Strategic Flood Risk Assessment – Level 2

Prepared for The Royal Borough of Kingston upon Thames

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ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
AEP	Annual Exceedance Probability
CDA	Critical Drainage Area
DTM	Detailed Terrain Model
EA	Environment Agency
GIS	Geographic Information System
IPEG	Increased Potential for Elevated Groundwater
Kingston	The Royal Borough of Kingston upon Thames
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
OS	Ordnance Survey
PPG	Planning Practice Guidance
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
TWUL	Thames Water Utilities Limited
WMS	Web Mapping Service

REPORT STRUCTURE

This Level 2 Strategic Flood Risk Assessment (SFRA) has been produced to assess flood risk at 16 sites allocated by the Royal Borough of Kingston upon Thames (Kingston). To meet the objectives of the assessment, this document has been structured as follows:

- **Section 1 (Introduction)** defines the Level 2 SFRA and outlines the intended document user. This section provides the background of this Level 2 assessment and highlights key and influential policy.
- **Section 2 (Site Assessment)** provides an overview of the site assessments conducted. This section lists the 16 sites assessed.
- **Section 3 (Methodology)** provides details on the methodology used to complete each site assessment. This includes a description of each section on the site assessment template and the assessment data sources.
- **Section 4 (General Requirements)** provides a list of general requirements that all sites within this Level 2 SFRA must follow. These are cross referenced in the individual site assessments to highlight them where appropriate.
- **Appendix** contains full details for each individual site assessment conducted as part of the Level 2 SFRA.

1 INTRODUCTION

The National Planning Policy Framework 2021 (NPPF) requires that Local Planning Authorities (LPAs) develop SFRAs to inform future development in their areas. In accordance with this, Kingston has commissioned a Level 2 SFRA to support their Local Plan.

A Level 2 SFRA is a detailed assessment of all sources of flood risk for specified sites requiring targeted assessments. This includes flood risk from fluvial, surface water, sewer, groundwater and reservoir sources. A total of 16 site allocations were assessed as a part of this Level 2 SFRA, as listed in *Section 2.2* of this report.

The purpose of this assessment is to provide the information necessary for the application of the Exception Test where appropriate. It also provides spatial planning and site-specific recommendations to support development opportunities for prospective developers, ensuring the planning policy is met and that the development can be made safe without increasing flood risk elsewhere.

The output of the Level 2 SFRA includes an assessment of each flood source, planning considerations, and potential mitigation measures for each assessed site. These outputs enable developers to produce appropriate flood risk mitigation actions for each assessed site.

1.1 Background

Kingston completed their latest Level 1 SFRA in July 2021. This provides a strategic overview of all forms of flood risk throughout the borough, now and in the future. The SFRA was conducted in line with the NPPF and the accompanying Flood Risk and Coastal Change Planning Practice Guidance (PPG). These documents advise on how to take account of and address the risks associated with flooding and coastal change in the planning process.

The PPG recommends that a Level 2 SFRA is carried out when the "*Level 1 Assessment shows that land outside flood risk areas cannot appropriately accommodate all the necessary development*". Kingston, in conjunction with the Environment Agency (EA), have identified ten sites which require assessment due to fluvial flood risk. There are a further six sites which have triggered an assessment due to the significance of surface water flood risk.

1.2 Policy

This Level 2 SFRA has been produced in line with national, regional, and local policy. The purpose of these policies is to ensure that development does not increase the risk of flooding and that property development is steered away from areas of greater flood risk to keep people safe from flooding. Although policy referenced as part of the Level 1 SFRA is relevant to the Level 2 SFRA, there are several policy documents that provide specific guidance and requirements that relate to Level 2 assessments.

The NPPF and the accompanying PPG provide national policy that guides the requirements of SFRAs. They introduce the purpose and requirements of the Sequential and Exception Tests. The Sequential Test is designed to steer development proposals to areas with the lowest probability of flood risk. The Kingston Level 1 SFRA provides the basis for the application of this test. The Exception Test is designed to follow the Sequential Test where necessary. It should be applied if it has been determined that a

development cannot be located in an area with a lower risk of flooding. The Exception Test needs to demonstrate that the proposed flood risk management measures will be satisfactorily applied to ensure both people and properties will be safe from flooding for the lifetime of the development. This Level 2 SFRA is structured to provide the basis for the application of this test. The Level 1 SFRA provides further guidance on the application of these tests.

Policy SI 12 of the London Plan (2021) highlights that Local Authorities should utilise SFRAs to identify areas where particular and cumulative flood risk issues exist and develop actions and policies aimed at reducing these risks. These actions must be informed by the Thames River Basin District Flood Risk Management Plan.

Policy DM 4 of the Kingston Core Strategy (2012) requires development proposals to include Sustainable Drainage Systems (SuDS) to manage and reduce surface water run-off unless it can be demonstrated that such measures are not feasible. It also highlights that in areas which are susceptible to flooding, development proposals should ensure that the buildings are designed to be flood compatible or incorporate flood resilient measures to mitigate flood risk. The Level 2 SFRA will provide site-specific recommendations to help developers meet this policy's aims.

The Kingston Level 1 SFRA provides a section on Planning and Policy Framework. This section provides an informative breakdown of the national, regional, sub-regional and local policy that LPAs, planners, and developers should follow as part of the development proposal process.

1.2.1 Flood Zones

The EA have defined Flood Zones to show the probability of tidal and / or fluvial flooding. Providing indicative flood risk information, the Flood Zones are a tool used in the Sequential and Exception Tests, as a part of the planning process. The fluvial / tidal Flood Zones are defined within the PPG 'Flood Risk and Coastal Change' (Table 1). As recommended in the Level 1 SFRA, Kingston have also implemented Flood Zones to account for predicted surface water flood risks. All Flood Zones included in this assessment are defined as follows:

- **Fluvial/Tidal Flood Zone 1** (Low Probability): Land having a less than 1 in 1,000 annual probability of river or sea flooding.
- **Fluvial/Tidal Flood Zone 2** (Medium Probability): Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between 1 in 200 and 1 in 1,000 annual probability of sea flooding.
- **Fluvial/Tidal Flood Zone 3a** (High Probability): Land having a 1 in 100 or greater annual probability or river flooding; or land having a 1 in 200 or greater annual probability of sea flooding.
- **Surface Water Flood Zone 3a** (High Probability): Land within the EA's Risk of Flooding from Surface Water (RoFSW) flood risk extents predicted for up to and including 1 in 100 annual probability of surface water flooding.
- **Fluvial/Tidal Flood Zone 3b** (Functional floodplain): Land within EA modelled fluvial flood risk extents predicted for up to and including 1 in 20 year return period events, allowing for

the impact of flood defences. It also includes land featured as part of the EA's Flood Storage Areas dataset.

1.2.2 Vulnerability Classifications

The flood risk vulnerability classification that is required for the Sequential Test is outlined in Annex 3 of the NPPF. It is summarised in *Table 1-1*.

Table 1-1 Flood Risk vulnerability classifications (as outlined in Annex 3 of the NPPF)

Essential Infrastructure
• Essential transport infrastructure which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons e.g., infrastructure for electricity supply (including generation, storage and distribution systems). • 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.
More Vulnerable
• Hospitals. • Residential institutions such as care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student 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. • Holiday or short-let caravans and camping sites (subject to a specific warning/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 (with adequate pollution control measures to manage sewage during flooding). • Car parks.
Water Compatible
• 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.

1.2.3 Flood Risk Vulnerability and Flood Zone Compatibility

The PPG Flood Risk Vulnerability and Flood Zone Compatibility table provides guidance on the types of development that may be considered as suitable within each Flood Zone. It sets out some circumstances where the Exception Test will need to be applied following the Sequential Test. This shown in *Table 1-2.*

Table 1-2 Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zone	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required †	X	Exception Test Required	✓	✓
Zone 3b	Exception Test Required *	X	X	X	✓*

Table 1-3 Key for Table 1-2

Key	
✓	Development is appropriate
X	Development should not be permitted
†	In Flood Zone 3a essential infrastructure should be designed and constructed to remain operation and safe in times of flood.
*	In Flood Zone 3b essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to: • Remain operational and safe for users in time of flood • Result in no net loss of floodplain storage • Not impede water flows and not increase flood risk elsewhere

2 SITE ASSESSMENT

2.1 Purpose

The Site Assessments completed as a part of this Level 2 SFRA have two major purposes:

- Help LPAs apply the Sequential Test so that development is directed to areas that are at least risk of flooding.
- Provide information needed to apply the Exception Test, checking whether a development can be built in a higher flood risk area.

The site assessments also provide recommendations and considerations for LPAs and prospective developers, to be used in conjunction with the guidance provided in *Section 6* of the Level 1 SFRA. For further information on the Level 2 SFRA methodology, refer to *Section 3* of this document.

2.2 Location Assessed

16 sites were assessed as part of this Level 2 SFRA. These are listed in *Table 2-1* and mapped in *Figure 2-1.*

Table 2-1 Summary of site allocations

Site ID	Site Name	Proposed Use	Residential units	Area (ha)
SA002	Seven Kings Car Park	Mixed Use (Residential Led)	108	0.49
SA010	Bentall Centre	Mixed Use (Town Centre)	N/A	1.96
SA011	Bentall Centre Car Parks A and B	Mixed Use (Residential, Town Centre)	134	0.77
SA019	Guildhall	Mixed Use (Residential, Town Centre)	252	1.26
SA026	The Malthouse and River Reach	Mixed Use (Residential, Offices)	28	0.26
SA038	Bittoms Car Park	Mixed Use (Residential Led)	80	0.52
SA012	1-6 Riverside Walk	Mixed Use (Residential, Town Centre)	41	0.70
SA029	John Lewis (North West)	Mixed Use (Residential, Town Centre)	93	0.69
SA089	St. James	Mixed Use (Residential, Retail)	108	1.24
SA045	Hawks Road Clinic	Mixed Use (Residential, Health Clinic)	23	0.32
SA047	Taverner House and Telephone Exchange	Residential Only	278	1.24
SA060	Cocks Crescent	Mixed Use (Residential, D-Uses, Town Centre)	343	2.37
SA061	Hobkirk House / Noble Centre	Residential Only		0.46
SA088	2-4 Kingston Road and 2 Presburg Road	Residential Only	0	0.27
SA113	Kingston Business Park	Residential Only	36	0.36
SA125	1-11 Elm Close	Residential (C2 only)	0	0.38

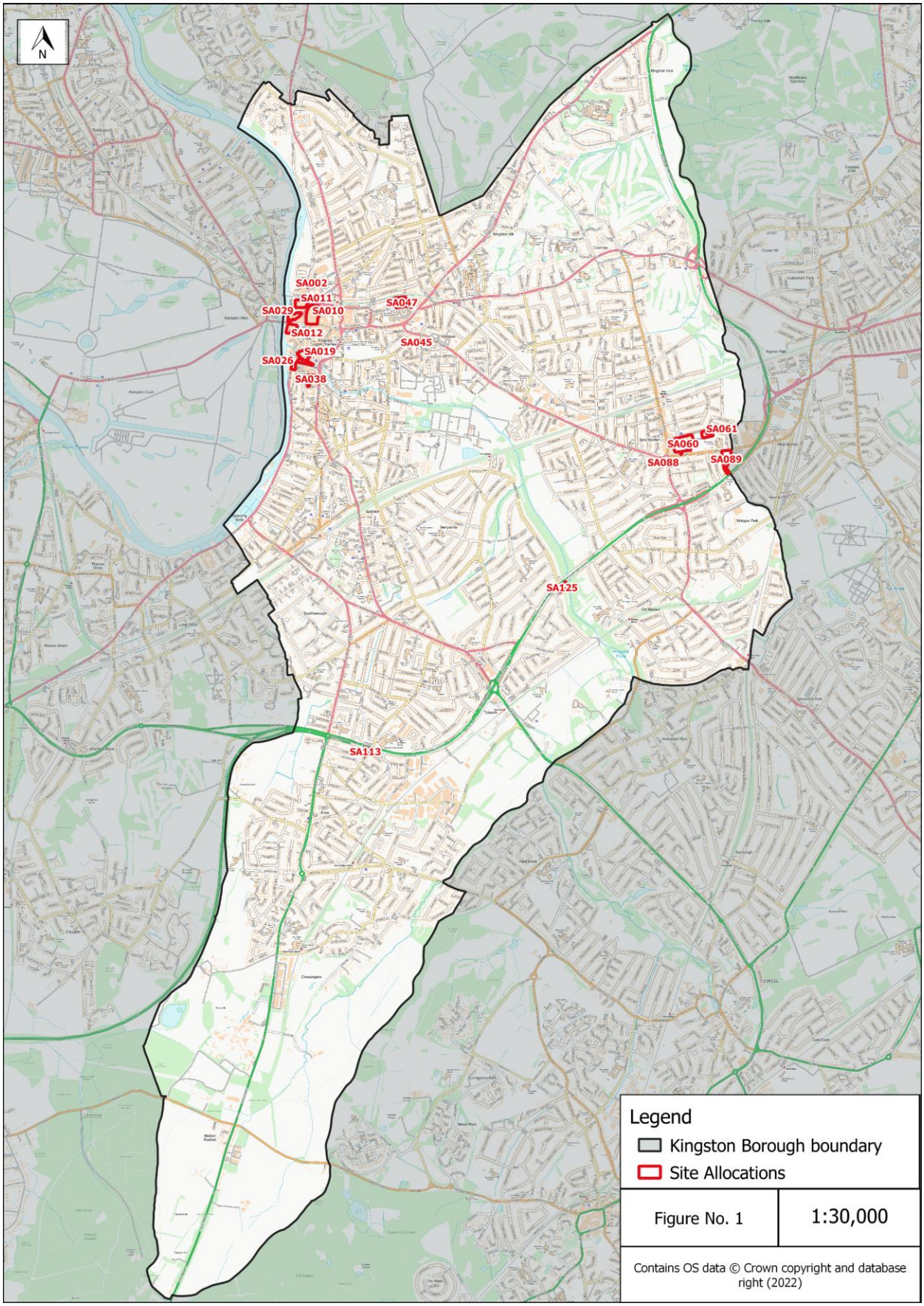

Figure 2-1 Borough map showing the location of the 16 sites targeted within the Level 2 SFRA

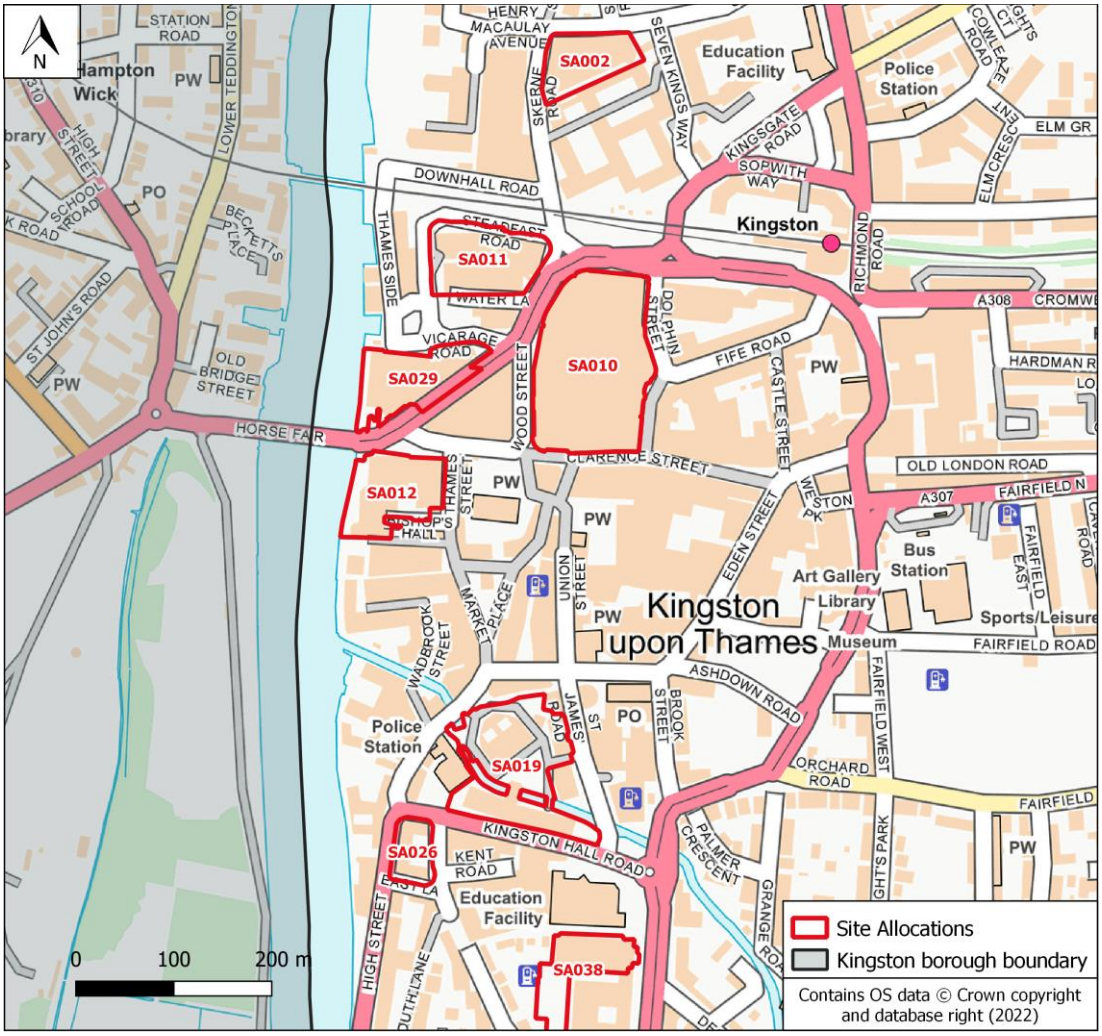

Figure 2-2 Kingston Town Centre where the majority of the site allocations are located

3 METHODOLOGY

3.1 Site Selection

Sites were selected from the 41 site allocations put forward for development in Kingston's draft Local Plan. As a part of the Level 1 SFRA, a high-level screening assessment was carried out on the 41 sites to determine whether a Level 2 SFRA was recommended. The criteria were outlined in the screening assessment, as follows:

"A Level 2 SFRA recommended where Sequential & Exception Tests are needed and Flood Zone 3a (fluvial and / or surface water) extent is greater than 20% of site (and will be a significant constraint on development), or if the site is currently less than 20% in Flood Zone 3a (fluvial and / or surface water), but will be more than 20% under the selected climate change scenario (1 in 100 year event +35% for fluvial, 1 in 1000 year event for surface water)."

Based on this assessment criteria, 21 sites were identified to be included in a Level 2 SFRA. Five of these sites have been removed for Kingston's local plan site allocation list since the Level 1 SFRA was published. They were removed for the following reasons:

- St. John's Industrial Estate is reserved for industrial uses
- Surrey House, Kingston Riding School, 127 Chiltern Drive and land to rear, and Kingston University have been removed as development has already begun at these sites.

Therefore, a total of 16 sites were identified for assessments within this Level 2 SFRA. Ten sites were triggered by fluvial flood risk, while a further six were triggered by surface water flood risk.

3.2 Analysis

Site assessments were carried out using datasets from the Kingston Level 1 SFRA, as well as data provided by the EA, Thames Water Utility Limited (TWUL) and Kingston. Predicted flooding from surface water, sewer, fluvial / tidal, groundwater and artificial sources were analysed using the predicted proportion of each flood risk type within each site. The assessments for fluvial, tidal, and surface water flood risks are based on the Flood Zones defined in the Level 1 SFRA. These are outlines of the predicted flood extents in an undefended scenario (where possible). The Flood Zones are outlined in *Section 1.2.1.* The flood hazard rating used in the site assessments can be interpreted as shown in *Table 3-1.*

Table 3-1 Surface water flood risk hazard (HR) categories

Figure		Definition
Low	0.5 ≥ HR < 0.75	Caution – Flood Zone with shallow flowing water or deep standing water
Moderate	0.75 ≥ HR ≤ 1.25	Dangerous for some (i.e. children) – Danger: Flood Zone with deep or fast flowing water
Significant	1.25 > HR ≤ 2.0	Dangerous for most people – Danger: Flood Zone with deep fast flowing water
Extreme	HR > 2.0	Dangerous for all – Extreme danger: Flood Zone with deep fast flowing water

3.3 Assessment Template

Site assessments were conducted on a specifically designed proforma. The sections included are summarised in *Table 3-2*.

Table 3-2 Site assessment proforma details

Section	Contents
Current and proposed use	Development use of each site assessed
Current and proposed vulnerability classification	Identifies the sites vulnerability classification as outlined in *Section 1.2.2*
Risk summary	Percentage of site area under each risk level for different types of flooding
Flood defences	Identifies if the site is benefiting from any fluvial flood defences
Flood Warning Areas	Identifies if the EA flood warning service is available at the site
Risk assessment	Data on risk from each flooding source, including flood depth, speed, hazard, duration, etc.
Flood mechanisms	For each flood source, how flood water behaves within the site
Site access/egress routes	Where flood-safe entry and exit routes should be located
Mitigation requirements	For each flood source, a list of mitigation measures to alleviate the flood risk for potential developments at the site. To be used in conjunction with the guidance provided in Section 6 of the Level 1 SFRA.
Safety of development	Analysis of how secure the development is against future flooding, including climate change considerations. This section also identifies if the site can be developed based on Exception Test criteria.

Seven site-specific maps are appended to each assessment proforma. These are summarised in *Table 3-3*.

Table 3-3 Summary of Maps

No.	Figure	Description
1	Fluvial Flood Depth (1% AEP + 35% Climate Change Allowance Event) *+ 20% CC was used for the Beverley Brook	Provides the maximum flood depth for the fluvial defended 1% AEP + 35% climate change flood event. Data was extracted from EA models for River Thames, Hogsmill and the Beverley Brook. Where available, the 35% climate change event was chosen to review the maximum fluvial flood depth at the sites as it represents the 'central' allowance peak river flow allowance for the Thames River Basin District. This was the case for sites that were at risk from the River Thames and Hogsmill. No sites were at risk from the Surbiton Stream. The +20% climate change event was used for the Beverley Brook, as it was the only climate change allowance available.
2	Fluvial Flood Hazard (1% AEP + 35% Climate Change Allowance Event)	Provides the maximum flood hazard for the fluvial defended 1% AEP + 35% climate change flood event. Data was extracted from EA models for River Thames, Hogsmill and the Beverley Brook. The 35% climate change allowance was used for the River Thames and

No.	Figure	Description
	*+ 20% CC was used for the Beverley Brook	Hogsmill, while the 20% climate change allowance was used for the Beverley Brook.
3	Surface Water Flood Depth (1% AEP Rainfall Event)	Provides the predicted surface water flood depth across a site using EA RoFSW data for a 1% AEP event. This is a detailed representation of the Flood Zone 3a (Surface Water) extent as defined in the Level 1 SFRA and Section *1.2.1.*
4	Surface Water Flood Hazard (1% AEP Rainfall Event)	Provides information on the predicted hazard of surface water flooding, based on EA RoFSW mapping for a 1% AEP event. Details about how hazard can be interpreted are shown in *Table 3-1.*
5	Thames Water (TW) Sewer Flooding Records	Provides the sewer flood incidences recorded by TWUL at four-digit postcode resolution. This includes records from 1997 up until 21/03/2022, when it was received from TW.
6	Areas Susceptible to Groundwater Flooding	Provides the strategic scale map of groundwater flood areas on a 1km grid.
7	Reservoir Flood Risk - Wet day	Provides the individual flood extents for all large, raised reservoirs in the event that they were to fail and release the water held on a "wet day" when local rivers had already overflowed their banks.

3.4 Data Sources

A number of different datasets were used in this assessment, a description of these datasets, their purpose and their source are outlined in *Table 3-4*.

Table 3-4 Datasets used in the site assessments

Category	File name	Description	Data source	Purpose
Base map	Basemap	Polygons of streets, buildings, and other features in the area	OS Master Map	Map creation
	Kingston borough boundary	Polygon demarcating the boundary of Kingston	OS Open Data	Defining study area; geographical boundary for other data needed
	Site Allocations final (with Bittoms car park)	Polygons giving outlines of 37 priority sites in borough	Kingston 2022	Conducting screening and site level assessments
Digital Terrain Model	LiDAR	Raster containing ground elevation data	EA 2022	Determining low elevation areas susceptible to surface water flooding
Detailed River Network	EA_DRN	Line files showing main rivers and ordinary watercourses, both overground and culverted	EA 2017	Determining locations of watercourses

Category	File name	Description	Data source	Purpose
Flood defences	Spatial_Flood_ Defences (without standardised attributes)	Lines showing EA flood defences which have a standard of protection equal to or better than 1 in 100 (1%) for rivers and 1 in 200 (0.5%) from the sea. (Some additional defences are also shown).	EA WMS	Analysing how flood defences affect current and future fluvial flooding
	Spatial_Flood_ Defences (incl. standardised attributes)	Lines showing all flood defences currently owned, managed or inspected by the EA	EA WMS	
	Areas_Benefitting_ From_Defences	Polygons showing the areas that would benefit from the presence of defences in a 1% chance of flooding each year from rivers	EA WMS	
Flood Warning Areas	Flood_Warning_Areas	Polygon showing the areas where the EA Warning Service is available	EA WMS	Determining if site users can sign up to the EA flood warning service
Groundwater	Areas_Susceptible_to _Groundwater_Flood	Provides strategic scale map of areas susceptible to groundwater flooding on a 1km grid	EA 2022	Analysing current groundwater flood risk
Flood Map for Planning	Flood_Zone_2	Polygons showing land with annual probability of river flooding between 1% and 0.1%	EA 2022	Prioritising sites for assessment
	Flood_Zone_3	Polygons showing land having a 1% or greater annual probability of river flooding	EA 2022	Prioritising sites for assessment
	Flood_Zone_3b	Polygons showing land within the River Thames, Hogsmill River, Surbiton Stream and Beverley Brook 1 in 20-year extents	Created using EA fluvial model data	
Risk of Flooding from Surface Water	RoFSW_1inXX_ Extent	Polygons showing flood extent, depth, and hazard values for rainfall scenarios with a 1 in 30 (3.33% AEP), 1 in 100 (1% AEP) and 1 in 1000 (0.1% AEP) chance of occurring in any given year. Hazard calculated from flood depth and velocity.	EA 2022	Prioritising sites for assessment; Analysing current and future surface water flood risk; Creating surface water flood risk mitigation plan
	RoFSW_1inXX_ Depth			
	RoFSW_1inXX_ Hazard			
Risk of Flooding from Reservoirs	Reservoir_Flood_Extent_Wet_Day	Map showing the largest area that might be flooded if a reservoir were to fail and	EA 2022	Analysing current flood risk from reservoir breach

Category	File name	Description	Data source	Purpose
		release the water it holds on a wet day i.e. when rivers are at capacity		
Sewer flood records	Kingston4digitPostcodes_20220322	Database of historic sewer flooding incidents by four-digit postcode	TWUL 2022	Sewer flood risk assessment
River model data	River Thames (Hurley to Teddington)	Data from EA-generated models of River Thames, Hogsmill River, Surbiton Stream and the Beverley Brook (NB: no sites on the Surbiton Stream)	EA 2019	Fluvial flood risk assessment (current and future); Determining climate Change allowance extents; Creating fluvial flood risk mitigation plan; Applying exception test
	Hogsmill River		EA 2015	
	Beverley Brook		EA 2009	

4 General Requirements

This section lists the general requirements that all sites within this Level 2 SFRA must follow (*Table 4-1*). These are cross referenced in the individual site assessments to highlight when they are appropriate. More information on the mitigation requirements can be found in *Table 6.1* in the Level 1 SFRA.

The site assessments use a climate change allowance of 35% to set out recommendations (except for sites along the Beverley Brook, which use 20% climate change allowance due to availability). This allowance is used for master planning purposes only. Developers submitting planning applications should refer to the Flood risk assessments: climate change allowances. The fluvial & tidal Flood Zones in Kingston can be viewed on the Level 1 SFRA mapping.

Table 4-1 General mitigation requirements for the site allocations

No.	Mitigation Requirement	Applicable Area	
		Fluvial	Surface Water
4.1	A net reduction in flood risk is required for new development. Only essential infrastructure (subject to the Exception Test) and water compatible infrastructure are permitted.	Flood Zone 3b	N/A
4.2	Finished floor levels for new developments must be set above the 1 in 100 year event with an allowance for climate change and 300mm freeboard level for 'More Vulnerable' and 'Highly Vulnerable' developments on greenfield or brownfield sites and on 'Less Vulnerable' on greenfield sites. Finished floor levels for 'Less Vulnerable' developments on brownfield sites must follow the following step-approach: 1. Ground floor finished floor levels must be above the 1 in 100-year with an allowance for climate change and 300mm freeboard level. 2. If Step 1 cannot be achieved, finished floor levels must be raised as high as possible. Passive resistance and resilience measures must be included up to the 1 in 100 year event with an allowance for climate change and 300mm freeboard level. If Steps 1 and 2 cannot be achieved, finished floor levels must be raised as high as possible. Passive resistance measures must be included as high as possible. Resilience measures up to and including the 1 in 100 year event with an allowance for climate change and 300mm freeboard must be included. Guidance on both resistant and resilient measures can be found here.	All	Flood Zone 3a (1% AEP flood extent)
4.3	For change of use developments that increase the vulnerability classification, ground floor finished floor levels must be above the 1 in 100 year event with an allowance for climate change and 300mm freeboard level.	All	Flood Zone 3a (1% AEP flood extent)

No.	Mitigation Requirement	Applicable Area	
		Fluvial	Surface Water
4.4	Flood resistance measures should be considered where predicted flood depths are less than 0.3m. Flood resilience measures should be considered where predicted flood depths are greater than 0.6m. Predicted flood depths between 0.3m and 0.6m should be analysed on a case-by-case basis to determine if resistance measures are sufficient. Design plans should show floor levels (relative to Ordnance Datum) and predicted flood depths.	All	
4.5	Flood storage compensation should be addressed through the following step-approach: 1. The development must be located in areas of lowest risk on the site. 2. A sequential approach should be applied to the site, with as much of the development as possible located in the areas of lowest risk. Supplementary direct level-for-level and volume-for-volume flood storage compensation must be provided for parts of the development that are not in an area of low risk. 3. The development must provide direct level-for-level and volume-for-volume flood storage compensation for the entire proposed development. 4. As much as possible of the development must provide direct level-for-level and volume-for-volume flood storage compensation. The development can supplement floodplain compensation with voids.	Flood Zone 3b Flood Zone 3a (fluvial), and the fluvial flood risk extent for the 1 in 100 year plus 35% climate change allowance (which covers some parts of Flood Zone 2).	Flood Zone 3a (1 in 100-year event)
4.6	The following voids mitigation specification must be adhered to if considering voids: 1. The openings to the void should extend from the existing ground level and the underside of the proposed void should be set to a minimum of the 1 in 100 year event with an appropriate allowance for climate change flood level. 2. There should be a minimum of 1m of open void length per 5m length of wall. Void openings should be provided along all external walls. 3. If security is an issue, 10mm diameter vertical bars set at 100mm centres can be incorporated into the void openings. More guidance can be found in *Table 6-1* in the Level 1 SFRA.	Flood Zone 3a, Flood Zone 3b	Flood Zone 3a (1 in 100-year)
4.7	Residual risk should be mitigated through flood resilient / resistant designs and emergency planning approaches to make sure suitable measures are in place to offer protection.	Entire area at risk	
4.8	All developments must be set back to a minimum of 8m from the top of bank of a main river, flood defence structure or culvert.	8m buffer area around main rivers	

No.	Mitigation Requirement	Applicable Area	
		Fluvial	Surface Water
	Development sites within 8m of a main river, flood defence structure or culvert require a flood risk activity permit in addition to planning permission.		
4.9	Development sites within 5m the top of bank of an ordinary watercourse require an approved ordinary watercourse consent in addition to planning permissions.	5m buffer area around ordinary watercourses	
4.10	Self-contained residential basements and bedrooms at basement level will not permitted. All basements must have internal access and egress to a higher floor above the design flood level (1 in 100 year plus an appropriate allowance for climate change) which can be utilised as part of emergency evacuation procedures. More guidance can be found in Table 6-1 in the Level 1 SFRA.	Flood Zone 3a Flood Zone 2	Flood Zone 3a (1 in 100-year)

APPENDICES

Appendix A - Updated Screening Assessment

The Bittoms Car Park site has been updated as the area of the site was increased. This affects the percentage of area in each Flood Zone. The sites which were identified to require a Level 2 SFRA but were not taken forward in this assessment *(see Section 3.1*) are marked in grey.

Appendix B - Site Assessments

- SA002 Seven Kings Car Park
- SA010 Bentall Centre
- SA011 Bentall Centre Car Parks A and B
- SA012 1-6 Riverside Walk, 2 Bishop's Hall, 19-31 Thames Street, and 2 Clarence Street
- SA019 Guildhall
- SA026 The Malthouse and River Reach
- SA029 John Lewis (North West)
- SA038 Bittoms Car Park
- SA045 Hawks Road Clinic
- SA047 Taverner House and Telephone Exchange
- SA060 Cocks Crescent
- SA061 Hobkirk House / Noble Centre
- SA088 2-4 Kingston Road and 2 Presburg Road
- SA089 St. James
- SA113 Kingston Business Park
- SA125 1-11 Elm Close