Appendix B - SuDS Guidance

Guidance for SuDS in Tower Hamlets

Introduction

Sustainable Drainage Systems (SuDS) are designed to maximise the opportunities and benefits of surface water management. This is particularly important in increasingly urban areas where there is less permeable ground available for natural infiltration and evapotranspiration, leading to increased rainfall runoff from impermeable surfaces and contributing to flooding, pollution and erosion. SuDS can counteract these impacts on the water cycle and additionally enhance urban spaces by making them more vibrant, attractive, sustainable and resilient, with improved air and water quality, microclimate and amenity.

There are four main categories of benefits which can be achieved through high quality SuDS design, as summarised below:

SuDS Design

Water Quantity

- Use surface water runoff as a resource
- Support the management of flood risk in receiving surface waters
- Preserve natural hydrological systems
- Design system flexibility and adaptability
- Drain the site effectively
- Manage on-site flood risk

Water Quality

- Support the management of water quality in the receiving surface waters and groundwater
- Design system resilience to cope with future change

Amenity

- Maximise multi-functionality
- Enhance visual character
- Deliver safe surface water management
- Support site resilience and adaptability
- Maximise legibility
- Support community environmental learning

Biodiversity

- Support and protect natural local habitats and species
- Contribute to the delivery of local biodiversity objectives
- Contribute to local habitat connectivity
- Create diverse, self-sustaining and resilient ecosystems

The installation of high quality and multi-functional SuDS is most likely to be achieved through early and multi-disciplinary consideration of surface water management. Ideally this should be integrated within the overall site planning and design, including early consultation with relevant stakeholders and consideration of ongoing operational and maintenance responsibilities.

SuDS design should be based around the general principles of:

- Harnessing surface water runoff as a resource;
- Managing rainfall close to where it falls;
- Managing runoff on the surface;
- Promoting infiltration of rainwater into the ground;
- Encouraging evapotranspiration;
- Attenuating runoff to mimic natural flow characteristics;
- Reducing contamination of runoff through pollution prevention and controlling the runoff at source; and
- Treating runoff to reduce the risk of urban contaminants causing environmental pollution.

The following sections provide an overview of common types of SuDS measures, which may be suitable for installation within the Borough. Generally, SuDS should not be thought of as isolated features, but delivered as an interconnected sequential train of surface water management and treatment.

Developers within Tower Hamlets should make reference to the Tower Hamlets SuDS Guidance, which provides local advice regarding SuDS installation and summarises the local approval process.

Further information on the philosophy of SuDS and detailed guidance on design, installation and maintenance, is provided in the CIRIA SuDS Manual (2015) and other sources described at the end of this document.

Swale

Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath the ground level. They have the ability to remove pollutants and can be used to channel surface water to the next stage of a treatment train. Check dams can be constructed along their route to control flow velocities, and promote infiltration and sediment deposition.

Advantages	Disadvantages
• Encourages evapotranspiration and infiltration of runoff • Provides attenuation to reduce peak run-off rates • Relatively simple to incorporate into landscaping • Effective removal of urban pollutants • Minimal maintenance requirements • Aesthetically pleasing • Good community acceptability	• Careful consideration of location and design is required to reduce potential health and safety hazards • May limit opportunities to use trees in landscaping • Blockages can occur in connecting pipe work • Retrofitting opportunities are limited

Effective Locations	Ineffective Locations
• Residential and commercial areas • Contaminated sites • Sites above vulnerable groundwater • Alongside roadways • Linear street garden areas • Field boundaries	• High density areas • Steeply sloping areas

Performance Criteria	Rating
Ecological Advantages	Medium
Peak Flow Reduction	Medium
Amenity Potential	Medium
Water Quality Treatment Potential	High
Surface Water Volume Reduction	Medium

In the Community

Swales can be used to replace conventional drainage systems and are particularly effective when installed adjacent roadsides or transport links, to capture and re-route surface water. They are also suitable for residential and commercial areas and may be integrated with areas of open space and landscaping, or used to create informal barriers.

Design

Example

Filter Strip or Drain

Filter strips and drains can be used to manage runoff from impermeable areas, providing conveyance and filtration. Filter Strips allow water to flow across grass or dense vegetation; whereas filter drains are hardscape systems where runoff is temporarily stored in a shallow trench filled with stone or gravel.

Advantages	Disadvantages
• Simple to design and can be incorporated into site landscaping for aesthetic benefit • Minimal public safety risks • Encourages evaporation and infiltration • Important hydraulic and water quality benefits can be achieved • Can be retrofitted into a site with ease • Low construction cost	• Vegetation must be light and can get damaged • Loose gravel can be removed • Drains relatively small catchments • High cost to replace filter materials

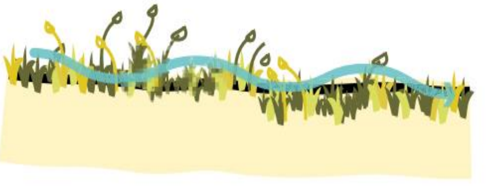
Effective Locations	Ineffective Location
• Residential and commercial areas • Between hard standing surfaces and grassland • High density areas • Contaminated sites • Sites above vulnerable ground water	• Steeply sloping areas

Performance Criteria	Rating
Ecological Advantages	Low
Peak Flow Reduction	Medium
Amenity Potential	Low
Water Quality Treatment Potential	High
Surface Water Volume Reduction	Low

In the Community

Filter strips or filter drains are a suitable retrofitting option for heavily trafficked or spatially constrained areas as they cause no safety hazards and can be implemented into small spaces with ease. They can be simply implemented along the edges of pathways or pavements or integrated within site landscaping.

Design



Example

Bio-Retention Areas or Rain Gardens

Bio-retention areas or rain gardens are vegetated depressions with gravel and sand layers below, designed to collect, channel, filter and cleanse water vertically. Water can infiltrate into the ground or enter a piped drainage system. These systems can be integrated with site landscaping, including tree pits, planter areas or gardens. Treatment performance can be improved through engineered soils and enhanced vegetation.

Advantages	Disadvantages
• Provides initial water treatment • Aesthetically pleasing • Provides ecological benefits • Capability to be retrofitted in heavily paved areas or existing vegetation • Effective pollutant removal • Minimal ground take with spatially flexible layout	• May be susceptible to clogging or blockage due to surrounding landscape • Regular inspection and maintenance is required to maintain effectiveness

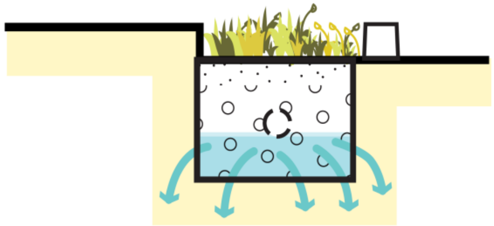
Effective Locations	Ineffective Locations
• Residential and Commercial areas • Contaminated sites • Sites above vulnerable groundwater • Seating areas • Impermeable areas • High density areas	• Steeply sloping areas

Performance Criteria	Rating
Ecological Advantages	Medium
Peak Flow Reduction	Medium
Amenity Potential	Good
Water Quality Treatment Potential	High
Surface Water Volume Reduction	Medium

In the Community

Rain gardens and bio-retention systems can be planned as aesthetically pleasing landscaped features, providing critical green space within the urban areas. These measures can be retro-fitted around existing street infrastructure, such as seating areas, and incorporated within both paved and vegetated areas.

Design



Example

Rainwater Harvesting

Rainwater harvesting involves capturing rainwater and reusing it for purposes such as irrigation or toilet flushing. Rainwater is collected from building rooftops or other paved surfaces and stored in tanks for treatment and reuse locally.

Advantages	Disadvantages
• Water can be used for variety of non-potable uses, such as toilet flushing and irrigation • Reduces potable water demand • Provides source control of storm-water run-off • Rooftop or underground tanks can minimise land take and visual impact • Can be retrofitted to existing buildings	• Potentially complex installation and high capital cost, particularly for retrofit • Ongoing energy requirement for pumping, if below ground storage is used • Careful management required to manage any health risks associated with water reuse • Above ground storage can be visually intrusive • Regular maintenance is required

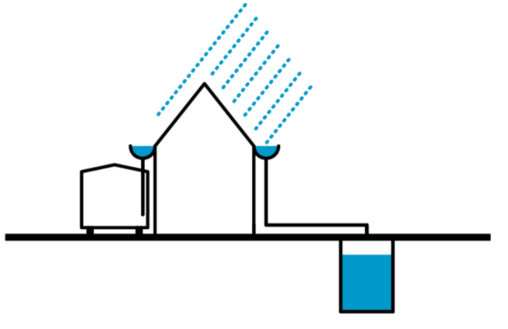
Effective Locations	Ineffective Locations
• Residential and Commercial areas • High density areas • Contaminated sites • Sites above vulnerable groundwater	• Fields or large open space

Performance Criteria	Rating
Ecological Advantages	Low
Peak Flow Reduction	High
Amenity Potential	Low
Water Quality Treatment Potential	Low
Surface Water Volume Reduction	High

In the Community

Rain-water harvesting can be implemented on a variety of scales; however, is particularly suitable for implementation in buildings with large rooftop areas, significant water consumption and defined ownership and maintenance responsibilities. Installation is generally easier when integrated into the design of new buildings; however, water butts can provide a simple means of retrofit.

Design



Example

Ponds and Basins

Ponds or Basins can be used to store and to treat water. 'Wet' (retention) ponds have a constant body of water and run-off water is additional to this, whilst 'dry' (detention) ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration through its base to ground or to store water for a period of time, before it is discharged via a soakaway to ground. They can support emergent and submerged vegetation, enhancing both treatment and biodiversity.

Advantages	Disadvantages
• Pollutant removal through sedimentation and biological treatment mechanisms • Effective accommodate of large storm events • Good community acceptability • Potential for biodiversity improvement • Relatively simple construction • Has the potential for supply of irrigation to other amenities • Aesthetically pleasing • Potential recreational benefit	• Requires infiltration to achieve significant reduction in surface water runoff volumes • Significant spatial requirements • Requires control measures to prevent migration of invasive species • Consideration of public safety may require control measures in certain settings • Careful design is required to manage undesirable impacts associated with eutrophication and fluctuating water levels

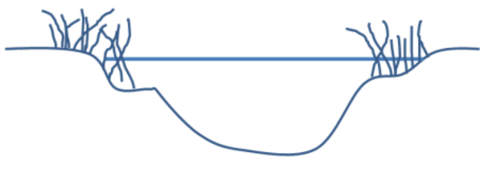
Effective Locations	Ineffective Locations
• Residential and Commercial areas • Fields • Parks or areas of open space • Areas with feature requirements	• High density areas • Locations with vulnerable people

Performance Criteria	Rating
Ecological Advantages	High
Peak Flow Reduction	High
Amenity Potential	High
Water Quality Treatment Potential	High
Surface Water Volume Reduction	Low

In the Community

Ponds can be aesthetically pleasing, and can be used to support urban amenity, recreation and ecology. They can provide central features within areas of community space. However, careful design consideration is required to ensure they do not pose a health and safety risk to the public.

Design



Example

Soakaway

Soakaways and other infiltration systems collect and store runoff, allowing it to rapidly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug and then filled with gravel and rubble, or specially designed structures. Surface water can be directed into a soakaway using a number of above or below ground methods, with overlying vegetation and underlying soils providing treatment benefits.

Advantages	Disadvantages
• Minimal land take • Provides recharge of natural ground water levels • Good storm volume reduction and peak flow attenuation • Simple operation and maintenance • Relatively simple to construct • Effective retrofitting solution • Good community acceptability	• Not always practicable near to structural foundations • Long term performance is uncertain and difficult to guarantee if property owner is responsible for maintenance • Requires good subsurface drainage • Infiltration rates need to be investigated

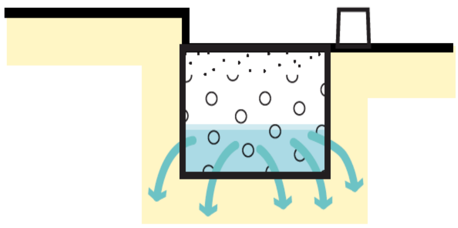
Effective Locations	Ineffective Locations
• Residential and commercial areas • High density areas • Fields • Small grassed/planted areas	• Contaminated sites • Sites above vulnerable groundwater • Sites with shallow groundwater • Sites underlain by impermeable ground

Performance Criteria	Rating
Ecological Advantages	Low
Peak Flow Reduction	High
Amenity Potential	Low
Water Quality Treatment Potential	Medium
Surface Water Volume Reduction	High

In the Community

Soakaways are effective in areas with good infiltration potential and where the water table is relatively low. Soakaways can be covered over by suitable permeable materials and be used for a variety of purposes at ground level. Caution should be taken when implementing these techniques in tightly constrained areas as they should not be built within a close proximity to structural foundations.

Design



Example

Living Roofs

A planted soil layer is constructed on the roof of a building to create a living medium. Following rainfall, water is stored in the soil layer and absorbed by planted vegetation. They may be designed to be accessible and landscaped to provide biodiversity and amenity benefit. Blue roofs can also be used to store water, without the use of vegetation.

Advantages	Disadvantages
• High potential to reduce surface run off • Suitable for high density development • Can deliver building insulation and sound proofing • Inaccessible to general public • Can provide biodiversity benefits to the local area • Improved air quality • Assists in amelioration of the urban heat island effect • Can be retrofitted	• Additional structural loading to roof (compared with most traditional rooftops) • Irrigation may be required during drought • Replacement and maintenance of plants is required on a regular basis

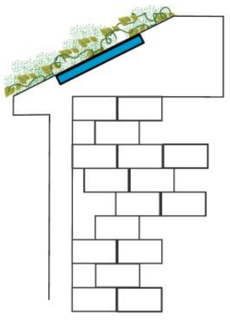
Effective Locations	Ineffective Locations
• Residential and Commercial areas • High density areas • Contaminated sites • Sports centres	• Roofs with inadequate access • Steep pitched roofs • Rooftops with inadequate structural support

Performance Criteria	Rating
Ecological Advantages	High
Peak Flow Reduction	Medium
Amenity Potential	High
Water Quality Treatment Potential	High
Surface Water Volume Reduction	Medium

In the Community

Living roofs provide an opportunity to attenuate and store rainwater in spatially constrained areas, while providing potential benefits for local biodiversity, air quality, microclimate and amenity. They have controlled access, which means the associated risk of misuse or vandalism is low.

Design



Example

Permeable / Porous Paving

This is paving which allows water to soak into the underlying ground. It can be in the form of paving blocks with gaps in between or porous mediums where water filters through the paving itself. Water can be stored in the sub-base beneath or be allowed to infiltrate into the ground below.

Advantages	Disadvantages
• Good potential for water quality treatment • High potential for surface water run off • Very efficient • Good community acceptability • Requires minimal maintenance • Effectively requires no space, as it allows for a dual usage • It can remove the need for manholes or gully pots	• Requires closure of surfaced areas whilst SuDS are constructed • Cannot be used where high sediment loads are likely to be washed across the surface • Requires vegetation maintenance • Regular inspection of the surfaces required to ensure effectiveness • Can deflect if subject to heavy vehicular loads

Effective Locations	Ineffective Locations
• Residential and Commercial areas • Car Parks • Low speed roads (below 30 mph) • Pathways • Residential pavements • Hard courts	• High speed roads

Performance Criteria	Rating
Ecological Advantages	Low
Peak Flow Reduction	High
Amenity Potential	Low
Water Quality Treatment Potential	High
Surface Water Volume Reduction	High

In the Community

Permeable surfaces offer effective drainage solutions that integrate within residential environments. Porous paving is effective at managing runoff from paved surfaces, and this low maintenance method is particularly useful in built up environments, including city centres. Replacing hard standing with permeable surfaces could improve drainage across a site whilst creating more aesthetically pleasing environments.

Design

Example

References

For detailed information on the design and delivery of SuDS, reference should be made to the CIRIA *SuDS Manual* (2015), which is freely available online at www.ciria.org.

A range of further resources on SuDS, including case studies, videos, presentations, fact sheets and links to research can be found on the Susdrain website at http://www.susdrain.org.

Additional supporting information is available from DEFRA (www.defra.gov.uk) and the Environment Agency (www.environment-agency.gov.uk).

Developers within Tower Hamlets should also refer to the London Borough of Tower Hamlets publication *SuDS Guidance,* for detailed guidance on drainage strategies submitted with planning submissions.

Mapping and Dataset Summary

A series of maps, and a geodatabase have been produced to accompany this study and assist the assessment of sites by London Borough of Tower Hamlets as part of their decision making process. A GIS based mapping system using the software package 'ArcGIS' was implemented to enable this. A summary of the figures created and the GIS layers used for each of the maps is included in the Table C1 below.

Table C1 *- Summary of Maps Created*

Map Number	Figure Title	Layers Used
Map 001	River Network	• Ordnance Survey Base-mapping (25k)* • Borough Boundary* • Main River* • Ordinary Watercourse* • Culvert* • Docks • Reservoirs • Quays
Map 002	Topography	• Lidar (Elevation Data)
Map 003A	Superficial Geology	• Drift Geology •
Map 003B	Bedrock Geology	• Solid Geology
Map 004	Flooding History	• Historical Groundwater Flooding • Recorded Surface Water Flooding Incidents • Recorded Flood Outlines • Properties Flooded From Overloaded Sewers
Map 005	Flood Risk From Rivers And Sea	• Flood Zone 2 • Flood Zone 3a • Flood Zone 3b
Map 006	Flood Map for Surface Water	• Flood Map for Surface Water 30 year extent • Flood Map for Surface Water 100 year extent • Flood Map for Surface Water 1000 year extent • Critical Drainage Areas
Map 007	Areas at Risk of Flooding from Groundwater	• Areas Susceptible To Groundwater Flooding
Map 008	Flood Risk From Reservoirs	• Flood Risk From Reservoirs
Map 009	Flood Risk Management Infrastructure	• Areas Benefiting From Defences • Flood Defences
Map 010	Flood Warning Areas	• Flood Alert Area • Flood Warning Area

Map 011	SuDS Infiltration Suitability	• SuDS Summary Map
Map 012A	Breach Assessment - Maximum Predicted Flood Extents	• Maximum Flood Extent - MLWL2015 • Maximum Flood Extent - MLWL2065 • Maximum Flood Extent - MLWL2100 • Breach Locations
Map 012B	Breach Assessment – Year 2100 Maximum Predicted Flood Depth	• Year 2100 Maximum Predicted Flood Depth • Breach Locations
Map 012C	Breach Assessment – Year 2100 Maximum Predicted Flood Velocity	• Year 2100 Maximum Predicted Flood Velocity • Breach Locations
Map 012D	Breach Assessment – Year 2100 Maximum Predicted Flood Hazard	• Year 2100 Maximum Predicted Flood Hazard • Breach Locations
Map 013	Fluvial Flood Outlines	• 2% AEP Flood Extent • 1% AEP Flood Extent • 1% AEP plus Climate Change Flood Extent • 0.5% AEP Flood Extent • 0.1% AEP Flood Extent
Map 014	Sites Allocated for Planning	• Proposed Site Allocations

Note:
*Included in all maps

ArcGIS uses multiple datasets with associated attribution to present geo-located features from multiple sources. An overview of the information provided for mapping purposes by the various key stakeholders is shown below.

Table C2 *- Description of GIS Layers used to inform the assessment*

	Dataset	Source	Format	Layer Description
Fluvial and Tidal	Detailed River Network	Environment Agency	GIS shapefile	Identification of the river network including main rivers and ordinary Watercourses
	Flood Map for Planning (Rivers and Sea) Flood Zones 2 and 3	Environment Agency	GIS shapefile	Shows areas at varying risk of flooding from rivers and the sea
	Historic Flood Map	Environment Agency	GIS shapefile	Single GIS layer showing the extent of fluvial historic flood events
	Asset Information Management System (AIMS)	Environment Agency	GIS shapefile	Shows where there are existing defences, structures, heights, type and design standard. However many fields contain default values
	Areas Benefitting from Defences	Environment Agency	GIS shapefile	Indicates the areas within the Borough that are under the protection of flood defences
	Flood Alert Area	Environment Agency Geostore	GIS shapefile	Shows areas benefitting from flood alert schemes in the Borough
	Flood Defences	Environment Agency	GIS shapefile	Location of flood defences within the Borough
	Flood Warning Area	Environment Agency Geostore	GIS shapefile	Shows areas benefitting from fluvial flood warning schemes in the Borough
	Thames Tidal Breach Modelling Study	Environment Agency	GIS asci and shapefiles and PDF	Reports and GIS outputs summarising the breach modelling of the TTD, completed in 2014

	Dataset	Source	Format	Layer Description
Pluvial	Updated Flood Map for Surface Water	Environment Agency Geostore	GIS shapefile	Provides an indication of the broad areas likely to be at risk of surface water flooding during a 1 in 30 year, 1 in 100 year and 1 in 100 year return period event
	Critical Drainage Areas	London Borough of Tower Hamlets	GIS shapefile	Location of designated critical drainage areas within the Borough
Groundwater	Geology	London Borough of Tower Hamlets	GIS shapefile	Illustrates bedrock and superficial geology across the Borough
	Aquifer Designation Map	Environment Agency	GIS shapefile	Broadly shows extents of aquifers in the Borough
	Infiltration SuDS Summary Map	British Geological Society	GIS shapefile	Dataset produced by BGS illustrating the likely suitability of the utilisation of infiltration SuDS techniques across the Borough
	Areas Susceptible to Groundwater Flooding	Environment Agency	GIS shapefile	Broad scale assessment of areas likely to be susceptible to groundwater flooding, within a 1 km grid
	Source Protection Zones	Environment Agency	GIS shapefile	Shows areas which are Groundwater Source Protection Zones
	Susceptibility to Groundwater Flooding	British Geological Society	GIS shapefile	Dataset produced by BGS illustrating the likely suitability to groundwater flooding, based on geological indicators.

	Dataset	Source	Format	Layer Description
Reservoir	Area Deemed at of Risk of Flooding from Reservoirs	Environment Agency	GIS shapefile	Identifies areas which are at risk of flooding in the event of a reservoir breach
Sewer	Sewer Network	Thames Water	GIS shapefile	Details of the combined sewer assets across the Borough
	DG5 Register of sewer flooding incidents, by post code area	Thames Water	MS Word	Indicates post code areas that may be prone to flooding as have experienced flooding in the last 10 years
General	Post Code Boundaries	London Borough of Tower Hamlets	GIS shapefile	Delineates Post Code Boundaries for the Borough, enabling mapping of Thames Water datasets
	National Receptor Database	Environment Agency	GIS shapefile	A comprehensive register of land uses across the Borough, used to identify vulnerable sites and water management infrastructure
	Ordnance Survey 25k Background	London Borough of Tower Hamlets	Raster file (.tiff)	Provides background mapping and indicates important features and street names in detail
	LiDAR Data	Environment Agency	Raster file (.tiff)	Provides a useful basis for understanding local topography and the surface water flood risk in the area
	Proposed Site Allocations	London Borough of Tower Hamlets	GIS shapefile	Indicates location of upcoming development sites across the Borough

SFRA Management Guide

NPPF highlights the importance of maintaining Strategic Flood Risk Assessments current to ensure the decision making process by the Local Planning Authorities is based on the most up to date information and understanding of flood risk within the Borough. A summary of the key aspects to be considered to ensure that the SFRA is kept up-to-date and maintained is provided in the table below.

Table D1 *- Summary of main aspects to be considered during maintenance of the SFRA*

Area Covered	Source of Information	Provider	Comments	Next Review
Climate Change Scenarios	Environment Agency Guidance and Modelling	EA	The hydraulic modelling results considered as a part of this SFRA were based on the latest available modelling of the River Lee and River Thames. However, modelling of the River Lee was undertaken using a 20% allowance for climate change, which is no longer in line with current allowances. Updating of this modelling is understood to be currently in progress and it is strongly recommended that this revised modelling be incorporated within the SFRA upon completion.	When updated hydraulic modelling becomes available, and during the next general review of the SFRA
Flood Zones	Hydraulic modelling of main rivers and the sea (Tidal Thames)	EA	Should new Flood Zone information become available, the data should be digitised and georeferenced within the GIS system	When further modelling is carried out and/or outlines reviewed by EA
Critical Drainage Areas	Tower Hamlets SWMP	LBTH	The CDAs presented in this SFRA are based on ongoing hydraulic modelling, currently being undertaken to refine the understanding of flood risk across the Borough. It is recommended that these CDAs are updated within the SFRA, as required upon completion of this study.	When updated surface water modelling is completed and refined CDAs are available.
Surface Water Flood Outlines	EA Dataset	EA	It is understood that the EA surface water flood maps are due to be updated during 2016 to take account of site specific modelling undertaken by local Boroughs	When new relevant information becomes available

Area Covered	Source of Information	Provider	Comments	Next Review
Flood Defences, Critical Water Management Structures and Areas Benefiting	EA Database and Tower Hamlets SWMP	EA, LBTH	If any new local flood defences or management structures are installed within Tower Hamlets these should be added as a new point to the relevant GIS layer, including metadata. EA datasets should be updated in their entirety to replace superseded layers	When new relevant information becomes available
Flooding History	Stakeholders records	EA, LBTH	When new flooding incidents are reported, these should be added as a new point to the relevant GIS layer, including metadata	Next general review of SFRA
Local Plan Information	Tower Hamlets Local Plan	LBTH	The new Tower Hamlets Local Plan in formulation at the time of publishing this SFRA. It is intended that detailed assessment of the proposed allocated development sites is undertaken as a further phase of this SFRA, once this plan and proposed development sites, are finalised	Finalisation of Local Plan and allocated development sites
Groundwater Flood Risk	Geology and Groundwater Vulnerability	EA	The groundwater flood risk dataset used for this SFRA is understood to provide the best available representation of groundwater flood risk. Understanding of groundwater flood risk is still emerging and therefore it is recommended that this is updated when further or update becomes available.	Next general review of SFRA
Sewer Flood Risk	Thames Water	TW	Very limited information on areas at risk of sewer flooding was provided during this study. Should greater information on sewer flood risk and network capacity become available, it is recommended that this is incorporated within the SFRA.	When information is available
OS Background Mapping	Ordinance Survey	LBTH	The SFRA has made use of OS 1:25,000 digital mapping. Periodically these maps are updated. Updated maps are unlikely to alter the findings of the SFRA but should be reviewed as part of the SFRA maintenance	Next General review of SFRA

Area Covered	Source of Information	Provider	Comments	Next Review
Flood Risk Policy	NPPF and NPPG		This SFRA was created using guidance that was current in June 2016, principally the NPPF and the accompanying Technical Guidance. Should new flooding policy be adopted nationally, regionally or locally, the SFRA should be checked to ensure it is still relevant and updates made if necessary	When changes to relevant planning policy are adopted

It should be noted that, prior to any data being updated within the SFRA, it is important that the licensing information is also updated to ensure that the data used is not in breach of copyright. The principal licensing bodies relevant to the SFRA at the time of publishing were the Environment Agency (Thames Region), Ordnance Survey and Thames Water. Updated or new data may be based on datasets from other licensing authorities and may require additional licenses. Generally, when updating the GIS information associated with this SFRA, it is important that the meta-data is updated in the process. This is the additional information that lies behind the GIS polygons, lines and points.

It is recommended that an interim review of the SFRA is undertaken on an annual basis, in liaison with the Environment Agency, to assess any maintenance or update work required. In particular, this would include incorporation of any major changes in terms of flood management infrastructure and any recorded flooding incidents. An overall general review of the SFRA is recommended every 3 years, to re-evaluate flood risk and planning policies according to latest legislation.

Should LBTH decide any significant changes are necessary; the SFRA should be updated and re-issued. It is essential that any reviews and updates of the SFRA are recorded in a structured manner. To facilitate this task, the following register has been created:

STRATEGIC FLOOD RISK ASSESSMENT REVIEW				
Type of Review	Scheduled ☐	Interim ☐	Date of Review:	
Reviewer Name:			Organisation:	
Area Reviewed	Source of Information	Provider	Maps Modified	Comments

Historic Flooding Records

Date	Attributed Source of Flooding	Location	Description and Comments	Reference
January 1928	Tidal flooding associated with the River Thames	Docklands and Thames Frontage	Severe flooding affected central London in 1928 when high tides overtopped the River Thames Defences.	EA Recorded Flood Outlines
1953	Tidal	Docklands	A storm surge impacted the east coast of the UK, causing high tidal levels to breach flood defences and resulting in extensive flooding across London and the Thames Estuary. Within Tower Hamlets, the event predominantly impacted the confluence of the River Lee and River Thames, causing flooding in the Docklands area.	2012 SFRA
March 1947	Fluvial	East India Docks Basin, South Bromley and Canning Town	A combination of rainfall and snowmelt caused a rise in water levels within the River Lee and its tributaries resulting in overtopping and inundation of surrounding areas.	2012 SFRA
21st December 2004	Groundwater	Mile End	No Details	EA Groundwater Flooding Dataset
Summer 2014	Pluvial	Junction of Tredegar Road and Parnell Road, Bow	Flooding of 4 gullies, carriageway and footway with approximate depth of 300 mm.	LBTH Flood Register
Summer 2014	Pluvial	Coate Street	Blocked gully with flooding of carriageway to estimated depth 30 mm.	LBTH Flood Register
September 1995	Pluvial / Sewer	Manchester Road, Isle of Dogs	Flood record identified through discussions with Tower Hamlets and Thames Water during Tier 3 surface water modelling study.	Surface water modelling report
1994	Pluvial / Sewer	Harbinger Road, Isle of Dogs	Flood record identified through discussions with Tower Hamlets and Thames Water during Tier 3 surface water modelling study.	Surface water modelling report

Appendix C - Mapping and Dataset Summary

Mapping and Dataset Summary

A series of maps, and a geodatabase have been produced to accompany this study and assist the assessment of sites by London Borough of Tower Hamlets as part of their decision making process. A GIS based mapping system using the software package 'ArcGIS' was implemented to enable this. A summary of the figures created and the GIS layers used for each of the maps is included in the Table C1 below.

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Map 003A	Superficial Geology	• Drift Geology •
Map 003B	Bedrock Geology	• Solid Geology
Map 004	Flooding History	• Historical Groundwater Flooding • Recorded Surface Water Flooding Incidents • Recorded Flood Outlines • Properties Flooded From Overloaded Sewers
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Map 006	Flood Map for Surface Water	• Flood Map for Surface Water 30 year extent • Flood Map for Surface Water 100 year extent • Flood Map for Surface Water 1000 year extent • Critical Drainage Areas
Map 007	Areas at Risk of Flooding from Groundwater	• Areas Susceptible To Groundwater Flooding
Map 008	Flood Risk From Reservoirs	• Flood Risk From Reservoirs
Map 009	Flood Risk Management Infrastructure	• Areas Benefiting From Defences • Flood Defences
Map 010	Flood Warning Areas	• Flood Alert Area • Flood Warning Area

Map 011	SuDS Infiltration Suitability	• SuDS Summary Map
Map 012A	Breach Assessment - Maximum Predicted Flood Extents	• Maximum Flood Extent - MLWL2015 • Maximum Flood Extent - MLWL2065 • Maximum Flood Extent - MLWL2100 • Breach Locations
Map 012B	Breach Assessment – Year 2100 Maximum Predicted Flood Depth	• Year 2100 Maximum Predicted Flood Depth • Breach Locations
Map 012C	Breach Assessment – Year 2100 Maximum Predicted Flood Velocity	• Year 2100 Maximum Predicted Flood Velocity • Breach Locations
Map 012D	Breach Assessment – Year 2100 Maximum Predicted Flood Hazard	• Year 2100 Maximum Predicted Flood Hazard • Breach Locations
Map 013	Fluvial Flood Outlines	• 2% AEP Flood Extent • 1% AEP Flood Extent • 1% AEP plus Climate Change Flood Extent • 0.5% AEP Flood Extent • 0.1% AEP Flood Extent
Map 014	Sites Allocated for Planning	• Proposed Site Allocations

Note:
*Included in all maps

ArcGIS uses multiple datasets with associated attribution to present geo-located features from multiple sources. An overview of the information provided for mapping purposes by the various key stakeholders is shown below.

Table C2 *- Description of GIS Layers used to inform the assessment*

	Dataset	Source	Format	Layer Description
Fluvial and Tidal	Detailed River Network	Environment Agency	GIS shapefile	Identification of the river network including main rivers and ordinary Watercourses
	Flood Map for Planning (Rivers and Sea) Flood Zones 2 and 3	Environment Agency	GIS shapefile	Shows areas at varying risk of flooding from rivers and the sea
	Historic Flood Map	Environment Agency	GIS shapefile	Single GIS layer showing the extent of fluvial historic flood events
	Asset Information Management System (AIMS)	Environment Agency	GIS shapefile	Shows where there are existing defences, structures, heights, type and design standard. However many fields contain default values
	Areas Benefitting from Defences	Environment Agency	GIS shapefile	Indicates the areas within the Borough that are under the protection of flood defences
	Flood Alert Area	Environment Agency Geostore	GIS shapefile	Shows areas benefitting from flood alert schemes in the Borough
	Flood Defences	Environment Agency	GIS shapefile	Location of flood defences within the Borough
	Flood Warning Area	Environment Agency Geostore	GIS shapefile	Shows areas benefitting from fluvial flood warning schemes in the Borough
	Thames Tidal Breach Modelling Study	Environment Agency	GIS asci and shapefiles and PDF	Reports and GIS outputs summarising the breach modelling of the TTD, completed in 2014

	Dataset	Source	Format	Layer Description
Pluvial	Updated Flood Map for Surface Water	Environment Agency Geostore	GIS shapefile	Provides an indication of the broad areas likely to be at risk of surface water flooding during a 1 in 30 year, 1 in 100 year and 1 in 100 year return period event
	Critical Drainage Areas	London Borough of Tower Hamlets	GIS shapefile	Location of designated critical drainage areas within the Borough
Groundwater	Geology	London Borough of Tower Hamlets	GIS shapefile	Illustrates bedrock and superficial geology across the Borough
	Aquifer Designation Map	Environment Agency	GIS shapefile	Broadly shows extents of aquifers in the Borough
	Infiltration SuDS Summary Map	British Geological Society	GIS shapefile	Dataset produced by BGS illustrating the likely suitability of the utilisation of infiltration SuDS techniques across the Borough
	Areas Susceptible to Groundwater Flooding	Environment Agency	GIS shapefile	Broad scale assessment of areas likely to be susceptible to groundwater flooding, within a 1 km grid
	Source Protection Zones	Environment Agency	GIS shapefile	Shows areas which are Groundwater Source Protection Zones
	Susceptibility to Groundwater Flooding	British Geological Society	GIS shapefile	Dataset produced by BGS illustrating the likely suitability to groundwater flooding, based on geological indicators.

	Dataset	Source	Format	Layer Description
Reservoir	Area Deemed at of Risk of Flooding from Reservoirs	Environment Agency	GIS shapefile	Identifies areas which are at risk of flooding in the event of a reservoir breach
Sewer	Sewer Network	Thames Water	GIS shapefile	Details of the combined sewer assets across the Borough
	DG5 Register of sewer flooding incidents, by post code area	Thames Water	MS Word	Indicates post code areas that may be prone to flooding as have experienced flooding in the last 10 years
General	Post Code Boundaries	London Borough of Tower Hamlets	GIS shapefile	Delineates Post Code Boundaries for the Borough, enabling mapping of Thames Water datasets
	National Receptor Database	Environment Agency	GIS shapefile	A comprehensive register of land uses across the Borough, used to identify vulnerable sites and water management infrastructure
	Ordnance Survey 25k Background	London Borough of Tower Hamlets	Raster file (.tiff)	Provides background mapping and indicates important features and street names in detail
	LiDAR Data	Environment Agency	Raster file (.tiff)	Provides a useful basis for understanding local topography and the surface water flood risk in the area
	Proposed Site Allocations	London Borough of Tower Hamlets	GIS shapefile	Indicates location of upcoming development sites across the Borough

Appendix D - SFRA Management Guide

SFRA Management Guide

NPPF highlights the importance of maintaining Strategic Flood Risk Assessments current to ensure the decision making process by the Local Planning Authorities is based on the most up to date information and understanding of flood risk within the Borough. A summary of the key aspects to be considered to ensure that the SFRA is kept up-to-date and maintained is provided in the table below.

Table D1 *- Summary of main aspects to be considered during maintenance of the SFRA*

Area Covered	Source of Information	Provider	Comments	Next Review
Climate Change Scenarios	Environment Agency Guidance and Modelling	EA	The hydraulic modelling results considered as a part of this SFRA were based on the latest available modelling of the River Lee and River Thames. However, modelling of the River Lee was undertaken using a 20% allowance for climate change, which is no longer in line with current allowances. Updating of this modelling is understood to be currently in progress and it is strongly recommended that this revised modelling be incorporated within the SFRA upon completion.	When updated hydraulic modelling becomes available, and during the next general review of the SFRA
Flood Zones	Hydraulic modelling of main rivers and the sea (Tidal Thames)	EA	Should new Flood Zone information become available, the data should be digitised and georeferenced within the GIS system	When further modelling is carried out and/or outlines reviewed by EA
Critical Drainage Areas	Tower Hamlets SWMP	LBTH	The CDAs presented in this SFRA are based on ongoing hydraulic modelling, currently being undertaken to refine the understanding of flood risk across the Borough. It is recommended that these CDAs are updated within the SFRA, as required upon completion of this study.	When updated surface water modelling is completed and refined CDAs are available.
Surface Water Flood Outlines	EA Dataset	EA	It is understood that the EA surface water flood maps are due to be updated during 2016 to take account of site specific modelling undertaken by local Boroughs	When new relevant information becomes available

Area Covered	Source of Information	Provider	Comments	Next Review
Flood Defences, Critical Water Management Structures and Areas Benefiting	EA Database and Tower Hamlets SWMP	EA, LBTH	If any new local flood defences or management structures are installed within Tower Hamlets these should be added as a new point to the relevant GIS layer, including metadata. EA datasets should be updated in their entirety to replace superseded layers	When new relevant information becomes available
Flooding History	Stakeholders records	EA, LBTH	When new flooding incidents are reported, these should be added as a new point to the relevant GIS layer, including metadata	Next general review of SFRA
Local Plan Information	Tower Hamlets Local Plan	LBTH	The new Tower Hamlets Local Plan in formulation at the time of publishing this SFRA. It is intended that detailed assessment of the proposed allocated development sites is undertaken as a further phase of this SFRA, once this plan and proposed development sites, are finalised	Finalisation of Local Plan and allocated development sites
Groundwater Flood Risk	Geology and Groundwater Vulnerability	EA	The groundwater flood risk dataset used for this SFRA is understood to provide the best available representation of groundwater flood risk. Understanding of groundwater flood risk is still emerging and therefore it is recommended that this is updated when further or update becomes available.	Next general review of SFRA
Sewer Flood Risk	Thames Water	TW	Very limited information on areas at risk of sewer flooding was provided during this study. Should greater information on sewer flood risk and network capacity become available, it is recommended that this is incorporated within the SFRA.	When information is available
OS Background Mapping	Ordinance Survey	LBTH	The SFRA has made use of OS 1:25,000 digital mapping. Periodically these maps are updated. Updated maps are unlikely to alter the findings of the SFRA but should be reviewed as part of the SFRA maintenance	Next General review of SFRA

Area Covered	Source of Information	Provider	Comments	Next Review
Flood Risk Policy	NPPF and NPPG		This SFRA was created using guidance that was current in June 2016, principally the NPPF and the accompanying Technical Guidance. Should new flooding policy be adopted nationally, regionally or locally, the SFRA should be checked to ensure it is still relevant and updates made if necessary	When changes to relevant planning policy are adopted

It should be noted that, prior to any data being updated within the SFRA, it is important that the licensing information is also updated to ensure that the data used is not in breach of copyright. The principal licensing bodies relevant to the SFRA at the time of publishing were the Environment Agency (Thames Region), Ordnance Survey and Thames Water. Updated or new data may be based on datasets from other licensing authorities and may require additional licenses. Generally, when updating the GIS information associated with this SFRA, it is important that the meta-data is updated in the process. This is the additional information that lies behind the GIS polygons, lines and points.

It is recommended that an interim review of the SFRA is undertaken on an annual basis, in liaison with the Environment Agency, to assess any maintenance or update work required. In particular, this would include incorporation of any major changes in terms of flood management infrastructure and any recorded flooding incidents. An overall general review of the SFRA is recommended every 3 years, to re-evaluate flood risk and planning policies according to latest legislation.

Should LBTH decide any significant changes are necessary; the SFRA should be updated and re-issued. It is essential that any reviews and updates of the SFRA are recorded in a structured manner. To facilitate this task, the following register has been created:

STRATEGIC FLOOD RISK ASSESSMENT REVIEW				
Type of Review	Scheduled ☐	Interim ☐	**Date of Review:**	
Reviewer Name:			**Organisation:**	
Area Reviewed	**Source of Information**	**Provider**	**Maps Modified**	**Comments**

Appendix E - Flood History Register

Historic Flooding Records

Date	Attributed Source of Flooding	Location	Description and Comments	Reference
January 1928	Tidal flooding associated with the River Thames	Docklands and Thames Frontage	Severe flooding affected central London in 1928 when high tides overtopped the River Thames Defences.	EA Recorded Flood Outlines
1953	Tidal	Docklands	A storm surge impacted the east coast of the UK, causing high tidal levels to breach flood defences and resulting in extensive flooding across London and the Thames Estuary. Within Tower Hamlets, the event predominantly impacted the confluence of the River Lee and River Thames, causing flooding in the Docklands area.	2012 SFRA
March 1947	Fluvial	East India Docks Basin, South Bromley and Canning Town	A combination of rainfall and snowmelt caused a rise in water levels within the River Lee and its tributaries resulting in overtopping and inundation of surrounding areas.	2012 SFRA
21st December 2004	Groundwater	Mile End	No Details	EA Groundwater Flooding Dataset
Summer 2014	Pluvial	Junction of Tredegar Road and Parnell Road, Bow	Flooding of 4 gullies, carriageway and footway with approximate depth of 300 mm.	LBTH Flood Register
Summer 2014	Pluvial	Coate Street	Blocked gully with flooding of carriageway to estimated depth 30 mm.	LBTH Flood Register
September 1995	Pluvial / Sewer	Manchester Road, Isle of Dogs	Flood record identified through discussions with Tower Hamlets and Thames Water during Tier 3 surface water modelling study.	Surface water modelling report
1994	Pluvial / Sewer	Harbinger Road, Isle of Dogs	Flood record identified through discussions with Tower Hamlets and Thames Water during Tier 3 surface water modelling study.	Surface water modelling report