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Down Lane Park Improvement
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Strategy

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Flood Risk Assessment and Drainage Strategy

Prepared by Felix Spiers & Sara Simoes Gledhill

Reviewed by Rhys Williams MSc CEng MICE

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Revised

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1. Introduction

This document has been prepared by Civic Engineers on behalf of the London Borough of Haringey (the "Applicant") to support a Full Planning Application for the improvement of Down Lane Park (the "Site") and provides a full justification as to why the proposal should be deemed acceptable in Flood Risk terms.

Down Lane Park is a well-loved greenspace at the heart of a rapidly changing community in Tottenham Hale; it is a park of two distinct halves with differing but established landscape characters. The masterplan for the park's renewal has evolved through a process of co-design which started in spring 2022 with a client team from Haringey Council combining both Parks and Regeneration. Plans to improve Down Lane Park have been created in partnership with the Community Design Group (CDG) who's agreed focus is to shape proposals, inform engagement and build support for designs by channelling feedback from residents and groups using the park.

Proposals include significant new tree planting to reinforce the existing canopy cover, combining with a new range of planting styles which offer climate change resilience, support sustainable urban drainage interventions and respond to available maintenance budgets. A strong new offer for play will be distributed across the park with two landmark provisions supported by 'play on the way' and playful landscape interventions. A new community hub building will sit at the heart of the new masterplan with new active sports, play and leisure uses clustered around it. The facility will include a café, celebration spaces, LBH Park's office space, publicly accessible toilets, and a community garden directly adjacent. Inclusive design and accessibility are prioritised with enhanced entrances, footpath connections, lighting, and natural surveillance to improve safety and offer a greater level of comfort for all users.

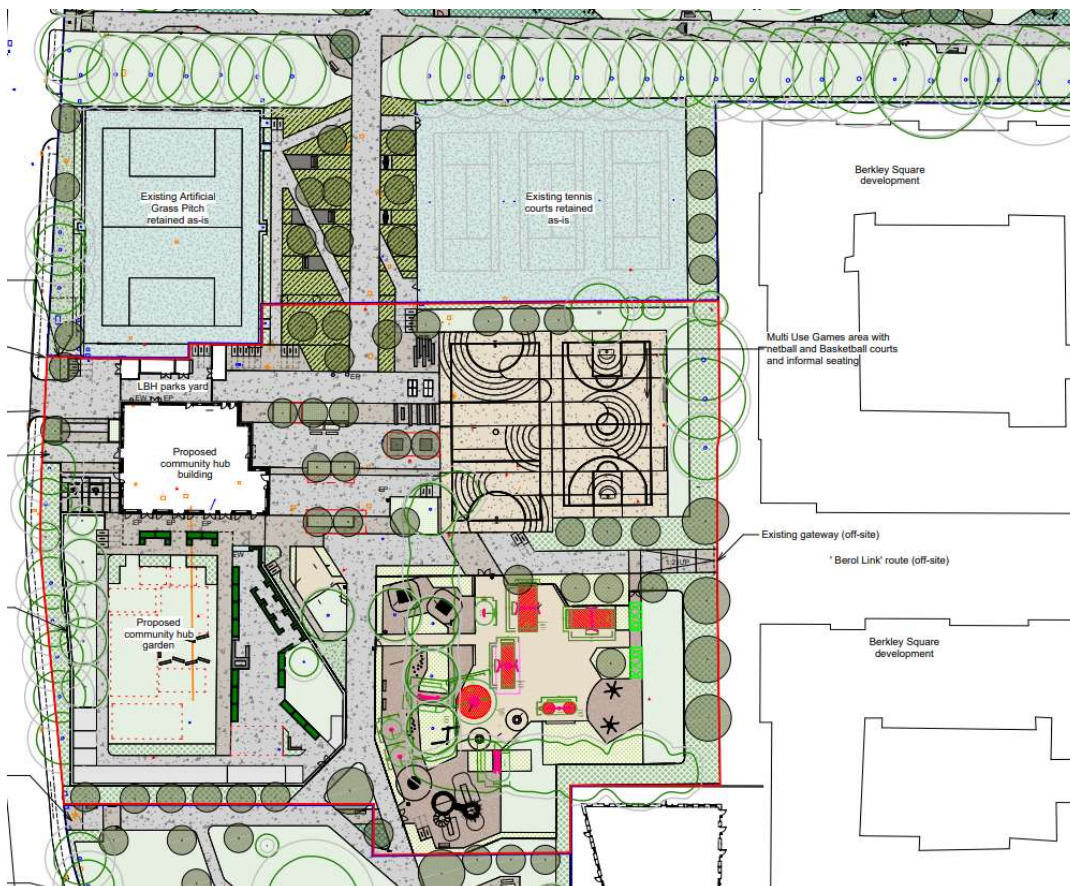


Figure 1: Down Lane Park Proposed Plan

2. Existing Site Details

2.1 Site Description

Down Lane Park is in North London, with the centre of the site approximately 300 metres from Tottenham Hale stations and retail park. Figure 2 shows an aerial view of the site which is located in between the Walthamstow Wetlands and the A10.

The total site area is approximately 0.95 hectares with national grid coordinates of 534263, 189779 and the postcode is N17 9EY. The site is bordered by Park View Road to the West, Ashley Road Depot to the North, Ashley Road to the East, and Hale Road to the South.

Further to confirmations received from the LBH Nature Conservation Officer, the Flood Risk Assessment and Drainage Strategy have been undertaken on a park-wide basis, as shown in Appendix A. However, Figure 2 shows that planning permission is sought for the redline covering part of the south of the park and community hub building only.



Figure 2: Down Lane Park Site boundaries

2.2 Existing Watercourses

The closest open air watercourse to the site is the Pymmes Brooke which is approximately 500 metres to the east from the centre of the site.

The Moselle River runs below the main east to west route bisecting the north and the south of the site. In 2015 an engineering review was undertaken to explore the options for de-culverting the Moselle River. De-culverting the river and restoring the natural banks would require a large impact area and removal of existing trees along the route. As well as the substantial tree removal it would also reinforce the disconnect between the north and the south. Instead the intention for this project is to focus on the higher community impact areas such as the community centre and park improvements.

2.3 Existing Site Drainage

A utility survey of the site was conducted by Alan Rhodes Associates Ltd. in October 2020. Their final drawings are available in Appendix B

The survey shows that the existing buildings are served by separate private foul and surface water sewers. There appears to be:

- A 150mmØ surface water pipe running from east to west through the centre of the site and connecting to the surface water public sewer in Park View Road. 5 auxiliary surface water pipes feed into this pipe with diameters ranging from 100mm - 150mm.
- A 150mmØ foul water pipe running from east to west along the top side of the site, then underneath the football pitch to connect to the foul water public sewer in Park View Road

2.4 Topography

A topographical survey of the site was conducted by Alan Rhodes Associates Ltd. in April 2023. The full survey is shown in the Topographical Survey in Appendix C.

The site is largely flat however the land generally falls away towards the west side of the site where levels are in the range of 8.20mAD compared to the east side of the site where levels are in the range of 8.70mAD.

A plan showing the existing overland flow route is available in Appendix D

2.5 Geology

The British Geological Survey (BGS) information available online identifies the following geological succession underlying the site:

- Enfield Silt Member – Clay and silt.
- London Clay Formation – Clay, silt, and sand.

A ground investigation was undertaken by Ground and Environmental Services Limited in 2019, 9 logs from boreholes in Down Lane Park confirms the presence of clay. The logs also show water at depths ranging from 1.9 to 3.4 metres. The logs are available in Appendix E.

The Environment Agency (EA) does not identify the site's superficial drift nor the bedrock as an aquifer, but the site is located directly next to a secondary (undifferentiated) superficial drift aquifer.

3. Relevant Policy and Guidance

3.1 National Planning Policy Framework 2021

Flood Risk Categorisation

The NPPF refers to the Flood Zones which are shown on the Environment Agency (EA) Flood Map for Planning, and establishes the range of uses which are appropriate, or compatible, land uses for each Flood Zone. Table 1, extracted from the Flood Risk and Coastal Change PPG summarises the Flood Zones.

Table 1: Flood Zones

Flood Zone	Definition
Zone 1 Low probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b).
Zone 2 Medium probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map).
Zone 3b Functional floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: - 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 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

The EA Flood Map for Planning (Figure 3) indicates that the site lies in Flood Zone 2.

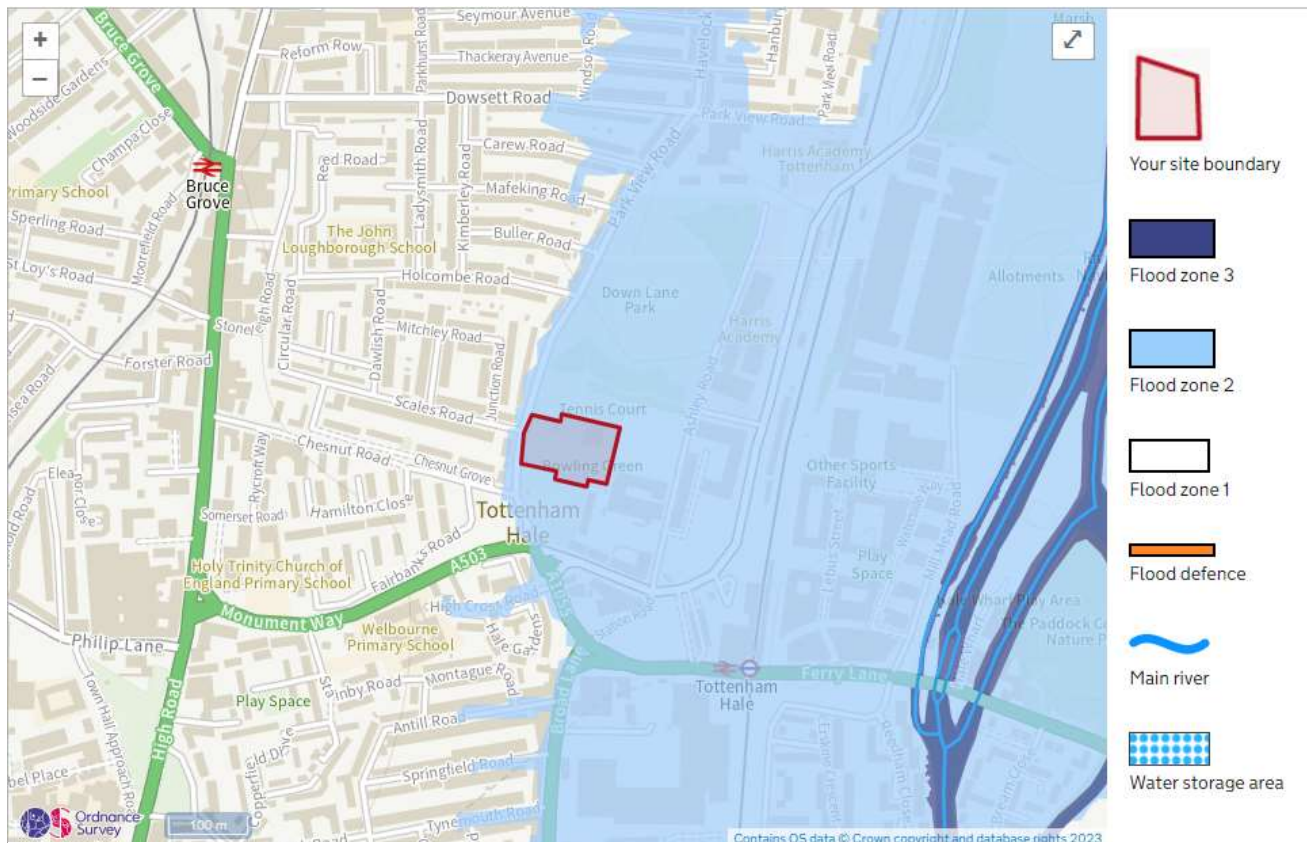


Figure 3: Flood Map for Planning (Source: <https://flood-map-for-planning.service.gov.uk>)

Flood Risk Vulnerability and Flood Zone Compatibility

The 'Flood Risk and Coastal Change' PPG defines the type and nature of different development classifications in the context of their flood risk vulnerability. Table 2 was extracted from this guidance and is presented in Table 2, **Flood Risk Vulnerability and Flood Zone Compatibility**

The 'Flood Risk and Coastal Change' PPG defines the type and nature of different development classifications in the context of their flood risk vulnerability. Table 2 was extracted from this guidance and is presented in Table 2.

Table 2: Flood Risk Vulnerability Classification

Classification	Description
Essential infrastructure	- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. - Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. - Wind turbines. - Solar farms

Highly vulnerable	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes, and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons, and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels. • Non-residential uses for health services, nurseries, and educational establishments. • Landfill* and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less vulnerable	• Police, ambulance, and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional, and other services; restaurants, cafes, and hot food takeaways; offices; general industry, storage, and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place. • Car parks
Water-compatible development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations.

	• Sand and gravel working. • Docks, marinas, and wharves. • Navigation facilities. • Ministry of Defence installations. • Ship building, repairing, and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.
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The flood risk vulnerability and Flood Zone compatibility, extracted from the PPG (Table 3) is presented in Table 3.

Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Zones	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	√	√	√	√	√
Zone 2	√	Exception Test Required	√	√	√
Zone 3a	Exception Test Required	×	Exception Test Required	√	√
Zone 3b (functional floodplain)	Exception Test Required	×	×	×	√
√ Development is appropriate × Development should not be permitted.					

The proposals for the development are likely to fall within the categories: 'Buildings used for shops; financial, professional, and other services; restaurants, cafes, and hot food takeaways; offices; general industry, storage, and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure'. This type of development would be classed as 'less vulnerable' in the Flood Risk Vulnerability Classification.

Less vulnerable developments are considered as appropriate within Flood Zone 2 without the need for an Exception Test.

3.2 Flood Risk Assessments: Climate Change Allowances Guidance

Table 4 shows the anticipated increases in rainfall intensity over time; it has been taken from the Government Hydrology Data online mapping tool for the London Management Catchment.

Table 4: Climate Change Allowances for Rainfall Intensity in the London Management Catchment

Allowance Category	3.3% annual exceedance event		1% annual exceedance event	
	2023-2060	2061-2125	2023-2060	2061-2125
Upper End	35%	35%	40%	40%
Central	20%	20%	20%	25%

*Source: <https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall>

It is assumed that the proposed development will have a design life of over 50 years, hence a 40% climate change allowance during the 1% annual exceedance event should be used for the design of the drainage system, according to the information obtained from the mapping tool.

3.3 The London Plan 2021

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. Development 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.

3.4 Haringey Borough Council Local Plan (adopted July 2017)

Policy DM24: Managing and Reducing Flood Risk

- A. The Council will ensure that all proposals for new development avoid and reduce the risk of flooding to future occupants and do not increase the risk of flooding.
- B. All proposals for new development within Flood Zone 2 and 3a will be required to provide sufficient evidence for the Council to assess whether the requirements of the Sequential Test and Exception Test, where required, have been satisfied. Proposals must be informed by a site-specific Flood Risk Assessment (FRA) taking account of all potential sources of flooding and should:
- a. Demonstrate the application of a sequential approach for the development of individual sites to ensure that the most vulnerable land uses are located in areas of the site that are at lowest risk of flooding;
 - b. Preserve overland flood and flow routes and ensure there is no net loss of flood storage. Adequate flood storage and compensation should be provided on site, or if this is not possible, provided off site where circumstances allow;
 - c. Where appropriate, set out the mitigation measures that will be incorporated on site to manage residual flood risk including:
 - i. Finished floor levels set no lower than 300mm above the 1 in 100 chance in any given year, including an allowance for climate change, flood level; and
 - ii. Ensure safe access and egress for future users of the development or an appropriate emergency evacuation plan.
 - d. Contribute to naturalising watercourses where opportunities arise.
- C. All proposals for new development will be required to:
- a. Manage and reduce surface water run-off; and

- b. Manage water and waste water discharges.
- D. With the exception of water compatible uses and essential infrastructure, development in areas designated in Haringey's Strategic Flood Risk Assessment as being within Flood Zone 3b will not be permitted.

Policy DM25: Sustainable Drainage Systems:

- A. All proposals for new development must seek to manage surface water as close to its source as possible in line with the London Plan drainage hierarchy.
- B. The Council will require Sustainable Drainage Systems (SuDS) to be sensitively incorporated into new development by way of site layout and design, having regard to the following requirements:
 - a. All major development proposals will be required to reduce surface water flows to a greenfield run-off rate for a 1 in 100-year critical storm event;
 - b. All minor development proposals should aim to achieve a greenfield run-off rate and, at a minimum, achieve a 50 per cent reduction on existing site run-off rates;
 - c. All other development should seek to achieve a greenfield run-off rate and include at least one 'at source' SuDS measure resulting in a net improvement in water quantity or quality discharging to a sewer; and
 - d. For all development where a greenfield runoff rate cannot be achieved justification must be provided to demonstrate that the run-off rate has been reduced as much as possible.
- C. Where Sustainable Drainage Systems are implemented they will be expected to:
 - a. Meet the requirements set out in the Council's relevant local standards and guidance, or national standards where agreed;
 - b. Incorporate measures identified in the Surface Water Management Plan;
 - c. Be designed to maximise biodiversity and local amenity benefits, and where appropriate, ensure that SuDS techniques provide for clean and safe water at the surface;
 - d. Improve water quality; and
 - e. Function effectively over the lifespan of the development.
- D. Where SuDS cannot be implemented due to site constraints (such as land contamination or space limitations) robust justification must be provided along with proposed alternative sustainable approaches to surface water management.

3.5 The London Sustainable Drainage Proforma

The filled in Haringey's London Sustainable Proforma is available in Appendix F.

4. Hydrological Assessment

4.1 Flooding History

The Historic Flood Map published by the Environmental Agency (EA) shows that the site has been subjected to a degree of flooding between 1946 and the present day.

HistoricFloodMap
Historic_Flood_Map

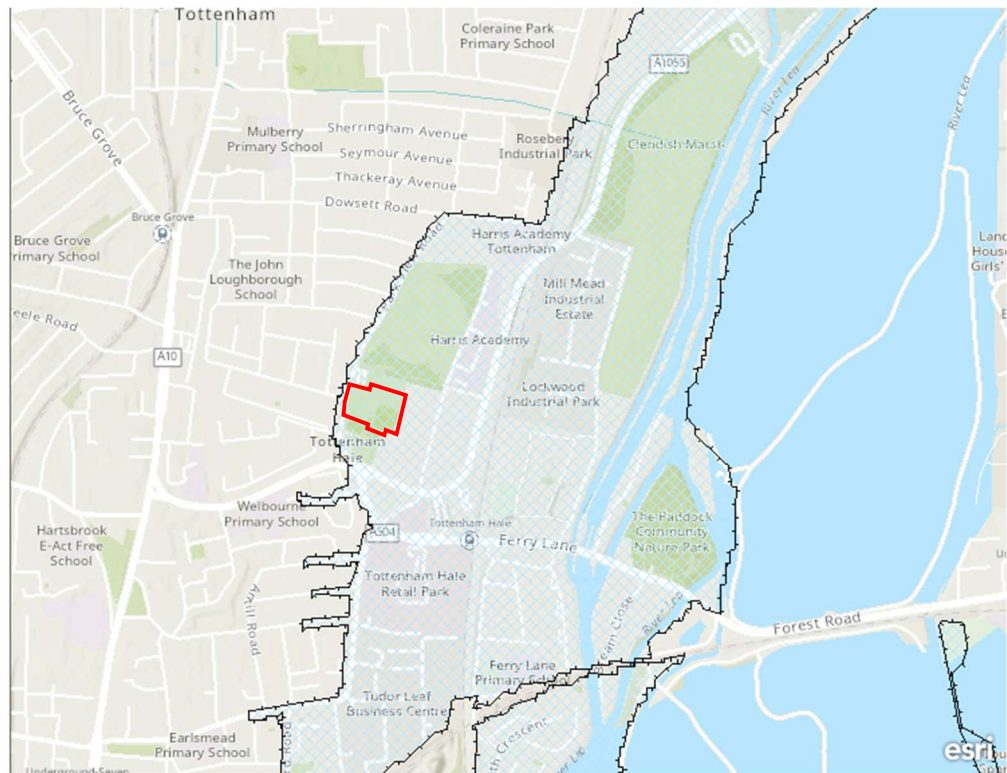
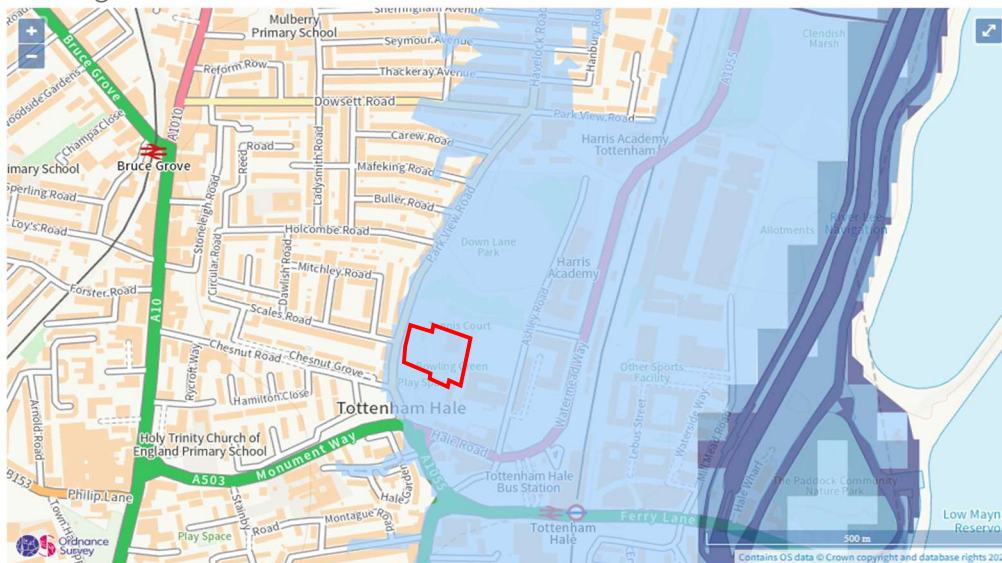



Figure 4: Historic Flood Map showing the extent of individual Recorded Flood Outlines from river, the sea and groundwater springs (Source: <https://www.data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map>)

4.2 Fluvial Flood Risk

The EA Flood Risk from Rivers or the Sea Map (Figure 5) indicates the site is at low risk from fluvial flooding.



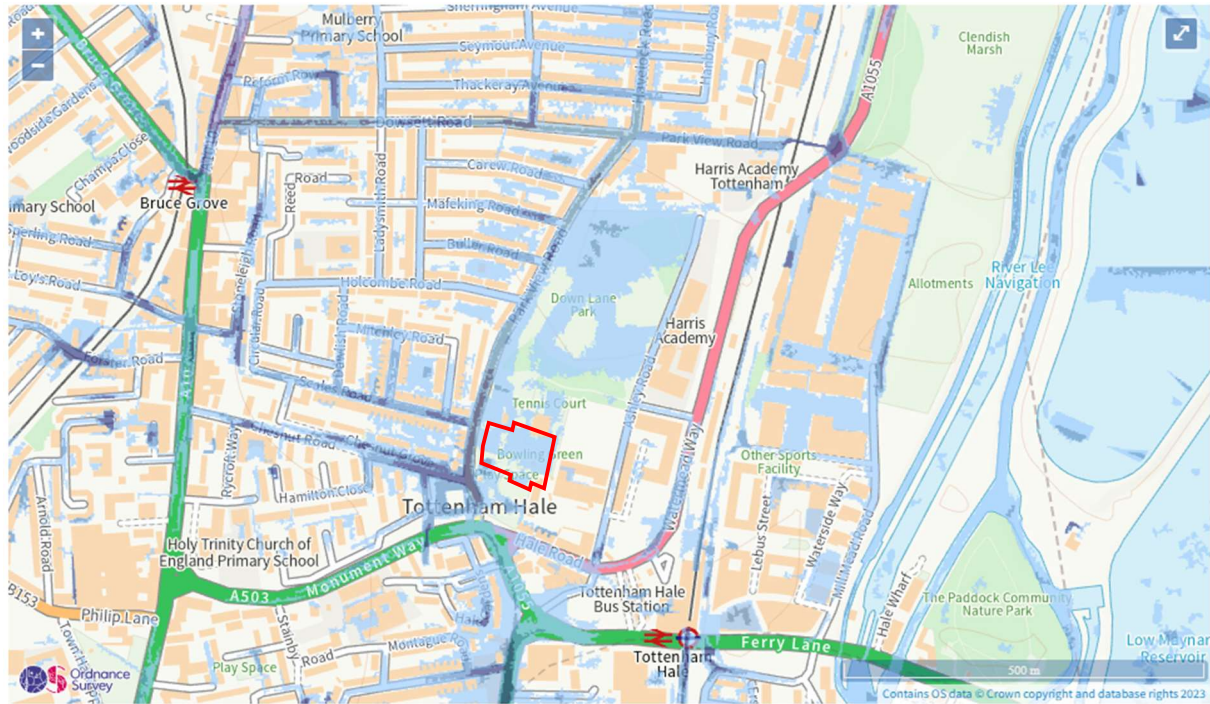
Extent of flooding from rivers or the sea

● High ● Medium ● Low ● Very Low 📍 Location you selected

Figure 5: Flood Risk from Rivers or the Sea Map (Source: <https://flood-warning-information.service.gov.uk>)

4.3 Surface Water Flood Risk to the Site

The EA Flood Risk from Surface Water (Figure 6) shows that the site is mostly at low risk from surface water flooding, however, there is a small region in the southwest of the site that are considered to be at medium risk from surface water flooding. This is likely due to existing depressions in the local topography.



Extent of flooding from surface water

● High ● Medium ● Low ○ Very low ⊕ Location you selected

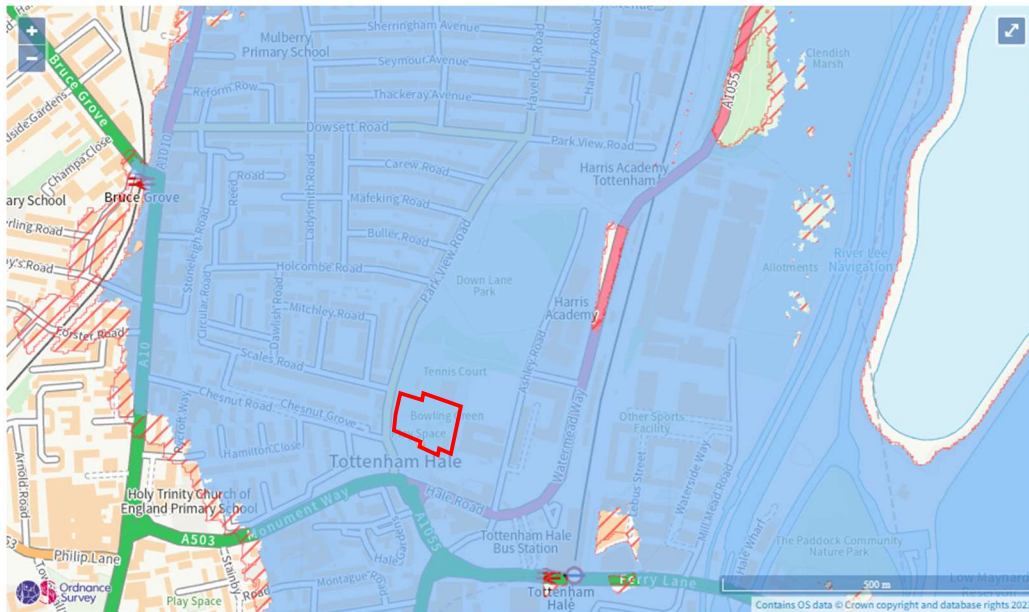
Figure 6: Pluvial Flood Risk (Source: <https://flood-warning-information.service.gov.uk>)

4.4 Tidal Flood Risk

The site is located over 50 kilometres away from the sea and thus the site is considered to be at no significant risk from sea flooding.

4.5 Reservoir Flood Risk

The EA Flood Risk from Reservoirs Map (Figure 7) shows the maximum extent of flooding due to reservoir failing. Reservoirs in England have an excellent safety record. The site is considered to be at low risk from reservoir flooding.



Maximum extent of flooding from reservoirs:

when river levels are normal when there is also flooding from rivers Location you selected

Figure 7: Flood Risk from Reservoirs Map (Source: <https://flood-warning-information.service.gov.uk/>)

4.6 Groundwater Flood Risk

Haringey's Local Plan (Figure 8) identifies the site (red box) as being outside of any Critical Drainage



Figure 8: Critical Drainage Areas (source: Haringey London Development Management DPD adopted 2017)

Furthermore, nine borehole logs from the site show groundwater at depths ranging from 1.9 to 3.4 metres. Thus, the site is considered to be at no significant risk from groundwater flooding

4.7 Public Sewer & Highway Drainage Flooding and Infrastructure Failure

Thames Water asset records, which have been transposed onto the utilities survey, available in Appendix B, shows small diameter (4" & 9") water mains running in Park View Road.

Thames Water asset records also show a 1372mm diameter surface water sewer and a 375mm diameter foul water sewer running to the west of the site in Park View Road.

Figure 9 shows Table 3-5 from Haringey Council's Surface Water Management Plan (SWMP) 2011. The table presents sewer flood records for ten years prior to June 2010 provided by Thames Water. The data indicates one external and one severe flood event in the N17 9 sector; this is considered a low number of flooding for an area this size over ten years.

Post Code Sector	2 in 10 external	2 in 10 internal	1 in 10 external	1 in 10 internal	1 in 20 external	1 in 20 internal	Severe	Total Properties
N10 1	0	0	0	0	0	2	0	2
N10 2	0	0	0	0	5	1	0	6
N10 3	0	1	0	3	0	3	1	8
N11 2	0	0	1	0	0	3	0	4
N15 3	0	0	0	0	0	1	0	1
N15 4	0	6	7	8	0	6	2	29
N15 5	0	0	0	0	0	1	2	3
N17 0	0	0	0	1	0	0	0	1
N17 7	0	0	1	0	1	0	0	2
N17 9	0	0	1	0	0	0	1	2
N2 0	0	0	2	1	0	11	0	14
N2 9	0	0	0	1	0	10	0	11
N22 5	0	0	1	0	0	3	0	4
N22 6	0	0	0	0	0	1	2	3

Figure 9: Number of Thames Water sewer flood records within the London Borough of Haringey

Thames Water has a duty to maintain and repair their assets and nothing suggests it is not, the site is considered to be at no significant risk from infrastructure failure flooding.

4.8 Flood Risk Summary

From the evidence collated and subsequent analysis, the flood risk to the site is summarised in Table 5.

Table 5: Summary of flood risk

Source of flooding	Risk to the site
River	Low
Surface water	Medium
Sea	Insignificant
Reservoir	Low
Groundwater	Insignificant
Infrastructure	Insignificant

In relation to the sequential test, it is considered that the proposal meets the requirements given that the scheme is locationally specific and cannot be constructed elsewhere. The proposed development is specific to Down Lane Park and cannot be moved elsewhere.

5. Surface Water Drainage Strategy

5.1 Point of Discharge

The London Plan Sustainable Drainage Policy, states that:

"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."

An appraisal of the discharge hierarchy has been conducted in the following paragraphs

Infiltration Based Systems

The Geo-Environmental Investigation Report carried out by Ground and Environmental Services Ltd. recorded infiltration rates on the site in the range of 1.32×10^{-5} to 5.36×10^{-6} m/s. This indicates a 'low to moderate' potential for infiltration-based systems to be used on the site.

Summary

Table 6: Summary of point of discharge suitability

Point of discharge	Suitability
Ground	√
Waterbody	x
Surface water sewer	x
Combined sewer	x
√ suitable x unsuitable	

5.2 Greenfield Run-off Rates

Greenfield run-off rates for the site have been estimated with the HR Wallingford online tool using the IH124 method. The results are displayed in Table 7 and the full outputs are available in Appendix G.

Table 7: Greenfield run-off rates

Qbar	1-in-1-year event	1-in-30-year event	1-in-100-year event
1.49l/s	1.27l/s	3.44l/s	4.76l/s

5.3 Attenuation

Water Quantity

Haringey Borough Council's Policy DM25 states that: "All major development proposals will be required to reduce surface water flows to a Greenfield run-off rate for a 1 in 100-year critical storm event", instead it has been proposed to infiltrate all surface runoff through pervious paving, meaning surface water flows will be reduced to 0.0l/s; see Table 8 for the betterment this represents for different storm events against the existing surface water discharge from site.

Table 8: Surface water discharge rate betterment

Storm event return period	1 in 1-year	1 in 30-year	1-in-100-year	1 in 100-year + 40% allowance for climate change
Existing discharge rate	142.9l/s	348.8l/s	447.7l/s	625.1l/s
Betterment	100%	100%	100%	100%

The first level of surface water management comes from the current landscaping proposals resulting in a 113% increase in permeable surfaces. Table 9 presents further details. For the landscaping proposal refer to Levitt Bernstein drawings 3862 – LB – ZZ – XX – D – L – 200001 and 200002

Table 9: Changes in surfacing across the site

Areas	Permeable	Impermeable
Existing areas	4240m ²	5329m ²
Proposed areas	9065m ²	504m ²
Percentage change of areas	+113.8%	-90.5%

It is proposed to store and infiltrate rainwater on-site by means of permeable paving. The total proposed area draining to the proposed drainage system for the site is approximately 6791m². Refer to Table 10 for further details and to Appendix I for the Proposed Surface Water Drainage Strategy.

Table 10: Surface classification for surface water run-off calculations

Area draining to proposed drainage system		
Impermeable area (m ²)	Pervious pavement (m ²)	Total area to attenuate (m ²)
504	6287	6791

The Causeway software Flow has been used to estimate the volume of storage required to attenuate the 1-in-100-year storm event + 40% allowance for climate change without any flooding. The total volume required is estimated to be approximately 587 m³, the full flow outputs can be found in Appendix I.

It is proposed to have over 6200m² of the site dedicated to surface water management in the form of pervious pavements, Table 11 shows how this will provide the required storage for the site.

Table 11: Attenuation Details

SuDS feature	Pervious pavement
Area(m ²) x Depth(m) x Porosity	6287 x 0.3 x 0.3
Volume provided (m ³)	565.8

The Proposed Surface Water Drainage Strategy drawing is available in Appendix H and shows the location for all SuDS features.

Sustainability

Haringey Borough Council's Policy DM25 states that: "the Council will require Sustainable Drainage Systems (SuDS) to be sensitively incorporated into new development by way of site layout and design."

The 'SuDS Manual' CIRIA report C753 states that "surface water run-off should be managed for maximum benefit." The types of benefits that can be achieved by SuDS can be put into four categories, the four pillars of SuDS: water quantity, water quality, amenity and biodiversity. Table 12 presents what benefits are likely to be achieved by different SuDS features.

Table 12: SuDS Likely Benefits

	SuDS Feature	Water quantity	Water quality	Amenity	Biodiversity
Most Benefits 	Living roofs	√	√	√	√
	Infiltration systems	√	√	√	√
	Dry planted features – Swales, bio-retentions areas, trees, detention basins	√	√	√	√
	Ponds and wetlands	√	√	√	√
	Pervious & reservoir pavements	√	√		
	Filter strips	√	√		
	Filter drains	√	√		
	Proprietary treatment systems		√		
Least Benefits	Attenuation storage tanks	√			

Table 13 shows what SuDS techniques are proposed to manage surface water on-site. These features are being designed in collaboration with the landscape architect to achieve a maximum of

benefits to the project. It is also worth highlighting that no underground storage tank is proposed for this site,

Table 13 Summary of SuDS techniques proposed.

SuDS Technique	Proposed?	Comment
Living roofs	N	Living roofs haven't been considered due to the style of roofing proposed
Infiltration systems	N	Infiltration systems have been considered in the forms of permeable paving and dry planted features
Dry planted features	Y	Dry planted features have been proposed across most of the site.
Open water features	N	Open water features haven't been considered for this project due to space and safety concerns
Pervious & reservoir pavements	Y	Pervious pavements are proposed on most hardstanding areas throughout the park.
Attenuation storage tanks	N	Not necessary.

5.4 Maintenance Strategy

A maintenance schedule has been developed for each of the proposed SuDS features; it is available in Appendix J.

6. Conclusion

The Site is located in Flood Zone 2 and the development is likely to fall within the categories: 'Buildings used for shops; financial, professional, and other services; restaurants, cafes, and hot food takeaways; offices; general industry, storage, and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure'. This type of development would be classed as 'less vulnerable' in the Flood Risk Vulnerability Classification. Less vulnerable developments are considered as appropriate within Flood Zone 2 without the need for an Exception Test.

The FRA has also demonstrated that the proposed development is at no significant risk from flooding from the sea, groundwater and infrastructures and is at low risk from river, surface water and reservoir flooding. The proposed surface water drainage strategy should reduce the flood risk from surface water to the site and downstream by significantly reducing the discharge rate to the public sewer.

The Geo-Environmental Investigation Report carried out by Ground and Environmental Services Ltd. recorded infiltration rates on the site in the range of 1.32×10^{-5} to 5.36×10^{-6} m/s. This indicates a 'low to moderate' potential for infiltration-based systems to be used on the site. In line with Haringey Borough Council Policy DM25: Sustainable Drainage Systems, it is proposed to manage surface water through a series of SuDS features, providing a total of 566m³ of effective storage in order to infiltrate the surface water into the ground.

The majority of the developments surfaces will either be planted landscaping or permeable hard surfacing. The areas which are designated as impermeable, such as building roofs and vehicle access areas will drain towards permeable surfaces which will allow for infiltration into the sub-soil.

7. Appendices

- A. Design Access
- B. Utility Survey
- C. Topographical Survey
- D. Overland Flow Routes
- E. Borehole Logs
- F. Haringey SuDS Proforma
- G. Greenfield Runoff Rate Estimation
- H. Surface Water Drainage Strategy
- I. Flow Calculations
- J. Maintenance Strategy

A. Design Access

-  Planning Application boundary
-  Permitted Development boundary
-  Entrances & Boundaries
-  New park entrance
 -  Improved existing park entrance
 -  School street
 -  Breaking-down park edge boundary
 -  Cycle routes connecting wider area
-  Community Space
-  Community hub space with outdoor cafe overspill
 -  Enclosed community garden space
 -  Back of House / Service Yard
-  Sports & Play
-  Upgraded outdoor gym
 -  New play area
 -  Existing artificial grass pitch
 -  New accessible Multi Use Games Area(basketball, netball)
 -  Existing retained tennis courts
 -  Perimeter activity route - Running, walking, cycle training (approx 0.85km)
-  Ecology & Biodiversity
-  Greening of southern area
 -  Biodiverse selectively mown meadow grass
 -  Sustainable urban drainage
 -  Mown grass / glades within planting
 -  New viewing mounds



B. Utility Survey