indicating the main elements of the proposals for the peninsula (new buildings, access, and beach) are presented on **Figure 3**. The proposed landscape layout for the revised proposal and hard surface materials strategy are provided in **Appendix A**.

Vehicular access will be provided via the existing access from Moorhall Road, with improvements to bring it up to adoptable standard.

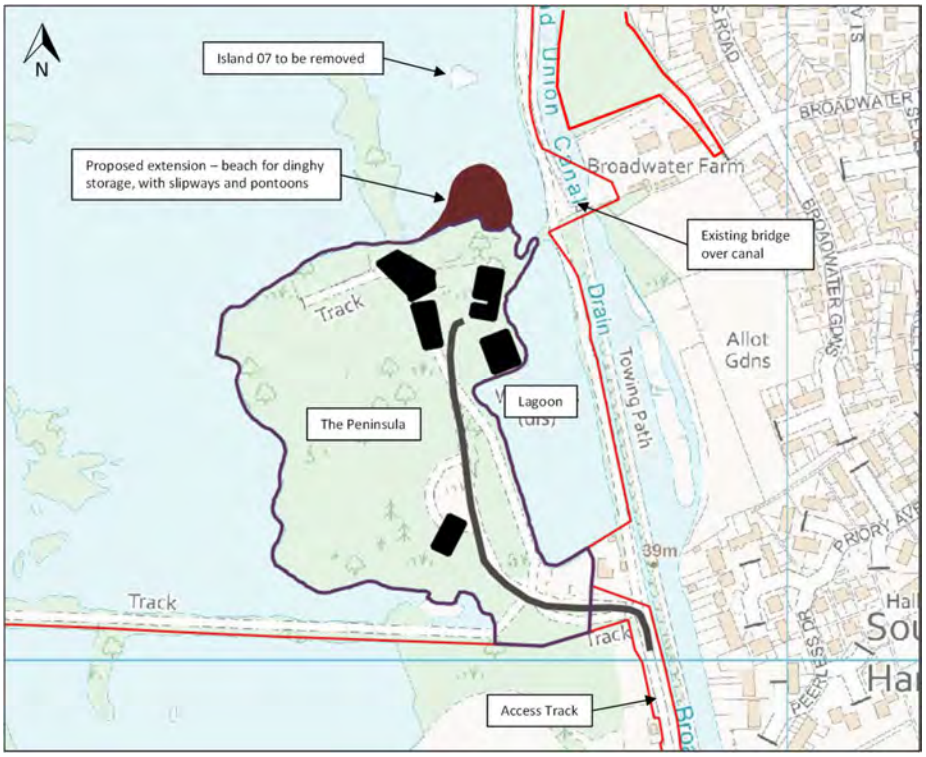


Figure 3: Main Elements Proposed on the Peninsula

The revised proposal reduces the area of reclaimed land, from 16,114 sq m in the submitted scheme to 2,892 sq m in the revised proposal (to form a beach area for dinghy storage, with slipways and pontoons). The material used for the proposed beach extension will be obtained by dredging from Island 02, Island 06, and Island 07 (which will be completely removed). The proposal will result in an net increase in open water of approximately 716 sq m. Full details of the proposed dredging are provided in the cut and fill analysis prepared by Colour-UDL (**Appendix B**).

The NPPF classifies water-based recreation and outdoor sports uses as Water Compatible land use. According to Table 2 of the PPG, water-based recreation is an appropriate form of development in all flood zones.

2.3 Surface Waterbodies in the Vicinity of the Site

The River Colne, a designated main river, flows in a southerly direction along the northern and western boundaries of the site. The Grand Union Canal is located along the eastern boundary of the site. The canal is owned and maintained by the Canal and River Trust. A number of existing lakes and water impounding structures are also located within the vicinity of the site.

2.4 Site Levels

A topographic survey of the site has been undertaken by Encompass Survey (**Appendix C**). LiDAR data has been used to develop a digital terrain model of the site and surrounding area as illustrated in **Figure 4** (site) and **Figure 5** (the peninsula). Ground levels across the peninsula are indicated to range from approximately 36.8 - 40.6 m AOD, and levels along the existing access road are in the range 37.2 - 38.8 m AOD.

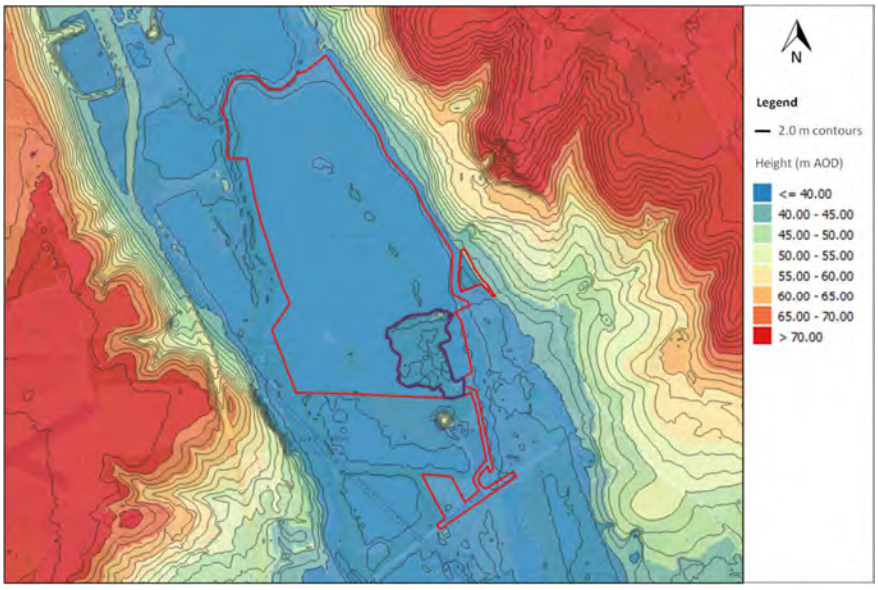


Figure 4: Site Topography (Site)

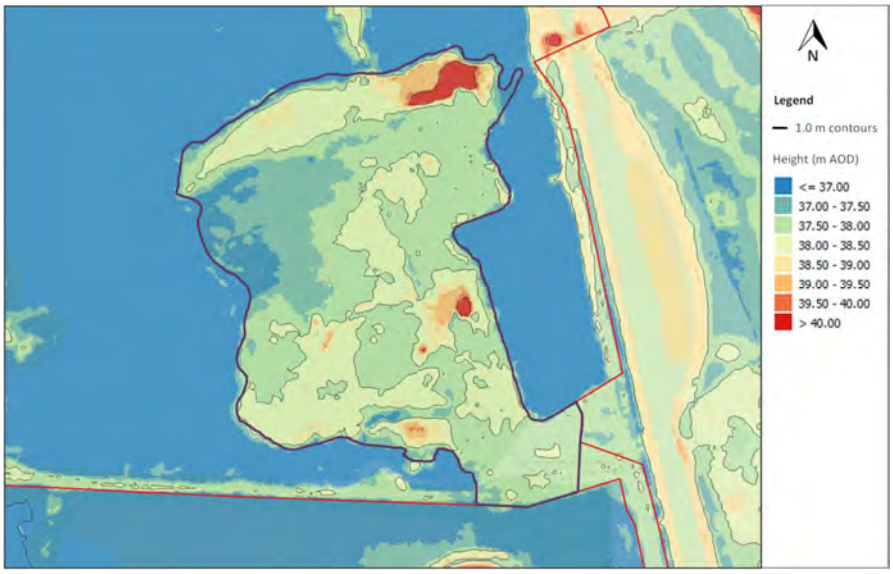


Figure 5: Site Topography (The Peninsula)

2.5 Ground Conditions

According to the Soilscapes soils dataset, soil conditions at the site and within the surrounding area are described as loamy and clayey floodplain soils with naturally high groundwater.

BGS mapping of surface geology indicates the underlying bedrock formation comprises Chalk (Seaford Chalk Formation and Newhaven Chalk Formation), overlain by Alluvium (Clay, Silt, Sand, and Gravel) superficial deposits.

The National Geoscience Data Centre's Single Onshore Borehole Index holds records of 7 boreholes within 500 m of the site. The closest boreholes indicate sandy clays and peat to a depth of 2.5 m bgl, underlain by sand and gravel comprising limestone and chalk to an approximate depth of 5.0 m bgl.

The Phase II Geotechnical and Geo-Environmental Report prepared by Geo Integrity indicates ground conditions to comprise of made ground and reworked soils, underlain by alluvium to depths ranging between 1.3 - 4.5 m bgl. This was underlain by a consistent medium dense to dense granular layer of superficial gravel (Shepperton Gravel Member) to depths ranging between 6.1 - 8.0 m bgl. The superficial gravels were underlain by structureless chalk comprising layers of gravelly silt and silty gravel to the base of the exploratory holes in excess of 15.0 m bgl.

According to the MAGIC website, the superficial deposits at the site are classified as a Secondary A aquifer whilst the underlying bedrock is classified as a Principal aquifer. The site is shown to be located within a designated Zone 1 Inner Protection Zone GSPZ.

The Phase II Geotechnical and Geo-Environmental Report reports groundwater at 1.0 - 4.9 m bgl and standing levels between 0.7 - 4.6 m bgl. The groundwater considered to be in continuity with Broadwater Lake.

Infiltration testing was undertaken in three locations in February 2023 as part of the site investigation. The results (**Appendix D)** indicate that infiltration is viable within the Made Ground at the site.

3 PLANNING POLICY AND GUIDANCE

3.1 National Planning Policy and Policy Guidance

The thrust of national planning policy, as articulated in the NPPF is that inappropriate development in areas at risk of flooding should be avoided where possible, as summarised below:

- Inappropriate development in areas at risk of flooding should be avoided and that development should be directed away from areas at highest risk (whether existing or future), but where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere (NPPF para. 170).
- A sequential risk-based approach should be taken to individual applications in areas known to be at risk now or in the future from any form of flooding (NPPF para. 173). The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. 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 (NPPF para. 174).
- The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk) (NPPF para. 175).
- Applications for some minor development and changes of use should also not be subject to the sequential, nor the exception test (NPPF para. 176), but should still meet the requirements for site-specific flood risk assessments set out in footnote 63.
- Having applied the Sequential Test, 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 test will depend on the potential vulnerability of the site and of the development proposed (as set out in Annex 3 of NPPF; also PPG Table 2) (NPPF para. 177). For example, the Exception Test need not be applied for less vulnerable development in any flood zone, or for more vulnerable development in flood zones 1 or 2.
- Where the Exception Test must be applied, application of the test for development proposals at the application stage should be informed by a site-specific flood risk assessment. For the test to be passed it should be demonstrated that: (a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; (b) and the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall (NPPF para. 178). Both elements of the test should be satisfied for the development to be permitted (NPPF para. 179).
- A site-specific flood risk assessment should be provided for all development in flood zones 2 and 3 [whilst] in flood zone 1, an assessment should accompany all proposals involving: sites of 1 ha or more; land which has been identified by the EA as having critical drainage problems; land identified in a SFRA as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use (NPPF para. 181).
- Development should not increase flood risk elsewhere (NPPF para. 181).
- Development should only be allowed in areas at risk of flooding where the flood risk assessment (and the sequential and exception tests, as applicable), demonstrate that: a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location; b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment; c) the development incorporates SuDS, unless there is clear evidence that this would be inappropriate; d) any residual (flood) risk can be safely managed; and e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan (NPPF para. 181).
- Applications which could affect drainage on or around the site should incorporate SuDS to control flow rates and reduce volumes of runoff, and which are proportionate to the nature and scale of the proposal. These should provide multifunctional benefits wherever possible, through facilitating improvements in water quality and biodiversity, as well as benefits for amenity. SuDS provided as part of proposals for major development should: a) take account of advice from the LLFA; b) have

appropriate proposed minimum operational standards; and c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development (NPPF para. 182).

Guidance on application of the sequential and exception test is provided in the PPG - Flood Risk and Coastal Change. For example:

- The approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This means avoiding, so far as possible, development in current and future (i.e. taking climate change into account) medium and high flood risk areas considering all sources of flooding including areas at risk of surface water flooding (PPG para. 7-023).
- Where it is not possible to locate development in low risk areas, the Sequential Test should go on to compare reasonably available sites within medium risk areas and then, only where there are no reasonably available sites in low and medium risk areas, within high risk areas (PPG para. 7-024).
- Initially, the presence of existing flood risk management infrastructure should be ignored, as the long-term funding, maintenance and renewal of this infrastructure is uncertain. climate change will also impact upon the level of protection infrastructure will offer throughout the lifetime of development (PPG para. 7-024).
- The Sequential Test should be applied to 'Major' and 'Non-major development' proposed in areas at risk of flooding, but it will not be required where; the site has been allocated for development and subject to the test at the plan making stage (provided the proposed development is consistent with the use for which the site was allocated and provided there have been no significant changes to the known level of flood risk to the site, now or in the future which would have affected the outcome of the test); the site is in an area at low risk from all sources of flooding, unless the SFRA, or other information, indicates there may be a risk of flooding in the future; the application is for a development type that is exempt from the test, as specified in [footnote 62] of the NPPF (PPG para. 7-027).
- For individual planning applications subject to the Sequential Test, the area to apply the test will be defined by local circumstances relating to the catchment area for the type of development proposed. For some developments this may be clear, for example, the catchment area for a school. In other cases, it may be identified from other Plan policies. For example, where there are large areas in Flood Zones 2 and 3 (medium to high probability of flooding) and development is needed in those areas to sustain the existing community, sites outside them are unlikely to provide reasonable alternatives. Equally, a pragmatic approach needs to be taken where proposals involve comparatively small extensions to existing premises (relative to their existing size), where it may be impractical to accommodate the additional space in an alternative location. For nationally or regionally important infrastructure the area of search to which the Sequential Test could be applied will be wider than the LPA boundary (PPG para. 7-027).
- 'Reasonably available sites' are those in a suitable location for the type of development with a reasonable prospect that the site is available to be developed at the point in time envisaged for the development. These could include a series of smaller sites and/or part of a larger site if these would be capable of accommodating the proposed development. Such lower-risk sites do not need to be owned by the applicant to be considered 'reasonably available' (PPG para. 7-028).
- The Exception Test should only be applied as set out in Table 2 [of the PPG ("Flood Risk Vulnerability and Flood Zone Incompatibility")] and only if the Sequential Test has shown that there are no reasonably available, lower risk sites, suitable for the proposed development, to which the development could be steered (PPG para. 7-032).

3.2 Local Planning Policy

3.2.1 London Borough of Hillingdon Local Plan, November 2012 (Part 1) and January 2020 (Part 2)

The London Borough of Hillingdon Local Plan comprises Part 1: Strategic Policies (adopted November 2012), Part 2: Development Management Policies (adopted January 2020) and Part 2: Site Allocations and Designations (adopted January 2020). The following policies are relevant in respect of flood risk and waterside development:

(Part 1) Policy EM1; Climate Change Adaptation and Mitigation

The Council will ensure that climate change mitigation is addressed at every stage of the development process by:

11. *Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.*
12. *Giving preference to development of previously developed land to avoid the loss of further green areas.*
13. *Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks*

(Part 1) Policy EM6; Flood Risk Management

The Council will require new development to be directed away from Flood Zones 2 and 3 in accordance with the principles of the [NPPF].

The subsequent Hillingdon Local Plan: Part 2 - Site Specific Allocations [local development document (LDD)] will be subjected to the Sequential Test in accordance with the NPPF. Sites will only be allocated within Flood Zones 2 or 3 where there are overriding issues that outweigh flood risk. In these instances, policy criteria will be set requiring future applicants of these sites to demonstrate that flood risk can be suitably mitigated.

The Council will require all development across the borough to use sustainable urban drainage systems (SUDS) unless demonstrated that it is not viable. The Council will encourage SuDS to be linked to water efficiency methods. The Council may require developer contributions to guarantee the long term maintenance and performance of uUDS is to an appropriate standard.

(Part 2) Policy DMEI 8: Waterside Development

A. *Development on sites that adjoin or include a watercourse should:*
   i. *have regard to the relevant provisions of the Thames River Basin Management Plan and any other relevant Catchment Management Plans;*
   ii. *not extend within 8 metres of the top of the bank of a main river or 5 metres either side of an ordinary watercourse or an appropriate width as may be agreed by the Council;*
   iii. *where feasible, secure the implementation of environmental enhancements to open sections of river or watercourse; and*
   iv. *where feasible, implement a scheme for restoring culverted sections of river or watercourses which must include an adequate buffer for flooding and maintenance purposes.*

B. *Where on-site environmental enhancements or deculverting are financially viable but not feasible, the Council will seek a financial contribution towards relevant projects for the enhancement or deculverting of other sections of rivers or watercourses.*
C. *Existing wharves and their access will be protected for continued use.*
D. *Proposals that would adversely affect the infrastructure of main rivers and ordinary watercourses, or which fail to secure feasible enhancements or deculverting, will be resisted.*
E. *Development located in or adjacent to watercourses should enhance the waterside environment and biodiversity by demonstrating a high design quality which respects the historic significance of the canal and character of the waterway and provides access and improved amenity to the waterfront.*
F. *All development alongside or that benefits from a frontage on the Grand Union Canal will be expected to contribute to the improvement of the Canal.*

(Part 2) Policy DMEI 9: Management of Flood Risk

A. *Development proposals in Flood Zones 2 and 3a will be required to demonstrate that there are no suitable sites available in areas of lower flood risk. Where no appropriate sites are available, development should be located on the areas of lowest flood risk within the site. Flood defences should provide protection for the lifetime of the development. Finished floor levels should reflect the Environment Agency's latest guidance on climate change.*
B. *Development proposals in these areas will be required to submit an appropriate level Flood Risk Assessment (FRA) to demonstrate that the development is resilient to all sources of flooding.*

C. *Development in Flood Zone 3b will be refused in principle unless identified as an appropriate development in Flood Risk Planning Policy Guidance. Development for appropriate uses in Flood Zone 3b will only be approved if accompanied by an appropriate FRA that demonstrates the development will be resistant and resilient to flooding and suitable warning and evacuation methods are in place.*
D. *Developments may be required to make contributions (through legal agreements) to previously identified flood improvement works that will benefit the development site.*
E. *Proposals that fail to make appropriate provision for flood risk mitigation, or which would increase the risk or consequences of flooding, will be refused.*

(Part 2) Policy DMEI 10: Water Management, Efficiency, and Quality

A. *Applications for all new build developments (not conversions, change of use, or refurbishment) are required to include a drainage assessment demonstrating that appropriate [SuDS] have been incorporated in accordance with the London Plan Hierarchy (Policy 5.13: Sustainable drainage).*
B. *All major new build developments, as well as minor developments in Critical Drainage Areas or an area identified at risk from surface water flooding must be designed to reduce surface water run-off rates to no higher than the pre-development greenfield run-off rate in a 1:100 year storm scenario, plus an appropriate allowance for climate change for the worst storm duration. The assessment is required regardless of the changes in impermeable areas and the fact that a site has an existing high run-off rate will not constitute justification.*
C. *Rain Gardens and non householder development should be designed to reduce surface water run-off rates to Greenfield run-off rates.*
D. *Schemes for the use of SuDS must be accompanied by adequate arrangements for the management and maintenance of the measures used, with appropriate contributions made to the Council where necessary.*
E. *Proposals that would fail to make adequate provision for the control and reduction of surface water run-off rates will be refused.*
F. *Developments should be drained by a SuDS system and must include appropriate methods to avoid pollution of the water environment. Preference should be given to utilising the drainage options in the SuDS hierarchy which remove the key pollutants that hinder improving water quality in Hillingdon. Major development should adopt a 'treatment train' approach where water flows through different SuDS to ensure resilience in the system.*

Water Efficiency

G. *All new development proposals (including refurbishments and conversions) will be required to include water efficiency measures, including the collection and reuse of rain water and grey water.*
H. *All new residential development should demonstrate water usage rates of no more than 105 litres/person/day.*
I. *It is expected that major development proposals will provide an integrated approach to surface water run-off attenuation, water collection, recycling and reuse.*

Water and Wastewater *Infrastructure*

J. *All new development proposals will be required to demonstrate that there is sufficient capacity in the water and wastewater infrastructure network to support the proposed development. Where there is a capacity constraint the local planning authority will require the developer to provide a detailed water and/or drainage strategy to inform what infrastructure is required, where, when and how it will be delivered.*

3.2.2 The London Plan, March 2021

The London Plan 2021 is the spatial development strategy for Greater London. It sets out a framework for how London will develop over the next 20 - 25 years and the Mayor's vision for good growth.

The Plan is part of the statutory development plan for London, meaning that the policies in the Plan should inform decisions on planning applications across the capital. Borough's Local Plans must be in 'general conformity' with the London Plan, ensuring that the planning system for London operates in a joined-up way and reflects the overall strategy for how London can develop sustainably.5

The following policies are relevant in respect of flood risk and waterways:

Policy SI 12 Flood Risk Management

A. *Current and expected flood risk from all sources (as defined in paragraph 9.2.12) across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.*
B. *Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues including with authorities outside London.*
C. *Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.*
D. *Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier.*
E. *Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.*
F. *Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.*
G. *Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat.*

Policy SI 13 Sustainable Drainage

A. *Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.*
B. *Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:*
    1. *rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)*
    2. *rainwater infiltration to ground at or close to source*
    3. *rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)*
    4. *rainwater discharge direct to a watercourse (unless not appropriate)*
    5. *controlled rainwater discharge to a surface water sewer or drain 6) controlled rainwater discharge to a combined sewer.*
C. *Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.*
D. *Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.*

Policy SI 14 Waterways - Strategic Role identifies the need for development proposals to *"address the strategic importance of London's network of linked waterways [including the River Thames, its tributary rivers and canals and other waters spaces including docks, lakes and reservoirs] and should seek to maximise their multifunctional social, economic and environmental benefits"*.

Policy SI 16 Waterways - Use and Enjoyment states that *"development proposals should protect and enhance, where possible, water-related cultural, educational and community facilities and events, and new facilities should be supported and promoted, but should take into consideration the protection and other uses of the waterways. Development proposals that increase the provision of water sport centres and associated new*

infrastructure will be supported if a deficit in provision has been identified locally, and if the infrastructure does not negatively impact on navigation or on the protection of the waterway".

Policy SI 17 Protecting and Enhancing London's Waterways states that development *"should support river restoration and biodiversity improvements…and improve the protection of the distinct open character and heritage of waterways and their settings"*.

3.3 Drainage Technical Guidance

Non-statutory technical standards for sustainable drainage published by DEFRA in June 2025 set out how surface water runoff generated during the 3.3% and 1.0% AEP rainfall events and for events exceeding the 1.0% AEP event should be managed, how peak runoff rates should be restricted and how runoff volumes should be controlled.

Hillingdon Council has produced a Sustainable Drainage: Design and Evaluation Guide (2018) to promote the integration of SuDS within development and to ensure that the above standards are met.

3.4 Water Framework Directive

The WFD provides a legal framework for the protection, improvement and sustainable use of inland surface waters, groundwater, transitional waters, and coastal waters across England, and seeks to:

- Prevent deterioration in the status of surface water and groundwater bodies;
- Protect, enhance and restore surface water and groundwater bodies (except artificial or heavily modified water bodies) with the aim of achieving good ecological, chemical and groundwater quantitative status by December 2021;
- Protect and enhance artificial and heavily modified water bodies with the aim of achieving good ecological potential and good chemical status by December 2021;
- Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment and progressively reduce pollution of groundwater.

The WFD applies to any proposed development which has the potential to impact on a waterbody. Where this is the case, the EA may require evidence demonstrating that the proposed development does not compromise the aims of the WFD.

3.5 Environmental Permitting

Under the Environmental Permitting (England and Wales) Regulations 2016 an Environmental Permit for Flood Risk Activities[1] is required from the EA for any permanent or temporary works, including works:

- In, over or under a designated main river
- Within 8 m of the top of bank of a designated main river or of the landward toe of a flood defence (16 m if it is a tidal main river or a sea defence).

In addition, any permanent or temporary works within the floodplain of a designated main river may also require an Environmental Permit for Flood Risk Activities. A permit is separate to and in addition to any planning permission granted.

1 https://www.gov.uk/guidance/flood-risk-activities-environmental-permits

4 REVIEW OF FLOOD RISK

4.1 Flood Defences

There are no flood defences located within the vicinity of the site.

4.2 Historical Records of Flooding

The EA Historic Flood Map[2] (refer to extract in **Figure 6**) and interactive web mapping for the 2018 SFRA ("Fluvial and Tidal Flood Risk") indicate that there are no records of flooding at the site. A small area of flooding to the north of the site (Black Jack's Mill) is indicated to have experienced flooding in 1987.

Figure 6: Historic Flood Map
Source: gov.uk website; Accessed: July 2025

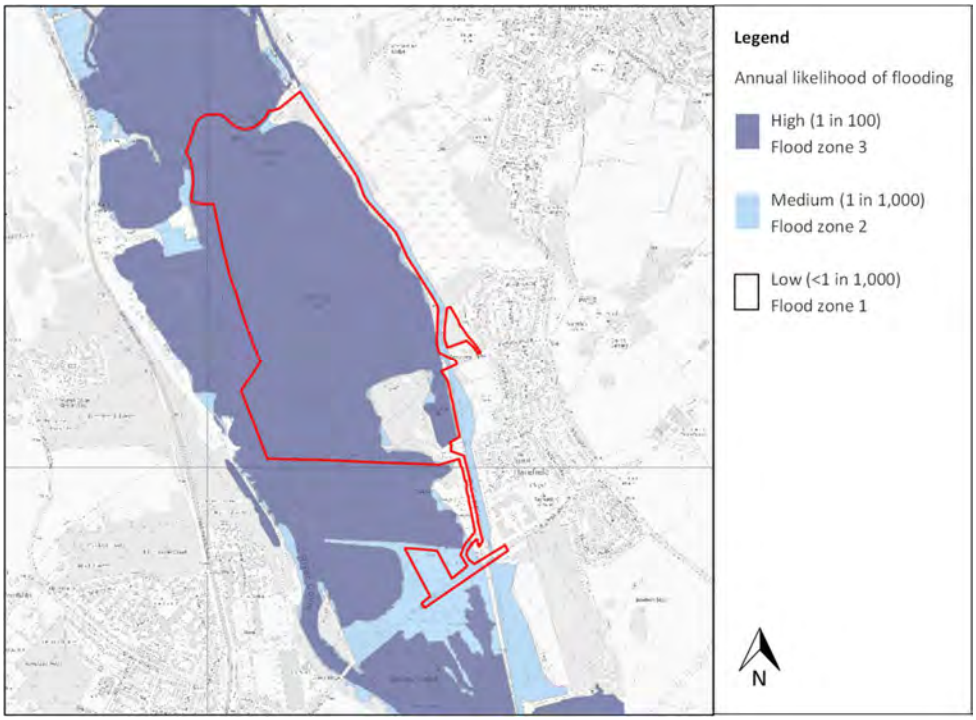
4.3 Flood Zone Classification

The EA Flood Map for Planning (Flood Zones 2 and 3) dataset (**Figure 7a**) indicates most of the site (i.e. Broadwater Lake) to be located within flood zone 3 (high risk), but that most of the peninsula and access road (**Figure 7b**) are located in flood zone 1, with only the southern part of the access road, at the junction with Moorhall Road indicated to be in flood zone 2.

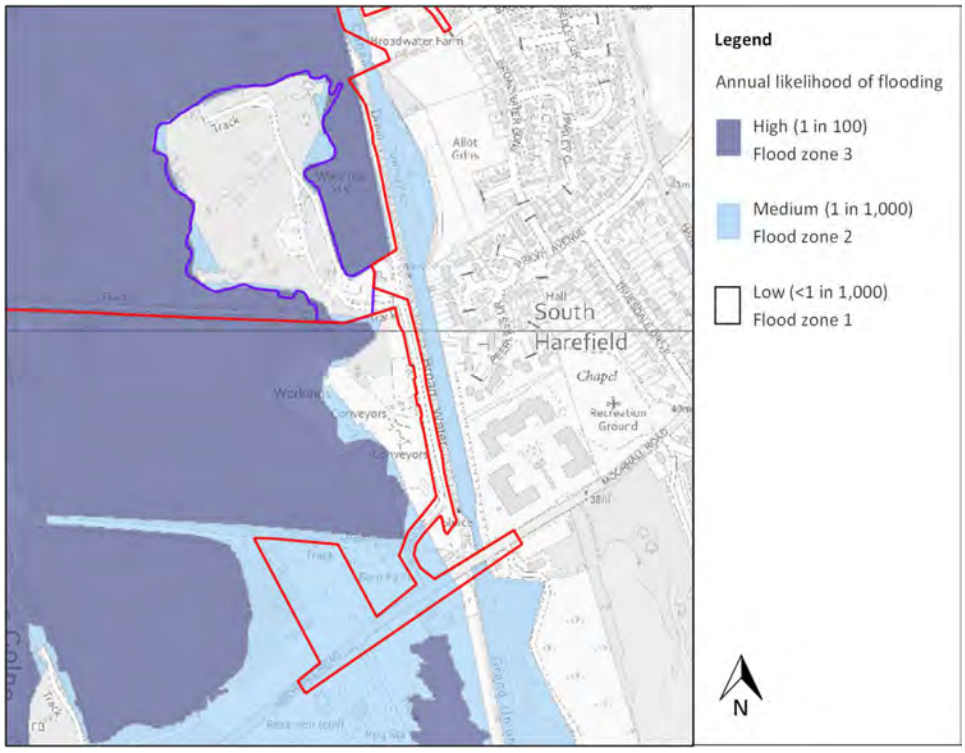
In respect of the risk of flooding from rivers, Table 1 of the PPG defines flood zones as follows:

- Flood zone 1: Low Probability. Land having a less than 0.1% annual probability of river flooding
- Flood zone 2: Medium Probability. Land having between a 1.0% and 0.1% annual probability of river flooding
- Flood zone 3a: High Probability. Land having a 1.0% or greater annual probability of river flooding
- Flood zone 3b: Functional Floodplain. Land where water from rivers has to flow or be stored in times of flood. Land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively or land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as a 0.1% annual probability of flooding).

[2] https://data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map



(a) Application site



(b) Peninsula and Access Road

Figure 7: Risk of Flooding from Rivers and the Sea
Source: EA FMfP (Flood zones 2 and 3) dataset; Accessed - July 2025

4.4 Risk of Flooding from Rivers (River Colne)

Detailed flood risk information for the site was provided by the EA in response to a RFI in January 2023 (EA ref: HNL294490/AS). The flood risk information pack is provided in **Appendix E**. The information provided by the EA includes outputs from a 1D/2D hydraulic model of the Upper Colne developed as part of the EA Upper Colne Flood Risk Mapping Study (December 2010).

The EA has advised by way of an email dated 9 July 2025 (EA ref. EIR2025/15871AS) that the proposed update to the 2010 hydraulic model has not yet been completed and therefore is unavailable. The correspondence states that the updated modelling "should be available later this year, most likely winter". Accordingly, outputs from the 2010 Upper Colne model are regarded as best available information for the purposes of this assessment.

The 2D element of the 2010 model covered areas where complex floodplain flow paths were expected or where a high density of properties were at risk of flooding. This was not the case within the vicinity of the site and to map in the vicinity of Broadwater Lake, 1D peak in-channel water levels were used with Broadwater Lake being represented in the hydraulic model as a reservoir unit. The model node locations are presented on **Figure 8**.

The maximum flood extent for the 5.0%, 1.0% and 0.1% AEP events, and for the 1.0% plus 20% climate change are presented in **Figure 9** and peak modelled-in channel levels from the 1D component of the model for the model nodes presented on **Figure 8** are presented in **Table 1**.

The model outputs indicate the following:

- 5.0% AEP event: Broadwater Lake and the northern tip of the peninsula is indicated to flood; The remainder of the peninsula, access road, and southern parcel are indicated not to flood;
- 2.0% AEP event (not shown): As 5.0% AEP event;
- 1.0% AEP event: As 5.0% AEP event;
- 1.0% AEP event plus 20% CC: As 5.0% AEP event, plus Grand Union Canal is indicated to flood;
- 0.1% AEP event: As 1.0% AEP event, plus - small areas on the edge of the peninsula, the southern parcel, and the access road at the junction with Moorhall Road indicated to flood.

Regarding the functional floodplain: The 2018 SFRA defines Flood Zone 3b (the functional floodplain) as land within fluvial and tidal flood risk extents predicted for up to and including a 5.0% AEP events allowing for the impact of flood defences. Since the 2018 SFRA was issued, the NPPF has redefined Flood Zone 3b as land having a 3.3% AEP, with any existing flood risk management infrastructure operating effectively (refer **Section 4.3**). Based on the model outputs, it is concluded that:

- Broadwater Lake and the northern tip of the peninsula are located in Flood Zone 3b;
- Almost all of the main part of the peninsula and access road are located in Flood Zone 1;
- The southern parcel, small areas on the edge of the main part of the peninsula, the southern parcel, and part of the access road (at the junction with Moorhall Road), are in Flood Zone 2.

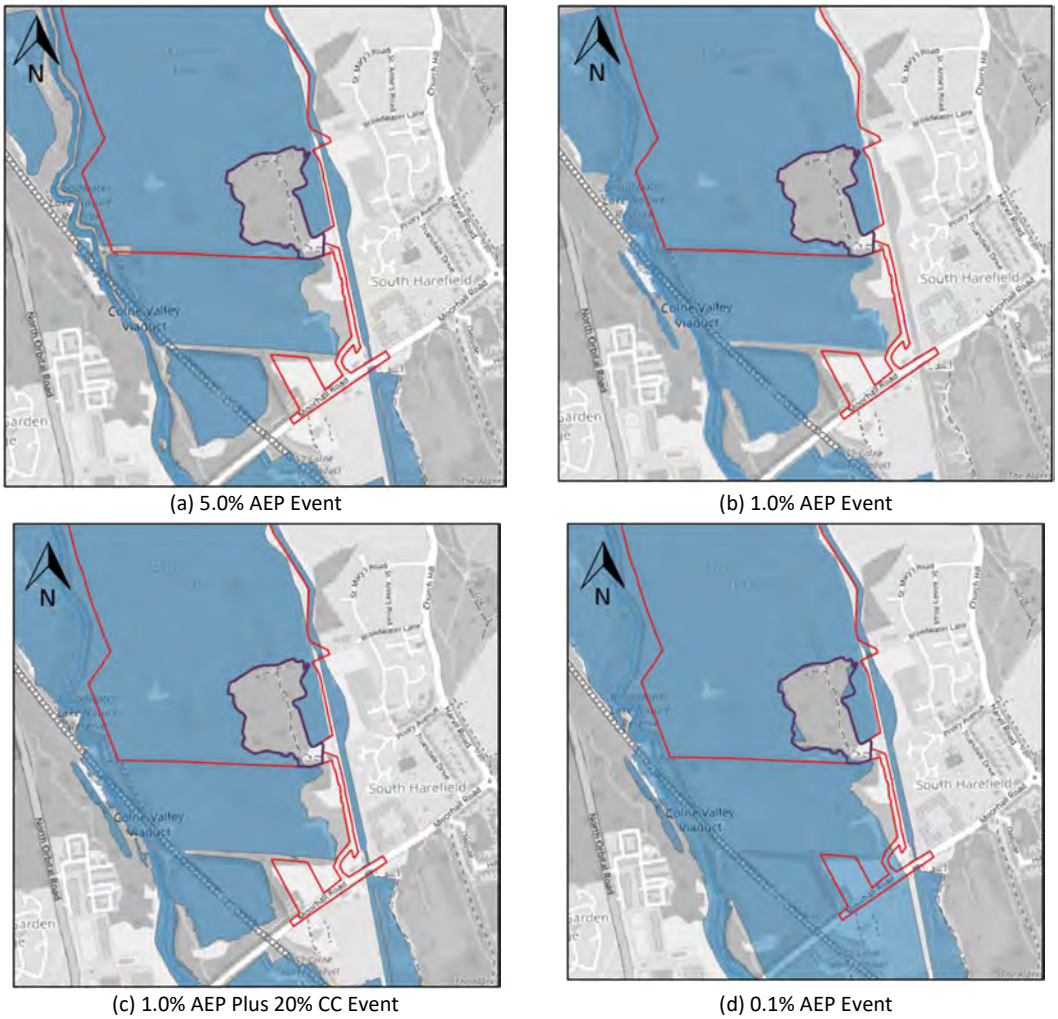
The hydraulic model of the River Colne predates the current guidance on climate change allowances. The current guidance advises that for water-compatible development, the Central allowance should be used to assess flood risk for the lifetime of the development. The Central allowance for the Colne management catchment is +21% (2080s epoch). As such, the 2010 modelled outputs (+20% climate change) are considered to provide an accurate indication of the flood risk to the site when accounting for climate change.

The mapping from the 2010 study is consistent with the flood zone extents on the Flood Map for Planning (**Figure 7**) and the interactive web mapping for the 2018 SFRA ("Fluvial and Tidal Flood Risk").

The existing unnamed access road is also shown to remain dry in up to a 1.0% AEP event +20% climate change. Some flooding is indicated at the junction of the access road with Moorhall Road during a 0.1% AEP event; however, this is only over a relatively short section (approximately 130 m) beyond which dry access is provided east along Moorhall Road.

It is concluded that the main part of the peninsula, within which development is proposed is at a Low risk of flooding from rivers, with the southern parcel, and a small part of the access road at a Medium risk.

Figure 8: River Colne Modelled Node Locations
Source: Upper Colne Flood Risk Mapping Study, EA, December 2010



(a) 5.0% AEP Event

(b) 1.0% AEP Event

(c) 1.0% AEP Plus 20% CC Event

(d) 0.1% AEP Event

Figure 9: River Colne Modelled Flood Extents
Source: Upper Colne Flood Risk Mapping Study, EA, December 2010

Table 1: Maximum Modelled In-Channel Water Levels

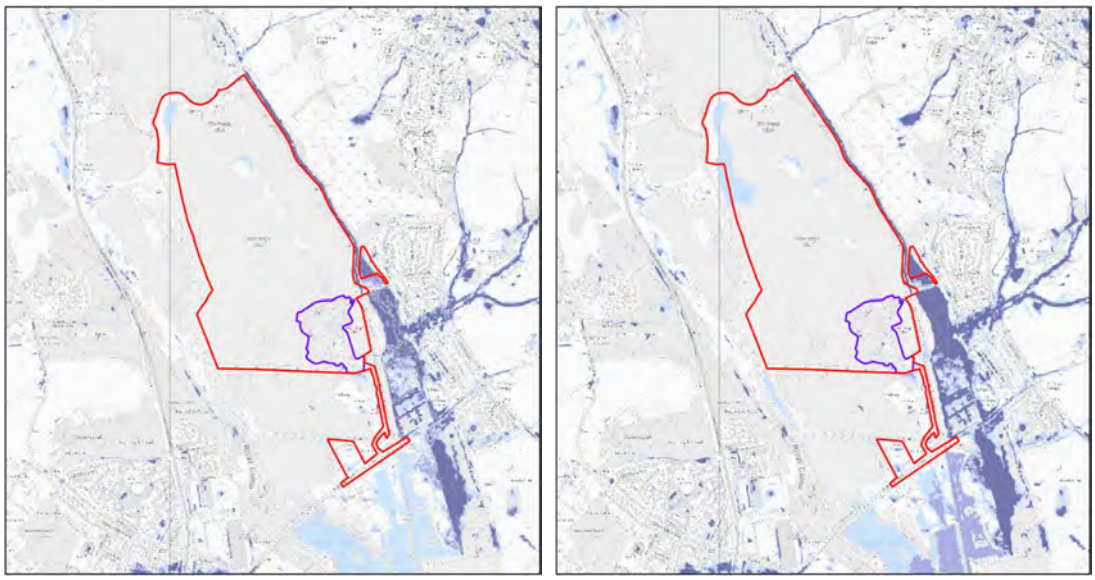
Source: Upper Colne Flood Risk Mapping Study, EA, December 2010

Mode node	Event AEP			
	5%	1.0%	1.0% 20%CC	0.1%
UCL70_4423	37.63	37.83	37.89	38.23
UCL70_4318	37.49	37.67	37.73	38.17
UCL70_4214	37.34	37.51	37.58	38.13

4.5 Flood Risk from Small Watercourses and Surface Water

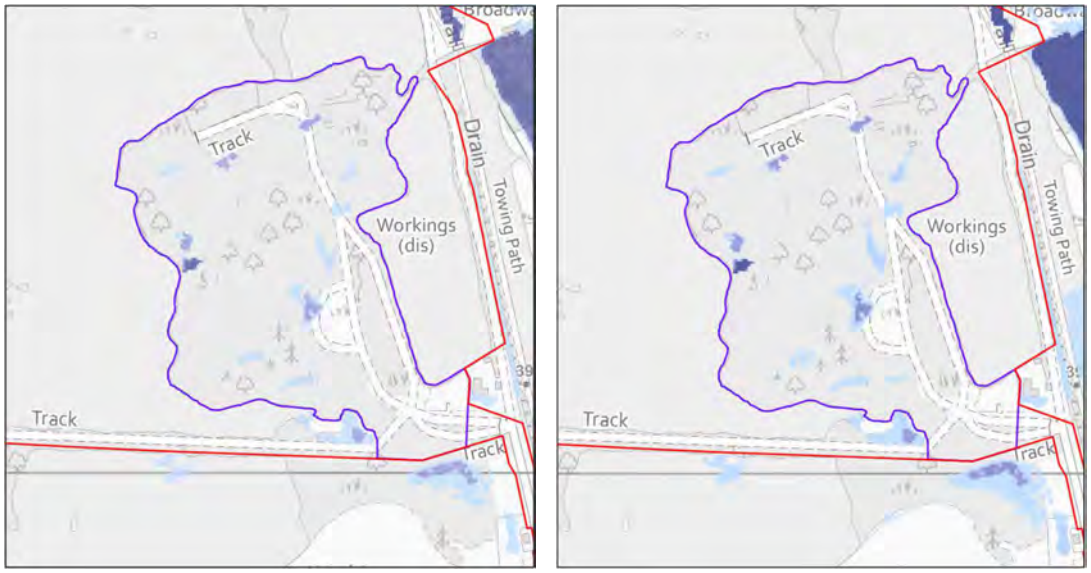
The EA mapping of flood risk from surface water is presented in **Figure 10**. The mapping indicates the following:

- Peninsula: Almost entirely at a Very low risk of surface water flooding both now and in the future (due to the effect of climate change), albeit with some isolated areas where the risk of surface water ponding is indicated to be at Medium to High.
- Access Road: Entirely at a Very Low risk of flooding from surface water.
- Land off Broadwater Lane: The area to the northeast of the peninsular (off Broadwater Lane) is indicated to be at a High risk of surface water flooding. However, this area of land has been set aside for potential biodiversity net gain interventions (as required) and no built development is proposed on this land.



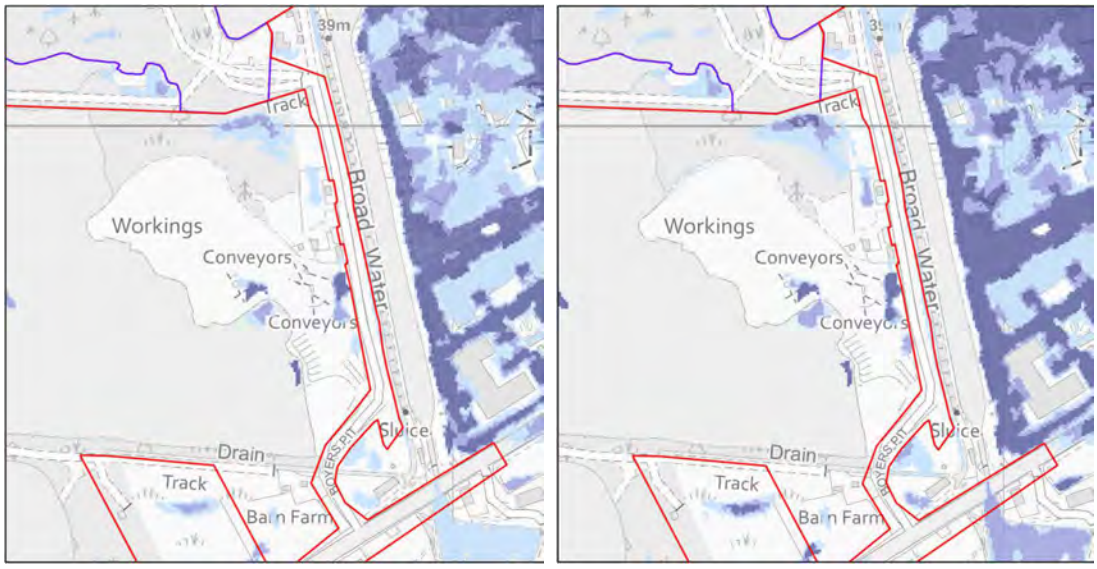
(i) Current Risk (ii) Future risk (Climate change to 2060)

(a) Application site



(i) Current Risk (ii) Future risk (Climate change to 2060)

(b) Peninsula



(i) Current Risk (ii) Future risk (Climate change to 2060)

(c) Access Road

Key to above

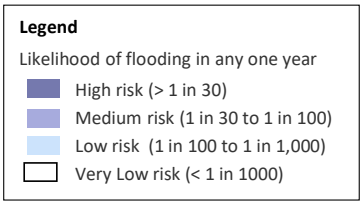


Figure 10: Risk of Flooding from Surface Water

Information sources:
(i) EA FMfP (Surface water) dataset, Accessed July 2025;
(ii) EA Long-Term Flood Risk (Surface water) dataset, Accessed July 2025

4.6 Flood Risk from Reservoirs, Canals and Other Water Impounding Structures

The Long Term Flood Risk (Reservoirs) dataset (**Figure 11**) indicates that the site is at risk of flooding from reservoirs. However, all large reservoirs are regularly inspected by reservoir panel engineers with essential safety work carried out as required. As detailed on the gov.uk website, reservoir flooding is therefore extremely unlikely to occur.

As detailed in **Section 2.3**, the Grand Union Canal is located along the eastern boundary of the site. Ground levels along the western canal bank adjacent to the peninsula are between 37.0 - 38.4 m AOD. Bank levels are higher than adjacent ground levels. However, a large interceptor channel adjacent to the western embankment would intercept water from the canal in the event that the canal embankment is overtopped or structurally fails.

In addition, CRT operates a comprehensive asset management system which enables it to manage the risks of such events occurring with the water level within the canal controlled by a number of weirs and sluice gates located along the pound length. The risk of the canal exceeding its bank level is therefore considered to be low. Furthermore, the CRT has advised[3] that it is not aware of any records of overtopping from, or breaches of this section of the waterway. Broadwater Lake would also act to intercept any flows arising from the canal and as such further minimise any risk to the proposed development.

The risk of flooding to the peninsula from Broadwater Lake, and the other surrounding lakes and water impounding structures is considered to have been assessed as part of the 2010 Upper Colne Flood Risk Mapping Study (as discussed in **Section 4.4**) and in the derivation of the Flood Risk from Surface Water map (**Figure 10**).

It is concluded that the site is at a Low risk of flooding from reservoirs, canals and water impounding structures.

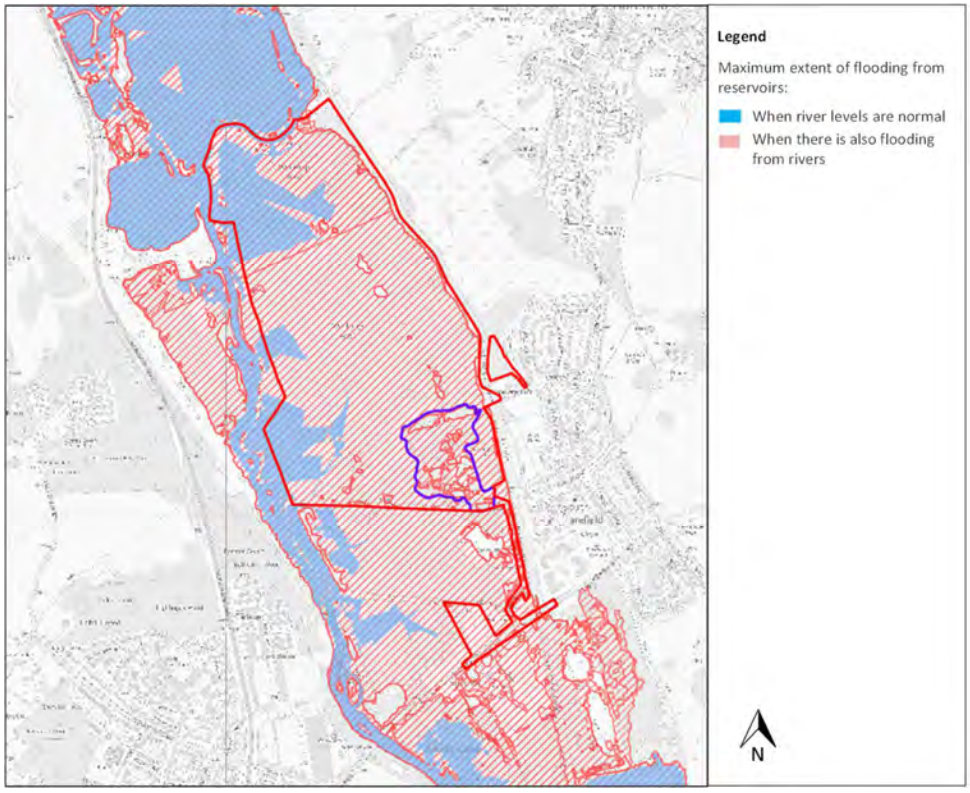


Figure 11: Long Term Flood Risk (Reservoirs)
Source: EA Long-Term Flood Risk (Reservoirs) dataset; Accessed: July 2025

[3] Letter from the CRT to Weetwood dated 30 January 2023 (Ref. MW GU-197 30/01/2023)

4.7 Flood Risk from Groundwater

The JBA Groundwater Flood Risk Indicator map (**Figure 12**) indicates that groundwater levels across the peninsula, most of the access road, and part of the southern parcel may be <0.025 m bgl during a 1.0% AEP groundwater flood event and are accordingly assessed to be at High risk from this source.

The interactive web mapping for the 2018 SFRA ("Sewer, Groundwater and Artificial Flood Risk") also identifies the site as being located in an area where >= 75% of the area may be susceptible to groundwater flooding.

As detailed in **Section 2.5**, as part of the site investigations undertaken by Geo Integrity in February 2023, groundwater was encountered at 1.0 - 4.9 m bgl with standing levels between 0.7 - 4.6 m bgl.

Due to the nature and topography of the site, emergent groundwater would be expected to be directed towards Broadwater Lake, away from the areas of proposed development and as such would not be expected to accumulate to any significant depth.

It is concluded that the proposed development is at a Low risk from groundwater flooding.

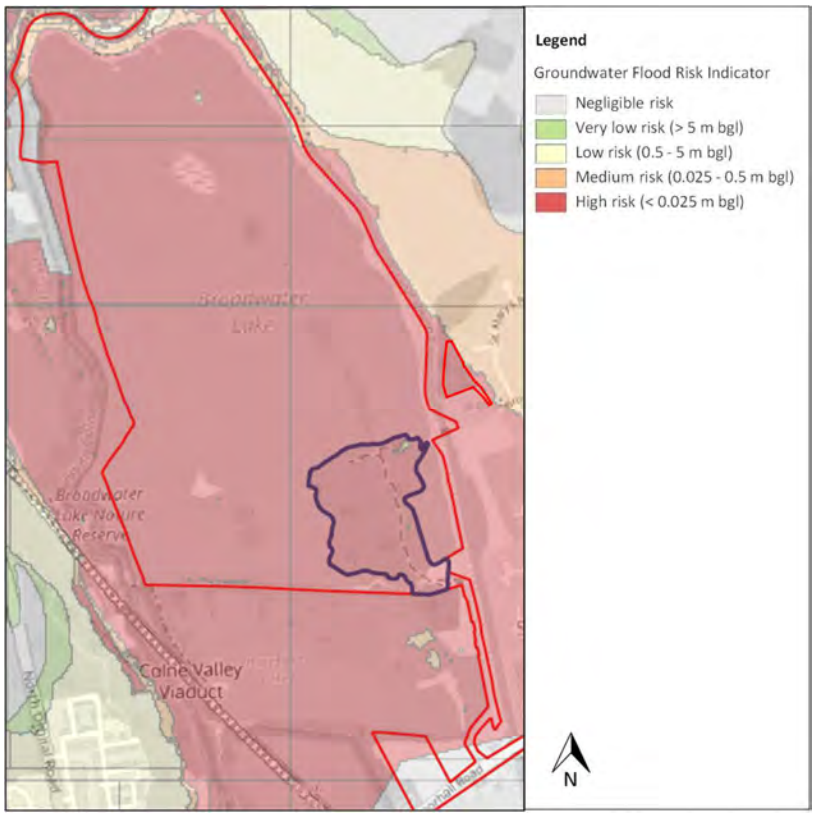


Figure 12: JBA Groundwater Flood Risk Indicator Map
Source: Blue Sky Maps; Accessed: April 2023

5 FLOOD RISK MITIGATION AND THE IMPACT ON FLOOD RISK ELSEWHERE

The risk of flooding to the area of proposed development (i.e. the peninsula) from all identified sources is assessed to be Negligible/Low. However, as detailed in **Section 2.2**, the proposals include the creation of an extension to the peninsula (refer to **Figure 3**), which is currently open water and classified as having a high risk of fluvial flooding (Flood Zone 3b – functional floodplain).

For the purposes of flood risk mitigation, the design event is the 1.0% AEP event +20% climate change in accordance with the PPG. Accordingly, the design flood level is the maximum modelled in-channel water level for the River Colne during the design flood event (37.89 m AOD). It should be noted that this level is greater than the water level would be in Broadwater Lake because of the flood storage provided by the lake and that the assessment of flood risk has confirmed that none of the peninsula would flood during the design flood event (accordingly, the access to the development is dry and hence, safe).

The risk of flooding to the proposed development will be mitigated through the implementation of the measures set out below:

1) The ground level across much of the peninsula is above 37.89 m AOD. However:
    a) Some ground levels in the area proposed for camping (located within Area 1 on **Figure 13**) are lower than 37.89 m AOD. It is recommended that levels in this area are raised to a minimum of 37.89 m AOD;
    b) Some ground levels in the vicinity of the Main Building, WC-Changing Building, Safety Equipment Store, Energy Centre, and Workshop (located within Area 2 on **Figure 13**) are lower than 37.89 m AOD. It is recommended that levels in this area are raised to a minimum of 37.89 m AOD.

    In both locations, the land requiring raising should be confirmed by topographical survey noting that ground raising may be locally constrained by mature trees that need to be retained.
    No ground raising is proposed in the following areas: (i) The beach area – this area is designed to be partially under water during typical winter water levels; (ii) In those parts of the peninsular where no development or activities are proposed; and (iii) where activities are water compatible and the risk is negligible.
2) The FFL of all proposed buildings should be set at a minimum of 38.23 m AOD. This is the maximum modelled in-channel water level for the River Colne during the 0.1% AEP event and 340 mm above the maximum water level during the design flood event;
3) FFL of all proposed buildings should be at least 150 mm above adjacent ground levels;
4) All buildings should have designed in resilience to flooding to a minimum level of 38.23 m AOD, i.e. the maximum modelled in-channel water level for the River Colne during the 0.1% AEP event. Measures may include, but not necessarily be limited to, raised power sockets, non-return valves on ground floor drainage etc. If actual finished floor levels are at or above 38.23 m AOD, then no additional flood resilience measures are deemed to be necessary;
5) It is recommended that a FWEP is prepared setting out the procedures to be followed in the event that flooding is forecasted. The site is included in an EA flood alert and warning area. This provides the opportunity for the response procedures set out in the plan to be invoked in response to receipt of a EA flood warning.

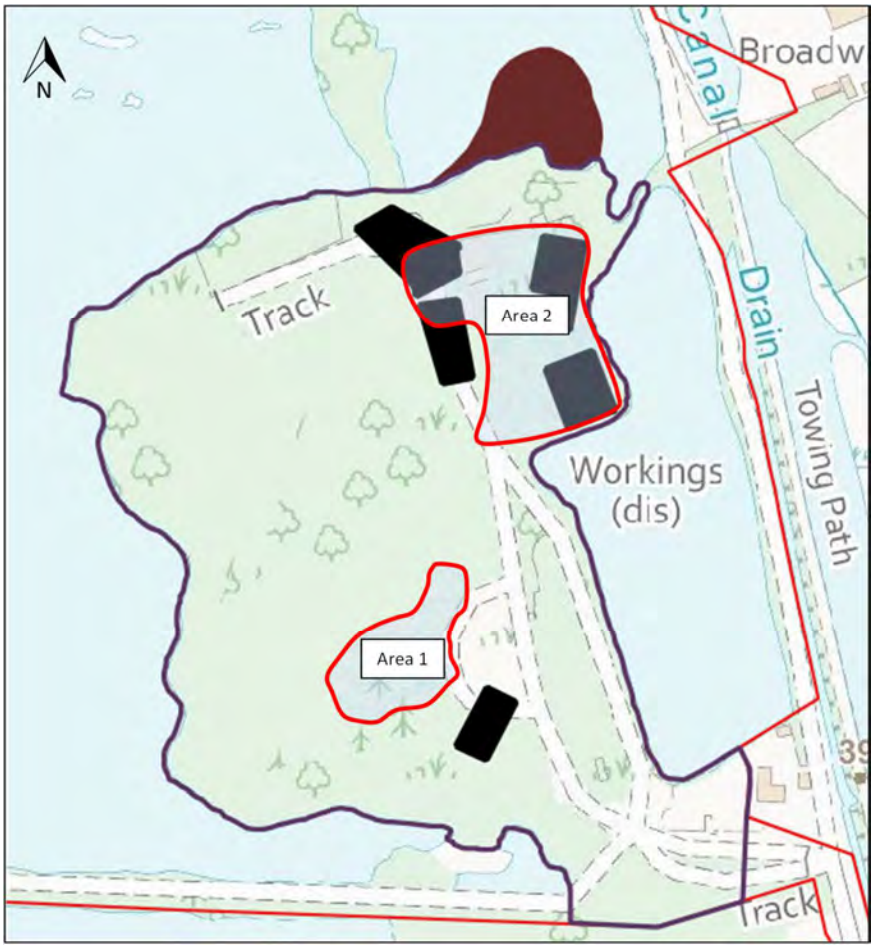


Figure 13: Areas of Potential Ground Raising

5.1 Flood Risk Elsewhere

5.1.1 Impact of the Formation of the Beach Area

The proposal entails the removal lake bed material of (via dredging) for use as fill material to extend the peninsula by 2,892 sq m to form a beach zone for dinghy storage and launching. The material used for the proposed beach extension will be dredged from Island 02, Island 06, and Island 07 (which will be completely removed).

The cut and fill analysis prepared by Colour-UDL (**Appendix B**) confirms the volume of fill material to create the beach is 7,965 cu m (plus an additional 325 cu m form a below water level link between Island 06 and Island 08), and that the amount of material to be removed from by dredging is 12,746 cu m. As such, the volume of cut material exceeds the volume of fill material by 4,456 cu m.

It is concluded that the proposals would not reduce the storage volume of the lake, nor impact existing water levels. As such, the proposals would not increase flood risk elsewhere.

5.1.2 Impact of the Proposed Development of the Peninsula

The assessment presented in **Section 4.4** of this report confirms that the peninsula and access road are not at risk of flooding in the 1.0% AEP fluvial event + 20% climate change (the design flood event). As such, the proposed development of the peninsula would not increase flood risk elsewhere.

6 SEQUENTIAL SITE ASSESSMENT (FLOOD RISK SEQUENTIAL TEST)

6.1 Requirement for Sequential Testing

The NPPF states that the sequential test should be applied to all sources of flood risk, not just river/sea flooding.

A summary of the risk assessment from all potential sources of flooding using a low to very high risk classification (as defined in **Appendix F**) is presented in **Table 2**. On the basis of the assessment, and specifically due to the risk of flooding to the wider site from the River Colne and the associated flood zone 3 designation, a sequential test is required.

Table 2: Site Summary of Flood Risk from All Sources

Source of Risk	Risk Classification					Sources of Information*
	None/Negligible	Low	Medium	High	Very High	
Sea (tidal / coastal)	✔					a, b
Rivers (fluvial)		✔ [1]			✔ [1]	a, b
Small watercourses	✔					a, b, c, f
Surface water (pluvial)		✔ [2]				b, c
Reservoirs		✔				b, d, f
Canals		✔				b, f
Other water impounding structures		✔				b, f
Groundwater		✔				b, e

Notes

* (a) EA Flood Map for Planning; (b) SFRA (April 2018); (c) EA Long Term Flood Risk (Surface Water); (d) EA Long Term Flood Risk (Reservoirs); (e) JBA Groundwater Flood Risk Indicator Map; (f) OS mapping.

1. The EA FMfP (Rivers and Sea with Defences) and 2010 Upper Colne Flood Risk Mapping Study indicate that Broadwater Lake is at risk of flooding during a (defended) 5.0% AEP event and as such may be defined as flood zone 3b (which is classified as Very High risk in accordance with **Appendix F**). However, no flooding of the peninsula (within which development is proposed) would be expected in a (defended and undefended) present day 0.1% AEP event and in a (defended) 1.0% AEP event +20% climate change. As such the risk to the peninsula is assessed to be Low.
2. The EA Long term Flood Risk (Surface Water) dataset (**Figure 10**) indicates that whilst areas of the site are at a Low to High risk of surface water flooding, owing to the presence of the existing lake, the peninsula is at a Very Low risk. Within the sequential assessment a Low risk classification has been attributed to the application site in accordance with **Appendix F**, which is defined as land having a < 0.1% annual probability of flooding.

6.2 Geographical Search Area

According to PPG para. 7-027 (refer to **Section 3.1** of this document) the area to apply the flood risk sequential test across "*will be defined by local circumstances relating to the catchment area for the type of development proposed*".

An Alternative Site Assessment has been undertaken by the London Borough of Hillingdon. Due to the nature of the proposals, the study area for the assessment is defined by the requirement for the new site to be in a location that meets the following criteria:

- Within an area that is a reasonable distance (20 km) of the previous HOAC, to ensure that the communities that previously utilised the HOAC are within proximity to the new Hillingdon Water Sports Facility and Activity Centre (HWSFAC);
- Within a location accessible to the strategic road network, well connected to 'A' roads, and reasonably accessible by public transport (defined as no more than 2 km walk from public transport);
- Proposed water and land activities located on a single site, ensuring that users are not exposed to the risks associated with off-site travel such as traffic, road crossings or unfamiliar locations.

The defined study area for the Alternative Site Assessment is subsequently illustrated in **Figure 14**.

Recognising the above, it is logical that the geographical search area for the flood risk sequential test is also defined by local circumstances in accordance with PPG para. 7-027, and as applied for the Alternative Site Assessment.

6.3 Potential Alternative Sites

The Alternative Site Assessment identified 71 potential alternative sites (including Broadwater Lake) as illustrated in **Figure 14**. These were assessed by the LBH based on specific recreational criteria for the proposed development, including lake and land surface area, accessibility (to the existing strategic road network and of the lake from level landform), site availability, site designation, intersection by HS2, other railway lines and proximity to noisy infrastructure, site security, depth, and water and land quality.

The assessment indicated that 66 of the potential alternative sites were prohibitively constrained and fundamentally unsuitable for the development and as such were discounted.

The five remaining potential alternative sites comprise Broadwater Lake, Ruislip Lido, Bury Lake, Aldenham Reservoir and Denham Quarry.

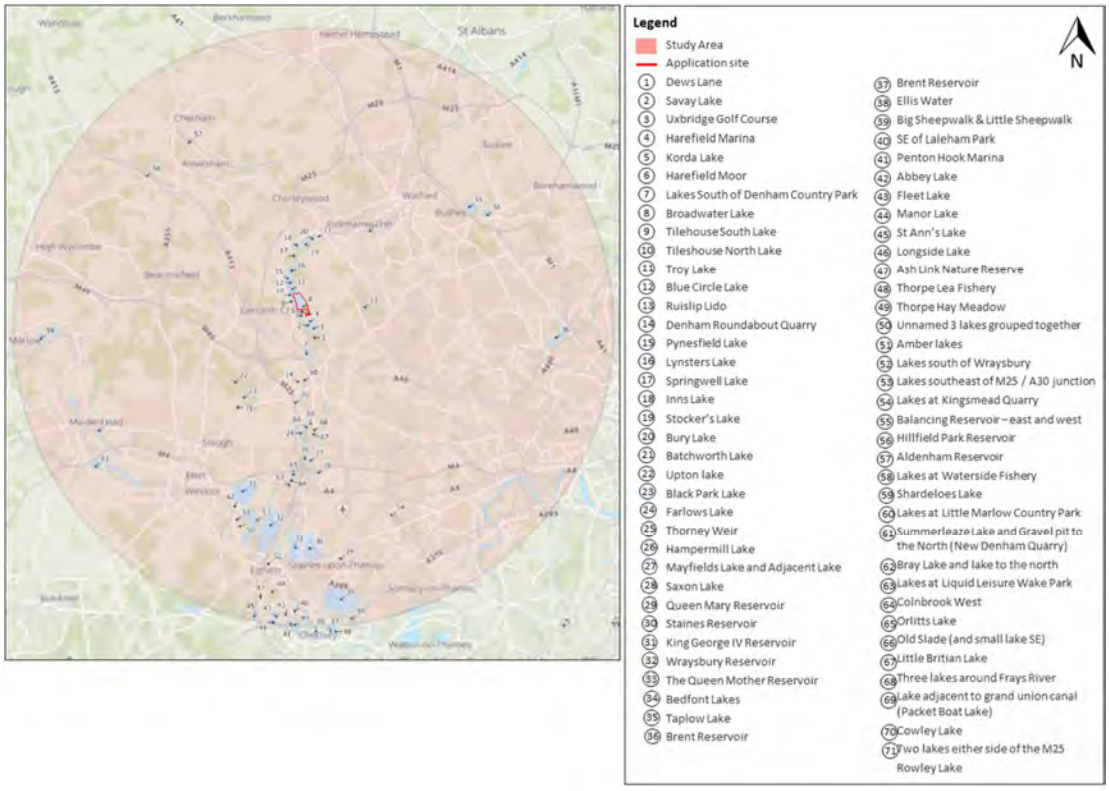


Figure 14: Application Site and Potential Alternative Sites
Source: Alternative Site Assessment, London Borough of Hillingdon

6.4 Sequential Assessment of Sites

The suitability and availability of the application site (Broadwater Lake) and four remaining potential alternative sites (Ruislip Lido, Bury Lake, Aldenham Reservoir and Denham Quarry) has been assessed by the LBH as part of the Alternative Site Assessment. The sequential assessment of sites presented within this report subsequently focuses on flood risk.

A comparative (sequential) assessment of flood risk for the application site and four remaining potential alternative sites has been undertaken using a scoring system based on the risk of flooding from all known sources (refer to **Appendix F**) utilising the following sources of information:

- EA mapping: FMfP (Flood zones 2 and 3) and FMfP (Surface water); Long Term Flood Risk (Surface Water) dataset; Long Term Flood Risk (Reservoir) dataset; Susceptibility to Groundwater Flooding mapping
- West London 2018 SFRA: Interactive web mapping - "Sewer, Groundwater and Artificial Flood Risk");
- OS mapping.

The assessment presented in **Table 3** indicates that Bury Lake and Denham Quarry are at an equivalent risk of flooding to the application site. As such they are not sequentially preferable.

Ruislip Lido and Aldenham Reservoir are indicated to be at a lower risk of flooding than the application site; however, it should be borne in mind that whilst the risk of flooding to Broadwater Lake from rivers (fluvial) is defined as Very High, the peninsula (within which development is proposed) is at a Low risk (i.e. flood zone 1). If the latter were considered within the sequential assessment, Broadwater Lake may be considered sequentially preferable to Ruislip Lido and Aldenham Reservoir, where flooding of the land surrounding the surface waterbody is indicated during a 1.0% AEP event (i.e. Flood Zone 3).

In addition to the above, the Alternative Site Assessment concludes that neither Ruislip Lido and Aldenham Reservoir (nor Bury Lake and Denham Quarry) are suitable for the proposed facility due to constraints imposed by other factors.

It is concluded that there are no alternative sites at a lower risk of flooding that are available and suitable, and the application is therefore considered to be compliant with the sequential approach to site selection as set out in the NPPF.

6.5 Exception Test

The Exception Test need not be applied for 'Water Compatible' development within Flood Zone 3, flood zone 2 or Flood Zone 1. Notwithstanding this, the assessment presented in this report demonstrates that the proposed development passes element (b) of the test, i.e. the development will be safe for its lifetime taking account of the vulnerability of its users and will not increase flood risk elsewhere.

Table 3: Flood Risk Sequential Site Assessment

Source of Risk	**Application Site - Broadwater Lake** (Ref. 8)	**Ruislip Lido** (Ref. 13)	**Bury Lake** (Ref. 20)	**Aldenham Reservoir** (Ref. 56)	**Denham Quarry** (Ref. 60)
Sea (tidal/coastal)	None/Negligible risk Score = 0 Site not near the sea.	None/Negligible risk Score = 0 Site not near the sea.	None/Negligible risk Score = 0 Site not near the sea.	None/Negligible risk Score = 0 Site not near the sea.	None/Negligible risk Score = 0 Site not near the sea.
Rivers (fluvial)	Very High risk Score = 4 The 2010 Upper Colne Flood Risk Mapping Study indicates that Broadwater Lake is at risk of flooding during a (defended) 5.0% AEP event. However, no flooding of the main peninsula area would be expected in a (defended and undefended) present day 0.1% AEP event and in a (defended) 1.0% AEP event +20% climate change. As such the risk to the peninsula may be classified as Low.	Very High risk Score = 4 The Flood Map for Planning (River and Sea with Defences) dataset indicates that Ruislip Lido is at risk of flooding from rivers during a 3.3% AEP event.	Very High risk Score = 4 The Flood Map for Planning (River and Sea with Defences) dataset indicates that Ruislip Lido is at risk of flooding from rivers during a 3.3% AEP event.	Very High risk Score = 4 The Flood Map for Planning (River and Sea with Defences) dataset indicates that Ruislip Lido is at risk of flooding from rivers during a 3.3% AEP event.	Very High risk Score = 4 The Flood Map for Planning (River and Sea with Defences) dataset indicates that Ruislip Lido is at risk of flooding from rivers during a 3.3% AEP event.
Surface water (pluvial)	Low risk Score = 1 Typically defined as having a < 0.1% AEP risk of surface water flooding (Very Low), with areas of Low to High risk in the locality.	Low risk Score = 1 Typically defined as having a < 0.1% AEP risk of surface water flooding (Very Low), with areas of Low to High risk in the locality.	Low risk Score = 1 Typically defined as having a < 0.1% AEP risk of surface water flooding (Very Low), with areas of Low to High risk in the locality.	Low risk Score = 1 Typically defined as having a < 0.1% AEP risk of surface water flooding (Very Low), with areas of Low to High risk in the locality.	Low risk Score = 1 Typically defined as having a < 0.1% AEP risk of surface water flooding (Very Low), with areas of Low to High risk in the locality.
Reservoirs	Low risk Score = 1 Within the maximum extent of flooding; however, extremely unlikely to occur.	None/Negligible risk Score = 0 Not within the maximum extent of flooding.	Low risk Score = 1 Within the maximum extent of flooding; however, extremely unlikely to occur.	Low risk Score = 1 Within the maximum extent of flooding; however, extremely unlikely to occur.	Low risk Score = 1 Within the maximum extent of flooding; however, extremely unlikely to occur.
Canals	Low risk Score = 1 Canals in the vicinity of the site but limited potential for flooding.	None/Negligible risk Score = 0 No canals in the vicinity of the site.	Low risk Score = 1 Canals in the vicinity of the site but limited potential for flooding.	None/Negligible risk Score = 0 No canals in the vicinity of the site.	Low risk Score = 1 Canals in the vicinity of the site but limited potential for flooding.

Other water impounding structures	Low risk Score = 1 Other water impounding structures in the vicinity of the site but limited potential for flooding.	None/Negligible risk Score = 0 No other water impounding structures in the vicinity of the site.	Low risk Score = 1 Other water impounding structures in the vicinity of the site but limited potential for flooding.	Low risk Score = 1 Other water impounding structures in the vicinity of the site but limited potential for flooding.	Low risk Score = 1 Other water impounding structures in the vicinity of the site but limited potential for flooding.
Groundwater	Low risk Score = 1 Limited potential for groundwater flooding due to the nature and topography of the site.	Low risk Score = 1 Limited potential for groundwater flooding due to the nature and topography of the site.	Low risk Score = 1 Limited potential for groundwater flooding due to the nature and topography of the site.	Low risk Score = 1 Limited potential for groundwater flooding due to the nature and topography of the site.	Low risk Score = 1 Limited potential for groundwater flooding due to the nature and topography of the site.
Total risk score	9	6	9	8	9
Position in sequential assessment	Joint 3rd	1st	Joint 3rd	2nd	Joint 3rd

Notes - Risk scores are allocated in accordance with **Appendix F** according to the following scale: None/negligible risk = 0, Low risk = 1, Medium risk = 2, High risk = 3, Very High risk = 4

7 SURFACE WATER MANAGEMENT

The site has a total area of approximately 80.0 ha. However, the assessment presented within the following sections of this report is restricted to the proposed development area, comprising the 6.5 ha peninsula area.

7.1 Surface Water Drainage at the Existing Site

As detailed in **Section 2.1**, the peninsula was formerly utilised as a gravel washing/processing plant with a silt lagoon and a tip for inert quarry wastes. Since the quarry was decommissioned the silt lagoon, peninsula edges and small areas of remaining natural ground have colonised with native broadleaf woodland. The majority of the peninsula area is impermeable with remnant concrete hardstanding from the sites previous use. No existing surface water drainage is believed to be present at the site.

The greenfield surface water runoff rates have not been considered given that the site will continue to drain as existing as discussed in **Section 7.2.1**. The proposals are to be constructed on the remnant impermeable concrete hardstanding.

7.2 Surface Water Drainage at the Redeveloped Site

7.2.1 Disposal of Surface Water

In accordance with PPG para. 7-056, surface water runoff should be disposed of according to the following hierarchy: Into the ground (infiltration); To a surface water body; To a surface water sewer, highway drain, or another drainage system; To a combined sewer.

As detailed in **Section 2.5,** infiltration testing has been undertaken by Geo Integrity in accordance with the guidelines in BRE365 (refer to **Appendix D**) which indicates that infiltration is viable within the Made Ground at the site, with a lowest infiltration rate of 1.95×10^{-4} m/s (0.7 m/hr).

Where proposed impermeable areas are to be constructed within the extent of existing concrete hardstanding (to be retained), surface water will continue to drain as existing. As the existing concrete is generally flat, surface water will either infiltrate through existing cracks in the slab or flow overland towards Broadwater Lake as directed by existing topography.

Where new tarmac surfacing is proposed and is constructed over the existing concrete hardstanding, preventing direct infiltration, runoff will be directed to adjacent infiltration trench soakaways and permeable Grasscrete paving from where it will infiltrate to the ground.

Where new tarmac surfacing is proposed over undeveloped land, runoff will be directed to adjacent permeable gravel and infiltrate to ground.

It is assumed that the existing access road to the site, which is to be resurfaced, will continue to drain as existing.

It is expected that the potential for rainwater harvesting and other methods of localised storage to manage surface water run-off as close to its source as possible, such as green roofs, water butts, and rain gardens will be explored as the proposals are developed further.

7.2.2 Post Development Impermeable Area

The area of new impermeable surfaces, i.e. the proposed tarmac surfacing, within the proposed development area which will be positively drained is 0.10 ha, based on the illustrative layout provided in **Appendix A**.

The area of the existing concrete hardstanding is 2.69 ha based on the topographic survey provided in **Appendix C.**

7.2.3 Attenuation Storage

The proposed infiltration trenches for the new tarmac surfacing have been modelled using the Source Control module of Micro Drainage.

Due to shallow groundwater levels, which is expected to be in continuity with Broadwater Lake, it is not considered practicable to design to the 3.3% AEP or 1.0% AEP event as the underside of any infiltration device is likely to be below groundwater level. Accordingly, the structures have been sized to store runoff generated during the 50.0% AEP event, with exceedance flood volumes for the 3.3% AEP event and 1.0% AEP event including a 40% increase in rainfall intensity, stored on the surface or allowed to flow overland into Broadwater Lake. Outputs for the hydraulic modelling are presented in **Appendix G**.

Assuming an infiltration rate of 1.95 x 10^{-4} m/s (0.7 m/hr), a total storage volume of 12.7 m^3 would be required. This can be provided by four trench soakaways with a total length of 88.1 m, each with a width of 0.4 m and a depth of 0.4 m and a void ratio of 0.3 (i.e. Type 3 sub-base).

Other areas of the site are that expected to continue to drain as existing or have been directed towards proposed permeable surfaces, are not considered to require attenuation storage.

Given the minimal difference between existing slab level (circa 37.70 - 38.20 m AOD) and water levels in Broadwater Lake (36.56 - 37.39 m AOD), and given the requirement to retain the existing hardstanding, providing additional attenuation is not considered practicable.

A preliminary surface water drainage layout is provided in **Appendix H**.

7.2.4 Exceedance Routes

Exceedance flows will be managed in exceedance routes. It is assumed that as the development proposals progress, the design of the site would ensure flood flows are directed towards the lake, away from built development.

7.2.5 Pollution Control

Table 26.2 of The SuDS Manual identifies non-residential car parking with infrequent change and commercial roofs as having a low pollution hazard level and indicates that the pollution hazard indices for non-residential car parking and commercial roofs for total suspended solids, hydrocarbons and metals are 0.5, 0.4 and 0.4, and 0.3, 0.2 and 0.05 respectively.

Table 26.3 of The SuDS Manual indicates that the SuDS mitigation indices for infiltration trenches (filter strips) and permeable gravel/Grasscrete (permeable pavements) for total suspended solids, hydrocarbons and metals are 0.4, 0.4 and 0.5, and 0.7, 0.6 and 0.7 respectively.

7.2.6 Adoption and Maintenance of SuDS

SuDS will be maintained by the site owner/operator. An indicative maintenance schedule is presented in **Table 4**.

Table 4: Illustrative Maintenance Requirements for Trench Soakaway (Filter Strip)

Schedule	Required action	Frequency
Trench Soakaway		
Regular maintenance	Remove litter including leaf litter and debris from filter strip surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter strip surface for clogging, standing water and structural damage	Monthly
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter strip, using recommended methods (e.g. NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, wash or replace overlying filter medium	Five yearly (or as required)

Permeable Paving (Grasscrete)		
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosphate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Three monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies accumulation rates and establish appropriate removal frequencies	Annually

7.2.7 GLA Sustainable Drainage Proforma

The Sustainable Drainage Proforma has been completed and is provided as **Annex J**. It should be noted that parts of the *pro forma* are not applicable due to the unconventional nature of the proposals.

8 FOUL WATER MANAGEMENT

The anticipated foul loading from the site has been calculated in accordance with Design and Construction Guidance. The expected total peak flow rate from the development is 1.0 l/s. An additional amount of flow will discharge from the washdown areas, which is expected to be not more than 2.0 l/s.

It is proposed to discharge foul flows from the site to the existing public foul water sewer located in Moorhall Road, approximately 600 m southeast of the site. An extract of the public sewer records obtained from Thames Water is provided in **Appendix I**.

Due to the distance involved, and known ground levels, it is anticipated that a private pumped solution will be required.

A preliminary foul water drainage layout is provided in **Appendix H.**

9 SUMMARY AND RECOMMENDATIONS

9.1 Background

Weetwood Services Ltd ('Weetwood') has been instructed by the London Borough of Hillingdon to prepare a FRDSA report to accompany a full planning application for the proposed Hillingdon Watersports Facility and Activity Centre (HWFAC), Broadwater Lake, Moorhall Road, Harefield, UB9 6PE ("the Site").

A planning application was submitted to the London Borough of Hillingdon in November 2023 for: *"Redevelopment of the site to create the Hillingdon Watersports Facility and Activity Centre including demolition of existing Broadwater Lake Sailing Club (BSC) clubhouse at the north of the lake and erection of a building to be occupied by HOAC [Hillingdon Outdoor Activity Centre] and BSC including changing facilities, meeting rooms, storage, Workshop and seasonal worker accommodation (sui generis), activity shelters; installation of pontoons and concrete slipways; boat shed; equipment storage huts (north of lake and at entrance); boat parking and racking areas; camping area; outdoor activity areas; ecological enhancement throughout the site; new pedestrian routes through the peninsula; landscaping including new woodland, dense vegetation screens and boundary treatment; new access and access road; localised dredging and land reclamation; relocation of existing sailing area and creation of floating and fixed islands within the lake; coach drop off and turning area; vehicle parking; cycle parking; and associated works."*

The planning application (Ref. 2382/APP/2023/2906) was accompanied by a FRDSA prepared by Weetwood in September 2023 (Ref. 5784/FRDSA/Final/v1.0/2023-09-28).

The proposals for the site have since been revised as outlined in **Section 2.2** of this report. Accordingly, the assessment of flood risk has been updated, and a revised drainage scheme prepared. In addition, the sequential assessment of potential alternative sites has been revised to take into account addition sites identified by LBH.

The assessment has been undertaken in accordance with the requirements of the NPPF, PPG and associated EA and local authority/LLFA guidance.

9.2 Assessment of Flood Risk

The EA Flood Map for Planning indicates: (i) Broadwater Lake is located in Flood Zone 3; (ii) part of the existing access road and southern parcel are in Flood Zone 2; (iii) the peninsula (within which development is proposed) is indicated located in Flood Zone 1 (in addition, hydraulic modelling confirms that the peninsula does not flood during the 1.0% AEP plus climate change - the design flood event). The risk of flooding to the peninsula from all identified sources is assessed to be Negligible to Low.

9.3 Sequential Assessment and Exception Test

On the basis of the assessment of flood risk, and specifically due to the risk of flooding across the wider site (but not the peninsula) from the River Colne, a sequential test is required.

A sequential assessment of potential alternative sites has therefore been undertaken to address the flood risk sequential test in accordance with the NPPF and informed by guidance presented in the PPG. An Alternative Site Assessment undertaken by the London Borough of Hillingdon identified five potential alternative sites (including Broadwater Lake). The sequential assessment presented in this report indicates that Bury Lake and Denham Quarry are at an equivalent risk of flooding to the application site and as such, are not sequentially preferable to the application site in terms of flood risk.

Ruislip Lido and Aldenham Reservoir are indicated to be at a lower risk of flooding than the application site; however, whilst the risk of flooding to Broadwater Lake from rivers (fluvial) is defined as Very High, the peninsula (within which development is proposed) is at a Low risk (i.e. flood zone 1). If the latter were considered within the sequential assessment, Broadwater Lake may be considered sequentially preferable to Ruislip Lido and Aldenham Reservoir, where flooding of the land surrounding the surface waterbody is indicated during a 1.0% AEP event (i.e. Flood Zone 3).

In addition to the above, the Alternative Site Assessment concludes that neither Ruislip Lido and Aldenham Reservoir (nor Bury Lake and Denham Quarry) are suitable for the proposed facility due to constraints imposed by other factors.

It is therefore concluded that there are no alternative sites at a lower risk of flooding that are available and suitable. The application is therefore considered to be compliant with the sequential approach to site selection as set out in the NPPF.

The Exception Test need not be applied for Water Compatible development within Flood Zone 3, Flood Zone 2 or Flood Zone 1.

9.4 Surface Water Drainage

The assessment demonstrates that surface water runoff from the developed site can be sustainably managed in accordance with planning policy. Surface water drainage will continue to discharge as existing, with exception of new areas of impermeable tarmac which are to drain via trench soakaways, permeable gravel and Grasscrete. Application of the SuDS Manual Simple Index Approach demonstrates that the proposed approach provides the required level of quality treatment.

9.5 Foul Water Drainage

Domestic foul water from the development will be pumped to the existing Thames Water public foul water sewer located in Moorhall Road.

9.6 Impact of Proposals on Flood risk Elsewhere

The proposal entails the removal lake-bed material (via dredging) from Island 02, Island 06, and Island 07. Some of the material will be used as fill to extend the peninsula by 2,892 sq m to form a beach zone for dinghy storage and launching. A cut and fill analysis confirms that the volume of cut material exceeds the volume of fill material by 4,456 cu m. As such, the proposals would not reduce the storage volume of the lake and would not increase existing lake water levels.

The assessment presented in this report confirms that the peninsula and access road are not at risk of flooding in the 1.0% AEP fluvial event + 20% climate change (the design flood event). As such the proposed development of the peninsula would not increase flood risk elsewhere.

9.7 Flood Risk Mitigation

For the purposes of flood risk mitigation, the design event is the 1.0% AEP event +20% climate change in accordance with the PPG. Accordingly, the design flood level is the maximum modelled in-channel water level for the River Colne during the design flood event (37.89 m AOD).

It should be noted that this level is greater than the water level would be in Broadwater Lake because of the flood storage provided by the lake and that the assessment of flood risk has confirmed that none of the peninsula would not flood during the design flood event (accordingly, the access to the development is dry and hence, safe).

This report demonstrates that the proposed development may be completed in accordance with the requirements of national and local planning policy subject to implementation of the following measures:

1) The ground level across much of the peninsula is above 37.89 m AOD. However:
    a) Some ground levels in the area proposed for camping (located within Area 1 on **Figure 13**) are lower than 37.89 m AOD. It is recommended that levels in this area are raised to a minimum of 37.89 m AOD;
    b) Some ground levels in the vicinity of the Main Building, WC-Changing Building, Safety Equipment Store, Energy Centre, and Workshop (located within Area 2 on **Figure 13**) are lower than 37.89 m AOD. It is recommended that levels in this area are raised to a minimum of 37.89 m AOD.

In both locations, the land requiring raising should be confirmed by topographical survey noting that ground raising may be locally constrained by mature trees that need to be retained.
No ground raising is proposed in the following areas: (i) The beach area – this area is designed to be partially under water during typical winter water levels; (ii) In those parts of the peninsular where no development or activities are proposed; and (iii) where activities are water compatible and the risk is negligible.

2) The FFL of all proposed buildings should be set at a minimum of 38.23 m AOD. This is the maximum modelled in-channel water level for the River Colne during the 0.1% AEP event and 340 mm above the maximum water level during the design flood event;

3) FFL of all proposed buildings should be at least 150 mm above adjacent ground levels;

4) All buildings should have designed in resilience to flooding to a minimum level of 38.23 m AOD, i.e. the maximum modelled in-channel water level for the River Colne during the 0.1% AEP event. Measures may include, but not necessarily be limited to, raised power sockets, non-return valves on ground floor drainage etc. If actual finished floor levels are at or above 38.23 m AOD, then no additional flood resilience measures are deemed to be necessary;

5) It is recommended that a FWEP is prepared setting out the procedures to be followed in the event that flooding is forecasted. The site is included in an EA flood alert and warning area. This provides the opportunity for the response procedures set out in the plan to be invoked in response to receipt of a EA flood warning.

APPENDIX A

Proposed Landscape Layout and Hard Surface Materials Strategy

KEY

Site

- Application boundary
- Existing waterbody
- Existing woodland to be protected (exempt from use / access)
- Sporadic tree groups on hard standing
- Existing tree cover (blue dashed = root protection zone blue dashed line)
- Existing native groundcover shrubs on top of existing hardstanding
- Exposed existing concrete hardstanding to be used as driveway, car parking, footpath and pedal karting track surface

Hardworks

- Vehicular Tarmac / Blacktop
- Pedestrian Tarmac / Blacktop
- Pedestrian coloured Tarmac / Buff
- Vehicular coloured Tarmac / Buff
- Grass-concrete paving (Grasscrete)
- Gravel surface with native wildflower overseeding for dinghy parking and rigging
- Wet-pour safety surface for fall protection at bouldering walls
- 2.0m high living acoustic barrier (Gramm EcoSoundBlok)
- 1.2m high chestnut paling fence
- 1.8m high V-mesh security fencing
- 1.2m high & 1.0m wide dry hedge with shrub planting alongside to close gaps in existing vegetation barrier
- 1.5m high hazel hurdle panels attached to dry hedge

Softworks

- Native tree planting
- Willow planting in submerged planters
- Native hedge planting
- Woven willow barriers
- Native shrub planting
- Other neutral grassland seeding
- Lowland meadow seeding
- Woodland improvement planting
- Floating reedbeds

Rev	Amendments	Date	Drwn	Chkd
12	Updated to Client comments	04.08.25	DB	PO
11	Updated layout	16.06.25	DB	PO
10	Removed activity structures, amended acoustic barrier	15.01.25	TK	PO
09	Amended woodland activity/ camping area	19.11.24	TK	PO
08	Amended zip line and boat wash locations	06.11.24	TK	PO
07	Amended building locations	31.10.24	TK	--
06	Amended EV charging parking bays	28.10.24	TK	PO
05	Amended car parking & coach reversing	25.10.24	TK	PO
04	Added woodland planting	10.10.24	TK	PO
03	Relocated Tarp Shelter	01.10.24	TK	PO
02	Updated layout	23.09.24	TK	PO
01	First Issue	17.09.24	TK	PO

Project
HWSFAC - Broadwater Lake

Drawing Title
Proposed Landscape Layout
Part 2 of 2 : Peninsula

Project No. 2121
Scale @ A0 1:500
Project Status RIBA stage 3
Drawing No. HWSFAC-COL-XX-XX-DR-L-1120
Revision 12

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0 5 10 15 20 30 40 50m