

SURFACE WATER MANAGEMENT PLAN



PREPARED FOR LONDON BOROUGH OF SOUTHWARK

Authored by Elizabeth Bunker and Lauren Barraclough
Reviewed by: Tom Whitworth
Approved by Mike Mair
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Metis Consultants Ltd.
Spencer House
23 Sheen Road, Richmond
London, TW9 1BN
United Kingdom
t. 020 8948 0249
e. info@metisconsultants.co.uk
w. metisconsultants.co.uk

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CONTACT DETAILS

Metis Consultants Ltd.
Spencer House
23 Sheen Road, Richmond
London, TW9 1BN
t. 020 8948 0249
e. info@metisconsultants.co.uk

EXECUTIVE SUMMARY

A Surface Water Management Plan (SWMP) is a technical document produced by a Lead Local Flood Authority (LLFA), in this case the London Borough of Southwark (LB Southwark). The purpose of the SWMP is to investigate flood risk from local sources and to present a long-term action plan of how to manage these risks. The SWMP will therefore influence future capital investment, drainage maintenance, public engagement and understanding, land use planning, emergency planning and future development. Key stakeholders and partners responsible for surface water management and/or drainage in Southwark have been actively engaged throughout the formation of this document to establish a collaborative approach. Improved communication can be achieved by working in partnership with these stakeholders, which in turn encourages the development of innovative solutions and practices. Further details on this are explained in Section 1.

Section 2 of this SWMP presents flood risks from all sources relevant to Southwark including from surface water, groundwater, sewers, rivers / tides and artificial sources. The main sources of flooding relevant to a SWMP study are the following, as explained by the SWMP Technical Guidance (DEFRA 2010):

Surface water flooding – flooding caused by overland runoff from short duration, high intensity storms causing permeable land to become saturated, preventing water from infiltrating below ground or be drained through the existing drainage systems.

Groundwater flooding – this occurs when natural groundwater levels within aquifers rise to the surface.

Sewer flooding – flooding caused when the piped network (predominantly sewers maintained by a water company) is no longer able to contain flows and starts spilling over into its immediate environment.

This SWMP replaces the previous Southwark SWMP (2011) with an updated structure, making the document more user friendly and clearer to navigate. This SWMP adopts an updated approach, moving away from previous Critical Drainage Areas (CDAs) to identify Hotspot areas within new Catchments. *Table A-1* provides information on the four Basins, within which 11 Catchments have been identified across Southwark, and further information is available in Section 3.

Table A-1 Basins and Catchments

Code	Basin	Catchment Code	Catchment Name	Cross-Boundary Authority
A	Southwark-Lambeth North	S01	Waterloo	LB Lambeth
		S05	Newington	LB Lambeth
B	Southwark Central	S02	London Bridge	N/A
		S03	Rotherhithe	N/A
		S06	Burgess Park	N/A
		S09	East Dulwich	N/A
C	Southwark-Lewisham	S04	Surrey Quays	LB Lewisham
		S08	New Cross	LB Lewisham
		S07	Peckham Rye	N/A
D	Southwark-Lambeth South	S10	Dulwich Village	LB Lambeth
		S11	West Dulwich	LB Lambeth; LB Croydon; LB Bromley

Sections 4 to 14 consist of a chapter per Catchment within Southwark detailing information including: changes within the locality since the 2011 SWMP and any updated modelling; Catchment extents and links to neighbouring boroughs; a description of the Risk of Flooding from Surface Water (RoFSW) and historic flood incidents; and a summary of the Hotspots identified by the analysis. Hotspots have been identified as areas with more than 15 properties predicted to be at risk of surface water flooding, as identified from the Environment Agency’s RoFSW mapping for a 1 in 100-year return period.

Section 15 uses the information gathered in earlier sections to produce detailed mitigation options for Southwark at a borough-wide level. This replaces the previous SWMP’s methodology which only produced mitigation options for the identified CDAs and did not consider wider, catchment-scale issues. Three types of options have been identified adopting the source-pathway-receptor model: source, pathway and receptor level options. Source options include swales, detention basins, or wetlands which could be used to attenuate small or large volumes of surface water upstream of catchments. Pathway options include improving maintenance regimes, managing overland flow through preferential flow paths, or de-culverting watercourses to provide flood mitigation along flood corridors. Receptor options include planning policies to influence development and social change, education and awareness, to propose mitigation through the end user’s experience. Wherever possible, green, sustainable options have been identified.

The opportunity assessment categories a list of different mitigation options using a ‘red’, ‘amber’, ‘green’ (RAG) classification system. This ranks the suitability of options to reduce surface water flood risk that can be applied within Southwark at a borough-wide scale. The number of properties at risk in a 1 in 100-year return period are used to give each Hotspot a risk level which are as follows:

- Low risk – between 0 and 50 properties at risk at a 1 in 100-year return period
- Medium risk – between 51 and 149 properties at risk at a 1 in 100-year return period
- High risk – 150 or more properties at risk at a 1 in 100-year return period

This SWMP identifies six high risk Hotspots from a total of 86 across Southwark. These have been shortlisted as being of the greatest priority Hotspots for the Southwark LLFA to investigate further. *Table A-2* summarises the high-risk Hotspots mitigation options which are detailed in *Table 15-2*.

Table A-2 High-risk Hotspots

Hotspot ID	Properties at Risk	Option Description
S07_S08_01 Section 10 and 11	462	<ul style="list-style-type: none"> • Overland flow paths could be redirected to green open spaces such as Bird in Bush Park, Caroline Gardens or Brimington Park to be attenuated in ponds or detention basins. • Raingardens, swales and planters in footways, roadsides and areas of open space. • Retrofit flat roofs with green/blue roofs. Retrofit public buildings with raingardens, planters and permeable paving. • This area has suitable underlying geology for infiltration methods subject to site specific testing. • Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. • Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options
S06_01 Section 9	443	<ul style="list-style-type: none"> • Raingardens, swales and planters in footways, roadsides and areas of open space such as Brunswick Park. • Retrofit flat roofs with green/blue roofs. • Retrofit schools with raingardens, planters and permeable paving. • This area has suitable underlying geology for infiltration methods subject to site specific testing. • Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. • Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options.
S06_02 Section 9	420	<ul style="list-style-type: none"> • Raingardens, swales and planters in footways, roadsides and areas of open space such as Paterson Park. • Retrofit flat roofs with green/blue roofs. • Retrofit schools with raingardens, planters and permeable paving. • This area has suitable underlying geology for infiltration methods subject to site specific testing. • Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. • Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options.
S09_01 Section 12	244	<ul style="list-style-type: none"> • Raingardens, swales and planters in footways, roadsides and areas of open space such as Goose Green. • Retrofit flat roofs with green/blue roofs. • Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. • Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options.
S07_02 Section 10	198	<ul style="list-style-type: none"> • Raingardens and planters in footways and roadsides such as in Philip Walk. • Permeable paving in carparks. • Retrofit flat roofs with green/blue roofs.

Hotspot ID	Properties at Risk	Option Description
		<ul style="list-style-type: none"> Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options.
S06_03 Section 9	162	<ul style="list-style-type: none"> Overland flow paths could be redirected to green open spaces such as Surrey Square Park or Burgess Park to be attenuated in ponds or detention basins. Raingardens, swales and planters in footways, roadsides and areas of open space. Retrofit schools with raingardens, planters and permeable paving. This area has suitable underlying geology for infiltration methods subject to site specific testing. Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options. Retrofit flat roofs with green/blue roofs.

Following this, an Action Plan has been devised which defines the activities recommended to take forward from the findings of this SWMP. These actions align to any associated LLFA requirements under the Flood and Water Management Act (FWMA) (2010). Each of the actions have been assigned a priority ranking and timeframe for completion. The actions have also been categorised into action types and the lead Risk Management Authority (RMA) has been allocated, with partner RMAs also included. The full Action Plan is included in Appendix 15, and the high priority actions are detailed in *Table 15-3*. The Action Plan will be reviewed every two or three years to capture any updates, such as investigatory works or projects being carried out or changes occurring which may influence the surface water flood risk within Southwark. The SWMP Action Plan should also be applied in future updates of the Local Flood Risk Management Strategy (LFRMS) to help underpin future work programmes and overarching aims and objectives.

Section 16 details the recommendations of this SWMP. It is recommended that, subject to securing funding, standalone feasibility studies are carried out for the Catchments containing the shortlisted Hotspots, prioritising those with the highest number of properties at risk. Recommended tasks for these studies are as follows:

1. The newly created and prioritised Catchment and Hotspot information should be used to create sub-catchments to enable inclusion of the contributing and benefitting areas of each Hotspot.
2. Gather further information about significant recorded flood incidents and validate against predicted surface water flood risk extents.
3. Identify potential benefactors and constraints.
4. Conduct locally specific long-list and short-listing exercises to identify potential mitigation options, accounting for any existing or planned Flood Alleviation Schemes (FASs) in the area.

5. Determine the feasibility of each potential mitigation option using a multi-criteria decision matrix.
6. Conduct an economic appraisal for each Catchment through cost benefit analysis. This should include identification of flood and non-flood risk related benefits, flood damage calculations, and consideration of whole life costs. This should also define the benefitting area and identify the volume of surface water that could be stored in a 1 in 30-year surface water flood event for each option.
7. Use the results of the economic appraisal to revise the current risk rating for each Catchment. The options with the highest refined rating which are shown to be feasible could then be prioritised for further detailed investigation.
8. Options which are prioritised for further detailed investigation should undergo detailed modelling and a business case should be prepared and submitted to determine potential for continuation through detailed design to construction.

Additional recommendations identified through this SWMP update include:

- LB Southwark LLFA should continue to work with neighbouring boroughs and strategic stakeholders, building on engagement made during this SWMP update, to manage the flood risks holistically where catchments overlap political boundaries.
- LB Southwark LLFA should continue to work with stakeholders and partners to identify potential funding contributions and secure funding for FASs.
- LB Southwark LLFA should ensure that flood incidents are recorded consistently and accurately and conduct investigations of repeat or significant flood incidents which have occurred in Hotspots.
- LB Southwark or other maintenance owners should conduct regular maintenance of gullies and drains, prioritising those within Hotspots.
- LB Southwark LLFA should liaise with LB Southwark's Planning team to ensure that new developments incorporate rainwater harvesting and green blue infrastructure, particularly within Hotspots.
- LB Southwark LLFA should liaise with strategic stakeholders to create and maintain a register of assets across Southwark which influence flood risk, including their owner and condition.

It is recommended that this document is updated when significant work to reduce the risk from flooding is completed and / or when significant improvements in knowledge and understanding of local flood risk are identified. Updates should also be undertaken when there is a significant change to national, regional, or local policy affecting flood risk. This may then impact the number of Hotspots and 'high' risk ratings. Ongoing LB Southwark FASs are examples where this is likely to occur.

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ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FAS	Flood Alleviation Scheme
FRMP	Flood Risk Management Plan
FRR	Flood Risk Regulations
FWMA	Flood and Water Management Act
GLA	Greater London Authority
LB	London Borough
LB Southwark	Southwark Council
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
PFR	Property Flood Resilience
PFRA	Preliminary Flood Risk Assessment
RFRA	Regional Flood Risk Appraisal
RMA	Risk Management Authority
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
Southwark	Administrative area of the London Borough of Southwark
Southwark town	The area of Southwark around Southwark London Underground station, between London Waterloo, London Bridge and Elephant and Castle National Rail stations
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
TWUL	Thames Water Utility Limited

1 INTRODUCTION

1.1 What is a Surface Water Management Plan?

A Surface Water Management Plan (SWMP) is a document produced by the Lead Local Flood Authority (LLFA) to outline the preferred method of managing surface water within a given area. Southwark Council (LB Southwark) act as the LLFA for the administrative area of the London Borough of Southwark (Southwark) and have commissioned this updated SWMP. A SWMP should be a collaborative document which involves other Risk Management Authorities (RMAs) and partners to identify and understand the causes and effects of surface water flooding in the study area. SWMPs should also set out other sources of flood risk within the area and detail how this may influence surface water management and the overall flood risk in the area. From this information, the SWMP should establish the most effective method of managing the risk in the future, creating a long-term Action Plan to manage surface water. The SWMP plays a strategic role in guiding future capital investments such as Flood Alleviation Schemes (FASs) and future development. It also informs drainage maintenance activities and schedules, public engagement, and emergency planning strategies. Land use planning decisions may also be influenced by the SWMP.

The benefits of undertaking a SWMP study are as follows:

- Increased understanding of the causes, probability, and consequences of surface water flooding.
- Spatial and emergency planning functions can be informed by increased understanding of where surface water flooding will occur.
- Partners and stakeholders are identified to enable the establishment of co-ordinated plans to tackle surface water flooding.
- Opportunities to implement Sustainable Drainage Systems (SuDS) to manage surface water flood risk are identified.
- An Action Plan can be generated, and potential flood alleviation options gathered based on the information gathered about surface water flood risk.

The SWMP acts in alignment with LB Southwark's Local Flood Risk Management Strategy (LFRMS) completed in August 2015, which considers key legislation and industry drivers related to flood risk. The SWMP has been updated to ensure that it captures the most up to date flood risk mapping, modelling and information on properties at risk and potential FASs. GIS analysis has been used to create drainage Basins and Catchments, within which localised areas of flood risk have been identified. These localised areas are referred to as Hotspots. Borough-wide mitigation options have been identified in Section 15 and an updated Action Plan and stakeholder engagement plan have been produced.

1.1.1 Objectives

This SWMP has the following objectives:

- Apply the most appropriate guidance and include the most relevant information from the existing 2011 SWMP.
- Signpost other strategic and guidance-based documents at local, regional and national levels.
- Apply a similar approach to neighbouring Local Authorities to help develop cross-boundary authority collaboration on future projects.
- Provide a user-friendly document for the end reader.
- Include up-to-date information about properties and infrastructure at risk of flooding.
- Identify flooding Hotspots at a surface water catchment level.
- Set out a plan for managing surface water flood risk at a borough-wide level.
- Provide guidance on how different partners and stakeholders will be involved to successfully deliver the SWMP's Action Plan.
- Enable engagement with key partners and stakeholders on developing an effective and achievable Action Plan for managing surface water flood risk.

1.1.2 LLFA responsibilities

The Flood and Water Management Act (FWMA) 2010 and the Flood Risk Regulations (FRR) 2009 set out responsibilities and statutory duties belonging to LLFAs. The role of LLFAs is to prepare and maintain a strategy for managing local flood risk. They must coordinate with other RMAs and the public to deliver area-wide benefits and reduce the risk of flooding. The SWMP assists the LLFA in carrying out their responsibilities by proposing potential mitigation measures and an Action Plan to reduce flood risk in the area, as well as suggesting methods for working collaboratively with partners and stakeholders.

Working collaboratively will also help LB Southwark apply guidance from the recent 2021 update to the [National Flood and Coastal Erosion Management Strategy Action Plan](#). This outlines that LLFAs must do more to engage with communities to help reduce the risk of flooding through improving resilience. Engaging with LB Southwark's local community is key in further reducing the risk of flooding, and will help deliver additional social, economic, and environmental benefits to the borough. This SWMP proposes appropriate measures in the mitigation options and Action Plan to achieve this objective.

1.1.3 The previous SWMP

This document will replace the previous SWMP, published in 2011. LB Southwark's previous SWMP was commissioned by the Greater London Authority (GLA). It was delivered as part of the Tier 2 package of works of the Drain London Project in 2011. The previous SWMP used GIS analysis and rainfall modelling to identify Local Flood Risk Zones and Critical Drainage Areas (CDAs), in which the risk of flooding to property and infrastructure from surface water was deemed to be high. The five CDAs at highest risk were: Herne Hill; Central Southwark; East Southwark; Camberwell; and London Bridge. These are shown in *Figure 3-1*. It identified five main flooding mechanisms (areas where water is most likely to pool), as listed below:

- River Valleys including the lost/hidden rivers, River Effra and River Peck which run south to north through the borough in the sewer system.
- Low Lying Areas
- Railway Lines
- Borough central belt following the A202 road, located in Flood Zone 3.
- Sewer Flood Risk: where sewer capacity is stretched and combines with fluvial and groundwater flood risk.

It was identified that 30,280 residential properties and 2,530 non-residential properties in Southwark could be at risk of surface water flooding of greater than 0.03m depth during the 1% AEP rainfall event (1 in 100-year). A large number of these properties at risk were found along the route of the 'hidden' River Effra.

The options suggested to manage surface water flood risk in the borough were shortlisted for each CDA, such as a catchment-wide drainage capacity study, and feasibility studies for SuDS, source control, or greening flood alleviation measures. Borough-wide options were also outlined, including the introduction of SuDS policy, increased community engagement around flooding, and continued maintenance to the drainage system. Identified options were included in the Action Plan, which was intended as a living document to be reviewed and updated at key milestones and events such as project completions, flood events, investment decisions or changes in the catchment.

1.1.4 Other strategic flood documents influencing Southwark

Local Flood Risk Management Strategy (LFRMS) 2015:

The FWMA 2010 requires each LLFA to produce a LFRMS to assess the local flood risk, set out objectives for managing it, define the costs and benefits of the proposed measures, and how the measures are proposed to be paid for. LFRMSs should be updated once every six years. LB Southwark plans to update its LFRMS shortly after the publication of this SWMP. The updated SWMP will act in alignment with the LFRMS and be used as an evidence base to deliver more flood investigation and option assessments into areas identified to be at risk, subject to available resources.

Preliminary Flood Risk Assessment (PFRA) 2011 and addendum in 2017:

PFRA are required as part of the FRRs (2009) which implement the requirements of the European Floods Directive (2007). Produced for each London borough LLFA by Drain London, it gives an overview of all local sources of flood risk. The information gathered for this SWMP will benefit future revisions of the PFRA document.

Regional Flood Risk Appraisal (RFRA) 2018:

The RFRA is produced by the GLA and gives a regional overview of flooding from all sources.

Strategic Flood Risk Assessment (SFRA) 2017:

The SFRA is a planning policy document that assesses flood risk from all sources in the present and future, considering the impact of climate change. The SFRA is designed to help address local requirements, manage development requirements, and manage the risk of flooding posed to residents and property from all sources.

Thames Catchment Flood Management Plan (CFMP) 2009:

Published by the Environment Agency (EA), the CFMP sets out policies for the sustainable management of flood risk across the whole Thames Catchment over the long-term (50 to 100-years) taking climate change into account. The CFMP emphasises the role of the floodplain as an important asset for flood risk management and the need to re-create river corridors so that rivers can flow and flood more naturally.

Thames River Basin District Flood Risk Management Plan (FRMP) 2015 – 2021 and 2021 - 2027:

The Thames River Basin FRMP sets out the risk of flooding from all sources within the London Flood Risk Area, and lists measures through which RMAs will manage flood and coastal risk over a six-year period. LB Southwark LLFA holds a list of these objectives and measures.

The second cycle of the Thames River Basin District FRMP was in consultation phase during the formation of this report, and as such has not been formally published. This has been evaluated by LB Southwark LLFA and its content has informed the proposed measures and Action Plan within this report.

Thames Estuary 2100 Plan (TE2100) 2011 and review in 2021:

The TE2100 plan sets out how tidal flood risk will be managed in the Thames Estuary until 2100. This document is produced by the EA and looks at how they will protect 1.4 million people and roughly £320 billion worth of property from tidal flood risk. Southwark is within the tidal reaches of the River Thames, therefore this plan influences the borough and must be considered in the SWMP.

1.2 Document overview

1.2.1 How a SWMP should be written

In 2010, DEFRA produced [Technical Guidance](#) on how a SWMP should be written. This guidance is summarised in *Figure 1-1* which shows the four main phases: **Preparation; Risk Assessment; Options; and Implementation and Review**. The first three stages entail planning and carrying out the SWMP analysis and report, whilst stage four involves creating and carrying out an Action Plan.

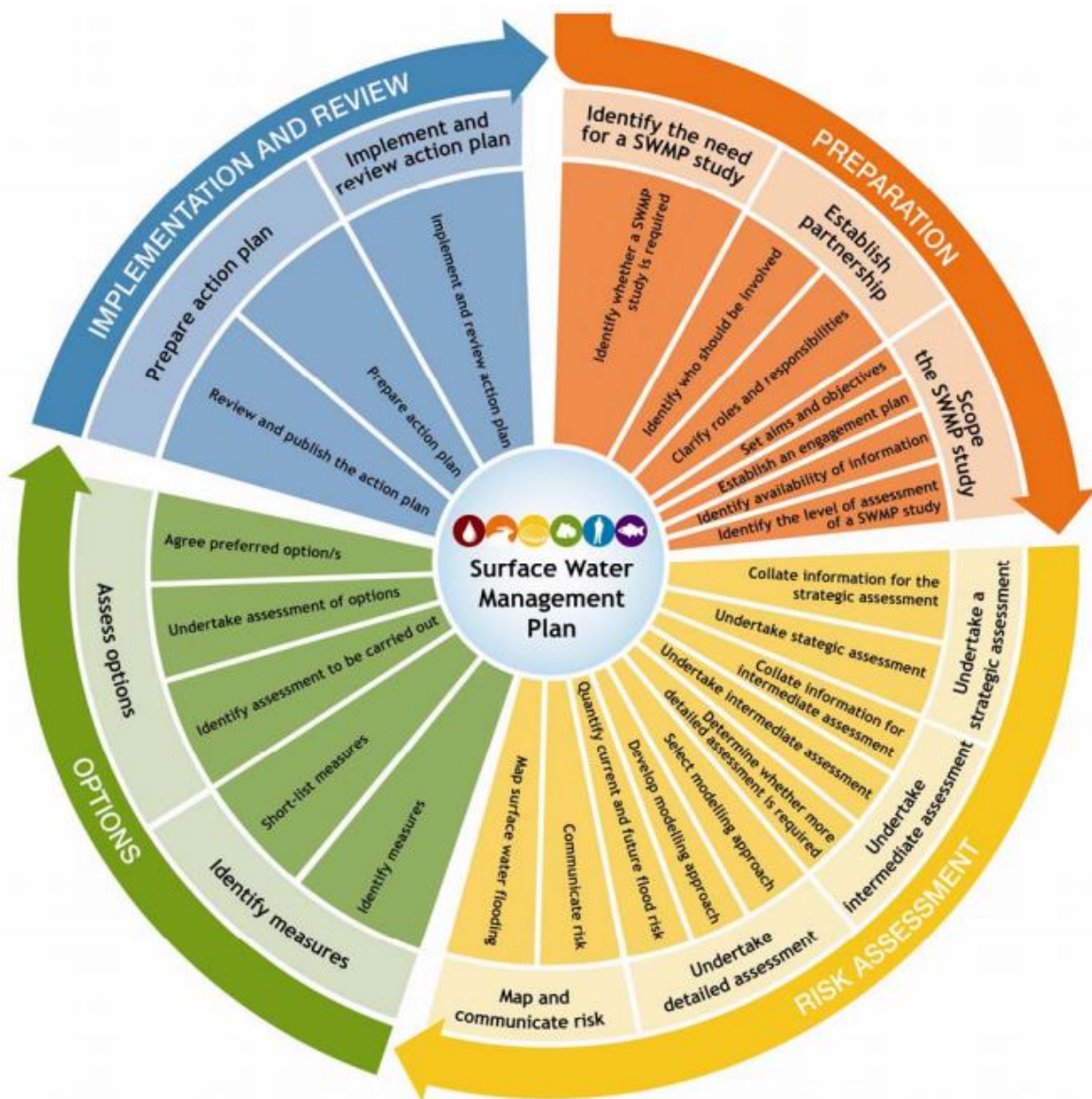


Figure 1-1 Recommended SWMP process (DEFRA, 2010)

1.2.2 Structure

This SWMP will follow the process laid out in DEFRA’s SWMP Technical Guidance. The four main phases are summarised below:

PREPARATION - The scope of the report including its purpose, objectives, data used, and relevant stakeholders are laid out in this introduction. The flood risk context in the borough is detailed in *Section 2*, which provides mapping and information on various sources of flood risk throughout the borough. *Section 0* explains the methodology utilised in this SWMP, which differs from the 2011 SWMP. Instead of producing CDAs which were the key output of the previous SWMP, this document produces hydrological Basins, Catchments and Hotspots.

RISK ASSESSMENT - In order to make this document user friendly, each hydrological Catchment identified by the analysis has its own section within the report. The risk of surface water flooding identified within each Catchment is detailed within *Sections 4 –14* including information on:

- *Catchment Extents* – this summarises the physical characteristics of the Catchment and any key features within it.
- *Changes since 2011* – a summary of any modelling, flood risk studies or FASs which have been carried out since the 2011 SWMP. It also identifies any CDAs, or Local Flood Risk Zones identified by the previous SWMP.
- *Hotspots and Properties at Risk* – This section details the flooding Hotspots identified by the analysis, and how many properties are at risk of surface water flooding within the Catchment.
- *Historic Flood Records* – an overview of any reported flood incidents held by LB Southwark and whether these fall into identified Hotspots.

OPTIONS - Following this, *Section 15* considers potential borough-wide mitigation options for the surface water flood risks which have been identified. These options follow the source-pathway-receptor model, which seeks to alleviate the risk as early as possible.

IMPLEMENTATION AND REVIEW – Once the high-level options have been considered, an Action Plan has been created along with a Stakeholder engagement plan. These sections can be used in conjunction to address the flood risks identified earlier in the document, as the stakeholder engagement plan aids the delivery of the SWMP Action Plan.

Below is a summary of the structure used in this and the previous SWMP (*Table 1-1*).

Table 1-1 Comparison between 2011 and updates SWMP structure

DEFRA SWMP Process	Section in 2011 SWMP	Section in 2021 SWMP
Preparation	1 – Introduction 2 – Preparation	1 – Introduction 2 – Flood Risk Overview 3 – Basin Based Approach
Risk Assessment	3 – Risk Assessment	4-14 – Catchment portfolios
Options	4 – Options	15 – Borough-wide Options
Implementation and Review	5 – Implementation and Review	15 – Action Plan 15 – Stakeholder engagement plan 16 - Recommendations

1.2.3 Relevant projects

Since publication of the first SWMP in 2011, several schemes have been put in place to reduce the risk of flooding in the area, listed below:

- Comber Grove and Southampton Way Pocket Parks
- Delawyck Crescent SuDS Scheme
- Herne Hill FAS
- SuDS and attenuation in Coleman Road and St George’s Church of England school

There are also multiple projects in planning or implementation phases which are due to be delivered over the next few years, including:

- The Lost River Peck FAS
- SuDS at Local Authority Housing - Astley House, Cameron House, Mawbey House, Caversham House, Wakefield House, Champion Hill
- SuDS at London Bridge - Lewes House (North and South), Melior Street and Snowsfields
- Paxton Green

The Lost River Peck FAS has been approved FCERM Grant in Aid funding through the EA. This funding is being used to revitalise the area surrounding the historical River Peck, aiming to reduce the risk of flooding to 133 properties. The remaining projects are being funded by LB Southwark, with some contributions from external stakeholders (e.g. Thames Water Utility Limited (TWUL)). More details about these projects can be found in the relevant Catchment portfolios (Sections 4 - 14).

All of the projects listed above may influence surface water flood risk in the future, so they will be considered in each Catchment portfolio as well as the Action Plan and recommendations.

1.3 Data overview

Data has been compiled from multiple sources and stakeholders to get a thorough picture of the potential risk of surface water flooding in the borough. This has supplemented data held by LB Southwark LLFA, and their knowledge on FASs and projects in the area. *Table 1-2* shows the various data sources, and how the data has been utilised in the SWMP.

Table 1-2 Data and sources used in the SWMP

Source	Data	Use in SWMP
British Geological Survey (BGS)	Geological Map	To understand and map the context
	Groundwater Flooding Susceptibility	To understand and map the flood risk from groundwater
Environment Agency	Detailed River Network	To understand and map the context
	Properties at Risk of Flooding for the 1 in 30, 1 in 100 and 1 in 100-year return periods (2014)	To understand and map the flood risk from multiple sources
	RoFSW Flood Extent 1 in 30 , 1 in 100 and 1 in 1000 years (2020)	
	Flood Map for Planning Rivers and Seas Zones 2 and 3	
	Recorded Flood Outlines	
	Reservoir Flooding Max Depth	
	LiDAR data	To map and understand the topographical context
LB Southwark	Land Use	To understand the land use context of flood risk in Southwark
	Flood Incident Data	To understand and visually represent the flood risk as well as validate the EA RoFSW data
	Local Authority Administrative Boundaries	For representation in mapping
	2011 SWMP CDA dataset	As comparative basis for new Catchments and Hotspots

	Drainage Asset Data	To understand the sewer network and define the Basins and Catchments
Thames Water	Sewer Flooding Incident Data (at post code level)	To understand and map the flood risk from sewers
	Drainage Asset Data including foul, surface water and combined sewers	To understand the sewer network and define the Basins and Catchments

1.4 Stakeholder engagement

Aside from providing data for the SWMP analysis, stakeholders and partners have been engaged throughout the project to ensure that it is a collaborative document which represents surface water flood risk accurately. The active involvement of the stakeholders listed in *Table 1-3* has enabled the successful delivery of this SWMP.

Table 1-3 Stakeholder Involvement in the SWMP

Stakeholder	Involvement
LB Southwark	
LLFA	<ul style="list-style-type: none"> Acted as main liaison throughout the formation of the SWMP. Attended a stakeholder engagement meeting to review the new Basins and Catchments created and to ensure that known areas of flood risk are being captured and represented correctly. Provided information on proposed and ongoing schemes since 2011 for incorporation into relevant Basin and Catchment sections.
Highways Team	<ul style="list-style-type: none"> Attended a stakeholder engagement meeting to review the new Basins and Catchments created and to ensure that known areas of flood risk are being captured and represented correctly. Provided feedback on content of the SWMP throughout various stages to ensure that content was accurate and relevant.
Key Organisations	
EA	<ul style="list-style-type: none"> Provided relevant datasets listed above.
TWUL	<ul style="list-style-type: none"> Provided relevant datasets listed above.
Cross boundary boroughs	
LB Lewisham LLFA	<ul style="list-style-type: none"> Engaged to review the new Basins and Catchments created and to ensure that known areas of flood risk are being captured and represented correctly.
LB Lambeth LLFA	<ul style="list-style-type: none"> Engaged to review the new Basins and Catchments created and to ensure that known areas of flood risk are being captured and represented correctly.
LB Croydon LLFA	<ul style="list-style-type: none"> Engaged to review the new Basins and Catchments created and to ensure that known areas of flood risk are being captured and represented correctly.
LB Bromley LLFA	<ul style="list-style-type: none"> Engaged to review the new Basins and Catchments created and to ensure that known areas of flood risk are being captured and represented correctly.

2 FLOOD RISK OVERVIEW

Detailed mapping of Southwark attributes and flood risk can be found in the appendices. Maps have been referenced throughout the following chapter.

2.1 Borough overview

Southwark covers areas of south and central London, with the River Thames forming the northern boundary of the borough. Its neighbouring boroughs are LB Lewisham to the east, LB Bromley to the southeast, LB Croydon to the southwest, and LB Lambeth to the west. Generally, the topography of the borough is low-lying to the north and inclines to the south. The south-eastern tip of the borough is the highest point in the borough (*Appendix 1.1*).

The borough contains the following infrastructure and amenities:

- London Bridge, Tower Bridge, Blackfriars Bridge, and the pedestrian Millennium Bridge
- Landmarks such as the Shard, Borough Market, and the Globe Theatre
- Major roads A2, A3, A202 (Peckham- Camberwell- Vauxhall- Westminster Highway)
- Hospitals including Guy's and St Thomas' Hospital, Kings College Hospital

Land use in the borough has been mapped in *Appendix 1.2*, showing that the borough is largely urban. From north to south, large green spaces in the borough include Stave Hill Park, Southwark Park, Burgess Park, Peckham Rye Park and Common, Dulwich Park, Belair Park and Horniman Gardens. The southern part of the borough also contains Dulwich and Sydenham Golf Club, Sydenham Hill woods and Dulwich woods making the southern part of the borough greener in general.

2.2 Interactions with neighbouring authorities

Southwark is part of the Thames River Basin District and the EA's Thames Region. The South-Central London Strategic Flood Partnership was set up during the creation of the 2011 SWMPs by Drain London. This group reports to the Thames Regional Flood and Coastal Committee quarterly, through a representative councillor. The group involves neighbouring boroughs including LB Lambeth and LB Lewisham. It is also attended by an EA Thames Flood Advisor and contacts from stakeholders such as TWUL.

2.3 Flooding overview

DEFRA's 2010 guidance on SWMPs identifies the main sources of flooding to be studied within a SWMP, which include:

- Surface Water
- Groundwater, including overland flows from groundwater
- Sewers
- Open-Channel and Culverted Watercourses

Sections 2.4 to 2.6 provide definitions of these types of flooding and outline the risk within the borough. *Sections 2.7 and 2.8* define the other types of flooding influencing the borough including risk

from fluvial, tidal and artificial sources. Section 2.9 then demonstrates how flooding has impacted the borough in the past by reviewing previous flood incidents in Southwark.

2.4 Surface water flood risk

Surface water flooding is caused by rainfall that cannot drain away which results in pooling or overland flow of water, as [defined in the FWMA \(2010\)](#). This is often caused by short, intense rainfall which cannot infiltrate below ground or enter the drainage system due to blockages or capacity issues. Excess water tends to pool at local low points and can form flow paths along roads, open spaces and within built-up areas. This kind of flooding can occur quite suddenly in urban areas because the extent of impermeable surfaces in an area, for example roads, roofs, and carparks, influences the volume of surface water runoff. Increasing the proportion of impermeable surfaces in an area increases the rate and frequency at which surface water flooding occurs. This makes surface water flooding a more prevalent problem in urban areas such as Southwark.

Surface water flooding tends to have less serious consequences compared to other forms of flooding, such as fluvial flooding, due to its shorter duration. However, it can still cause significant local damage and disruption particularly in sudden, intense rainfall events. High intensity, short duration rainfall events are typical in summer storms, but surface water flooding can occur at any time of the year. Flooding often occurs around rainwater gullies which may have become blocked, or the sewer may have reached capacity.

The EA's Risk of Flooding from Surface Water (RoFSW) dataset is based upon national-scale modelling to identify surface water flood risk areas. This is based upon topography and a catchment-based rainfall loss estimation. It provides data on the extent and depth of surface water flooding which has been modelled at a 2m grid scale. The RoFSW extents have been used in this SWMP to validate the flood incident records at a catchment-wide scale, and these incidents are displayed alongside the EA's RoFSW within *Appendix 1.3*.

2.4.1 Surface water flooding

The risk of surface water flooding is widespread across the borough. However, the highest risk of surface water flooding appears in four places:

- Areas surrounding Burgess Park, particularly to the south
- Between Peckham High Street and Old Kent Road – areas of Peckham around Caroline Gardens and Bird in Bush Park
- Dulwich Park, and Dulwich and Sydenham Golf Club
- East Dulwich Train station, and the areas to the southwest and northeast.

These areas have a risk of surface water flooding in a 1 in 30-year rainfall event, or a 3.3% Annual Exceedance Probability (AEP). This means that each year there is a 3.3% probability that a rainfall event of that size will occur.

2.4.2 Ordinary watercourse flooding

Ordinary watercourses are watercourses that do not form part of a main river, as defined in the [Land Drainage Act \(1991\)](#). The FWMA 2010 defines any watercourse that is not a main river, as an ordinary watercourse, including ditches, dykes, and drains but excluding public sewers. Flood risk

from ordinary watercourses is not the responsibility of the EA who manage the risk from main rivers, and thus the risk of flooding from Ordinary Watercourses is managed by the LLFA. Similar to main rivers, ordinary watercourses flood when the capacity of the channel is exceeded, causing water to overtop its banks onto adjacent land. Ordinary watercourses are typically faster responding than main rivers, meaning rainfall is a large controlling factor on water level. Southwark has two ordinary watercourses which run through Rotherhithe. One connects the Canada Water dock with Surrey Water and the Thames flowing through residential and commercial areas. The other flows between the Thames at the Lavender Ponds, through Stave Hill Ecological Park towards the Greenland Dock, becoming culverted at some points in the park. Flood risk from ordinary watercourses is included in the EA's RoFSW maps (*Appendix 1.3*).

2.4.3 Properties at risk

In 2013, the EA produced the RoFSW which enabled the number of properties at risk of such flooding to be identified. It has been calculated that in Southwark there are 7,130 properties at risk of flooding during the 1 in 100-year event (1% AEP) according to this modelling. For comparison, it is stated in the 2011 SMWP that 30,280 residential properties and 2,530 non-residential properties were at risk of flooding at a depth of 0.3 m in the 1 in 100-year event. The number of properties at risk has reduced drastically in this SWMP as the depth threshold for internal property flooding was increased by the EA modelling. The modelled ground level was raised within building footprints by an average of 0.3m to represent the way that the average building would not flood internally until water outside is 0.3m deep due to the height of thresholds. Once the modelled water level reaches that threshold, the buildings are flooded. More information on how this property data has been processed for use in the SWMP can be found in *Appendix 2.5*.

A breakdown of the types of properties at risk in the 1 in 30, 1 in 100 and 1 in 100-year events are presented in *Table 2-1*. The properties at risk within each hydrological Catchment will be detailed in *Sections 4 - 14*. In *Table 2-1*, the 'Other' category includes information about educational, religious, transport, and other infrastructural properties, as well as unclassified properties that have been identified as being at risk but have not been assigned a code due to lack of information. The EA periodically reviews unclassified properties when new information is provided to them.

Table 2-1 Number of properties at risk of flooding from surface water in Southwark

Property Type	Properties at RoFSW - 1 in 30-year Rainfall Event	Properties at RoFSW - 1 in 100-year Rainfall Event	Properties at RoFSW - 1 in 1000-year Rainfall Event
Residential	1,674	5,028	16,678
Commercial	257	832	2,861
Other	434	1,270	4,341
Total	2,365	7,130	23,880

Aside from the EA's RoFSW modelling, LB Lambeth have conducted hydrological modelling across the borough of Lambeth during the completion of their own SWMP. LB Lambeth have utilised a similar catchment-based approach in this, meaning that some areas of Southwark are incorporated into their modelling. This modelling has been used to inform the creation of Catchments used in the SWMP analysis, which is explained further in *Section 3.3*. Lambeth's modelling has also been

considered within each Catchment Section (*Sections 4-14*). It is recommended that any future updates to modelling or new hydrological modelling should be incorporated into future updates to the SWMP to ensure that understanding of flood risk in the borough is up to date.

2.5 Groundwater flood risk

Groundwater flooding occurs when water flowing through the sub-surface geological strata rises above the ground. This occurs due to natural seasonal fluctuations in groundwater level which rise and fall over weeks or months, making this risk of flooding the least reactive to rainfall events. This also means that the effects of groundwater flooding may persist for long periods. Groundwater levels can influence local river levels which may exacerbate fluvial flooding. Intense rainfall events may contribute to groundwater flooding, as runoff can infiltrate into the ground and increase the groundwater level. It can be difficult to immediately differentiate groundwater flooding from other sources such as surface water or sewer flooding.

Groundwater flood risk varies from low or negligible risk in the south of the borough, to high susceptibility to groundwater flooding in the north. Groundwater susceptibility mapping is available in *Appendix 1.4*. Most of the south of Southwark has <25% susceptibility to groundwater flooding, whereas Elephant and Castle in the northwest has more than 75% susceptibility, and the surrounding areas (Walworth, Elmington Estate, Bermondsey) have >50% to 75% susceptibility to groundwater flooding.

The risk of groundwater flooding is influenced by the local superficial and bedrock geology, which can be viewed in *Appendix 1.5*. The bedrock geology is mainly made up of London Clay to the east and south, Lambeth Group arching through the centre of the borough, and more permeable Thanet Formation beds in the northeast which surrounds a section of Sussex White Chalk Formation around South Bermondsey. Where the bedrock geology has a low hydraulic conductivity such as clay, water cannot easily infiltrate down away from the surface, which can increase the risk of surface water flooding.

Superficial deposits which lie on impermeable bedrock can retain some water, but the water will have limited capacity to move down into the bedrock. This can create aquifers or localised areas of groundwater throughflow. The northern half of the borough has superficial deposits due to the influence of the River Thames. These deposits are made up of alluvium near to the north and northeast, river terrace deposits between Elephant and Castle and Denmark Hill stretching to Bermondsey and Peckham, and a small area of glacial deposits in Rotherhithe. These deposits are mainly made up of unconsolidated sediments consisting of gravel, sand, silt and clay. These layers are more likely to facilitate infiltration or contain perched water within them.

2.6 Sewer flood risk

Sewer flooding occurs when the volume of rainfall entering the sewer is too large to be contained. This results in the sewers backing up, surcharging and creating overland flow. A lack of capacity in the sewers may be due to:

- Rainfall events exceeding the system-designed event
- Increase in sewer flow due (e.g. due to climate change or new developments)
- Failure of key infrastructure such as pumps or valves
- Poor maintenance causing silt build-up, blockage or collapse

- Watercourses culverted or incorporated into the drainage system i.e. 'lost rivers'
- Groundwater infiltrating into pipes which are in poor condition
- Limited outflow from the sewer due to high water levels in receiving watercourses

The impact of sewer flooding is usually locally confined. However, it can also be rapid and unpredictable. Furthermore, this kind of flooding is often contaminated with sewage, which is a health hazard, and unpleasant.

In Southwark, foul and surface water is serviced by TWUL. The sewerage network in the area is made up mostly of combined sewers, which transport both surface and foul sewage in the same system. The sewer system and associated infrastructure is dated and not built to withstand high intensity rainfall such as a 1 in 100-year event. This results in associated sewer flooding where the assets cannot cope with the volume of water.

TWUL has provided sewer flood incident data on a postcode scale as the data is sensitive in nature. This is presented in *Appendix 1.6* and explored further in *Section 2.9.1*. The risk of sewer flooding appears to be greatest towards the south of the borough, with SE22 0, SE24 9, SE21 7 and SE22 8 having the highest number of sewer flooding incidents according to TWUL's records (*Table 2-2*).

2.7 Fluvial flood risk

Watercourses are categorised as either a main river or ordinary watercourse based on its local hydrological importance. The risk of flooding from main rivers, 'fluvial' flood risk, has the potential to cause high-impact, wide reaching damage endangering lives, property, infrastructure, and the environment. The EA is responsible for managing the risk of flooding from main rivers, meaning they have statutory duties, powers, and responsibilities towards them.

The only main river influencing Southwark is the River Thames which forms the northern boundary of the borough. The fluvial Flood Zones are areas predicted to be at risk from river flooding. In the borough, areas within Flood Zone 2 are predicted to have between a 1 in 100 and 1 in 1,000 annual probability of river flooding, or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. Areas within Flood Zone 3 are predicted to be at a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. *Appendix 1.7* maps the main rivers in the borough and the risk resulting from them. It shows that the northern half of the borough is at risk of fluvial flood from the River Thames and benefits from river and tidal flood defences. Areas at risk are to the north of the A202 (Peckham Road/ Peckham High Street). There are small areas where the flood risk is reduced including Herne Hill, parts of Borough and small areas of Walworth.

More information can be found in LB Southwark's [SFRA](#) published in 2017.

2.8 Flood risk from other sources

2.8.1 Tidal flood risk

Tidal flooding can occur during extreme high tide or storm surges. Southwark is within the tidal extent of the River Thames, so must consider the risk that this poses to the borough. Southwark is protected by the Thames Barrier and other flood defences along the River Thames, which protect the borough from tidal and fluvial flooding up to the 1 in 1000-year event. The EA produces

mapping which shows the risk of flooding if the Thames Barrier were to fail, shown in *Appendix 1.7*. This shows that the northern half of the borough is at risk of tidal flooding and benefits from tidal defences.

2.8.2 Artificial flood risk

Artificial flooding occurs as a result of infrastructure failure or human interaction. Typical flood sources can include reservoirs or canals. The EA's Risk of Flooding from Reservoirs mapping shows the extents of flooding from artificial sources, shown in *Appendix 1.8*. The area of risk from artificial sources hugs the eastern borough boundary. It extends south of the railway line at South Bermondsey station, out to the south of Burgess Park, south to Nunhead, and covers Peckham Rye Park and Common, Nunhead Cemetery, and most of Peckham town.

2.9 Recorded flood incidents within Southwark

LB Southwark collects information on flooding in the borough and keeps a record of incidents. Information is collected on flooding from all sources as is not limited to significant events. This helps the LLFA build a picture of flooding across the borough and can aid understanding of how flood risk is changing, particularly with climate change and the implementation of FASs or SuDS. LB Southwark currently have records of over 102 flood incidents (some reports quote several incidents) within the period 2001 – 2021, with one additional report from 1953. Flood reports made after this date could not be included in the report as analysis had begun, and reports could not be added without changing the methodology (explained further in *Section 3.2.1*). The majority of these reports are in the northern half of the borough, particularly the northwest around Elephant and Castle and the area near the River Thames between Waterloo and London Bridge station. It should be noted that the flood incident dataset is limited, as not all flood incidents will be reported to the Council; some may be reported to other RMAs such as TWUL or the EA, and some may not be reported at all. TWUL and EA flood data is presented in this report, but this may also be incomplete. Residents are encouraged to report incidents of flooding to LB Southwark through the details on [their website](#), along with reporting to other relevant RMAs depending upon the source of flooding. Surface water flood incident data has been used to validate the RoFSW data (*Appendix 1.3*) and has also been used during the creation of Hotspots.

Recorded flood extent data has also been provided by the EA for fluvial flooding (*Appendix 1.9*, *Appendix 1.10*). This shows that Southwark has experienced floods directly adjacent to the River Thames around Rotherhithe, Bermondsey and around London Bridge. Flooding is particularly notable around docks and quays at the riverside.

2.9.1 Sewer flood incidents

Sewer flood incidents are the responsibility of TWUL in Southwark as they are the local water company. In the past, TWUL has gathered flood incident reports through phone calls and postal report forms. They have recently moved to an online report form accessed through their website. This may change the rate at which sewer flood incidents are reported to TWUL. In total, there were 132 recorded sewer flood incidents across Southwark. The locations and types of incidents have been presented in *Table 2-2*. The largest number of incidents have occurred in postcode SE22 0 which covers the area to the southwest of Peckham Rye Park and Common. The next highest

postcodes are SE24 9 with 11 incidents, SE21 7 with nine incidents, and SE22 8 also with nine incidents. These are grouped together in the south of the borough as shown in *Appendix 1.6*.

Table 2-2 TWUL Sewer Flood Incidents

Postcode	Internal			External			Total
	2 in 10 year	1 in 10 year	1 in 20 year	2 in 10 year	1 in 10 year	1 in 20 year	
SE22 0	1	13	20	0	3	0	37
SE24 9	0	7	3	0	1	0	11
SE21 7	1	2	2	0	4	0	9
SE22 8	0	3	5	0	0	1	9
SE17 2	0	0	8	0	0	0	8
SE5 9	0	2	5	0	0	0	7
SE23 1	0	0	4	0	2	0	6
SE22 9	0	1	4	0	0	0	5
SE26 6	0	0	2	0	0	3	5
SE21 8	0	2	0	0	1	1	4
SE1 2	0	0	3	0	0	0	3
SE14 5	0	0	1	0	2	0	3
SE15 3	0	0	3	0	0	0	3
SE16 3	0	2	1	0	0	0	3
SE15 5	0	0	2	0	0	0	2
SE24 0	0	1	1	0	0	0	2
SE5 8	0	0	1	0	0	1	2
SW9 6	0	0	1	0	0	1	2
SE1 0	0	0	1	0	0	0	1
SE1 7	0	0	1	0	0	0	1
SE1 9	0	0	0	0	0	1	1
SE11 4	0	0	1	0	0	0	1
SE11 6	0	0	1	0	0	0	1
SE15 2	0	0	1	0	0	0	1
SE16 2	0	0	0	0	1	0	1
SE16 5	0	0	1	0	0	0	1
SE17 1	0	0	1	0	0	0	1
SE5 0	0	0	1	0	0	0	1
SE5 7	0	0	1	0	0	0	1
Total	2	33	75	0	14	8	132

3 BASIN BASED APPROACH

3.1 Why this approach

The approach used in this SWMP has been chosen because of recommendations from the EA to utilise an integrated catchment-based flood risk management approach. This approach was recommended in the 2013 policy framework [Catchment Based Approach: Improving the quality of our water environment](#). The framework encourages collaborative working at the river-catchment, sub-catchment, and local scales. This means that a variety of stakeholders can work together to prevent flood risk within the natural flow path of water, rather than within administrative boundaries. Many LLFAs are adopting this approach as they update SWMPs and LFRMSs; aligning these study areas creates consistency in flood risk management approaches across space.

As well as aligning better to the EA's catchment-based approach to managing fluvial flood risk, this method uses more accurate hydraulic modelling meaning that hydrological processes are better represented. The modelling used in the 2011 SWMP did not fully integrate the local drainage system and topography, meaning surface water was not properly accounted for.

The approach used in this SWMP varies from the previous, which identified, defined, and prioritised CDAs and smaller Local Flood Risk Zones. Although this allowed focus on the most at-risk areas, it meant that areas outside of the CDAs were not analysed to the same extent. The Basins and Catchments identified in this SWMP cover the whole geographic area of the borough meaning that flood risk is more thoroughly evaluated. *Figure 3-1* shows the new Basins against the locations of CDAs from the 2011 SWMP. The new approach reflects the predicted flow paths of rainfall runoff regardless of whether it is over the surface, in watercourses or in the sewer network and mirrors the source-pathway-receptor model for managing flood risk.

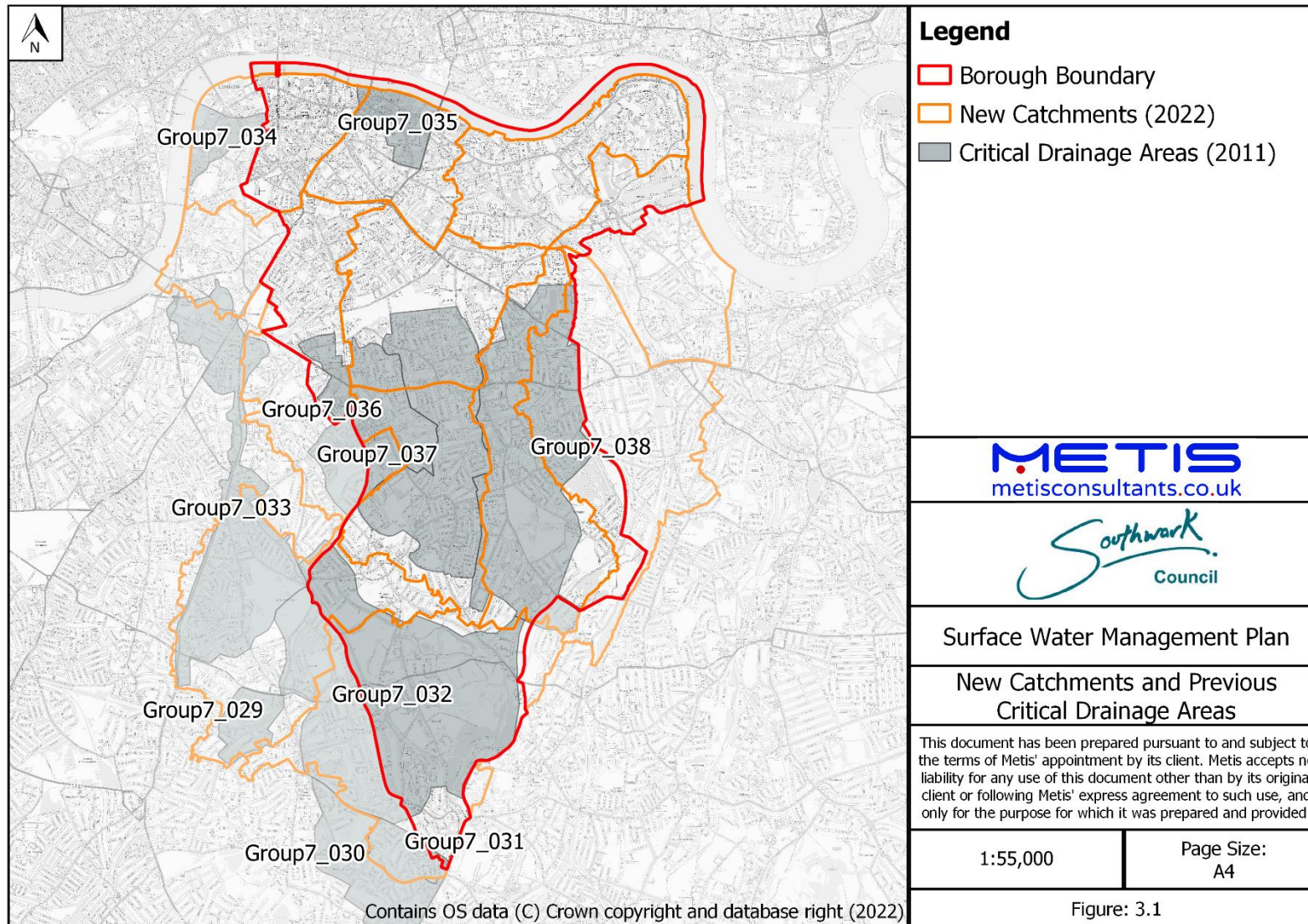


Figure 3-1 2011 SWMP Critical Drainage Areas and 2022 SWMP New Catchments

3.2 How the approach was applied

The catchment-based approach was applied by creating hydrological Basins and Catchments using GIS analysis. For the purposes of this report, the definition of a Basin is an area where all of the rain that falls within that area flows towards the same natural low point. Catchments are smaller areas within each Basin which link together to form the wider hydrological Basin.

Lidar elevation data (DTM) was analysed using a GIS Watershed tool which identified the natural low points that water would naturally flow towards. This was used to define the natural hydrological Catchments, and wider Basins, within the borough. Once these general areas were identified, they were refined using:

- Topographical features
- Detailed river network and ordinary watercourses
- Surface water and combined sewer system with flow direction
- Flow paths identified by watershed analysis
- Local features such as railways and major roads

This refinement was restricted to within the borough boundaries as areas outside of this were not the focus of the analysis. However, the neighbouring borough LB Lambeth has recently completed the update of their SMWP and completed detailed hydrological modelling on a catchment scale through this project, also utilising the catchment-based approach. Where appropriate, the Catchment boundaries identified in this SWMP have been edited to match the ones created by LB Lambeth LLFA. Catchment boundaries of S05, S10 and S11 have been aligned with the Catchments identified by Lambeth in their SWMP where the catchment boundaries fall outside of the borough. Within Southwark administrative boundaries, Lambeth's catchment boundaries have been used as a guide due to the more in-depth hydrological modelling undertaken. However, the boundaries have been adjusted where major infrastructural features or sewer flows would influence the hydrological catchment. This alignment will allow for easier cross-boundary identification of risk and partnership working in future.

A total of four Basins containing 11 Catchments were identified across Southwark, shown in *Figure 3-2*.

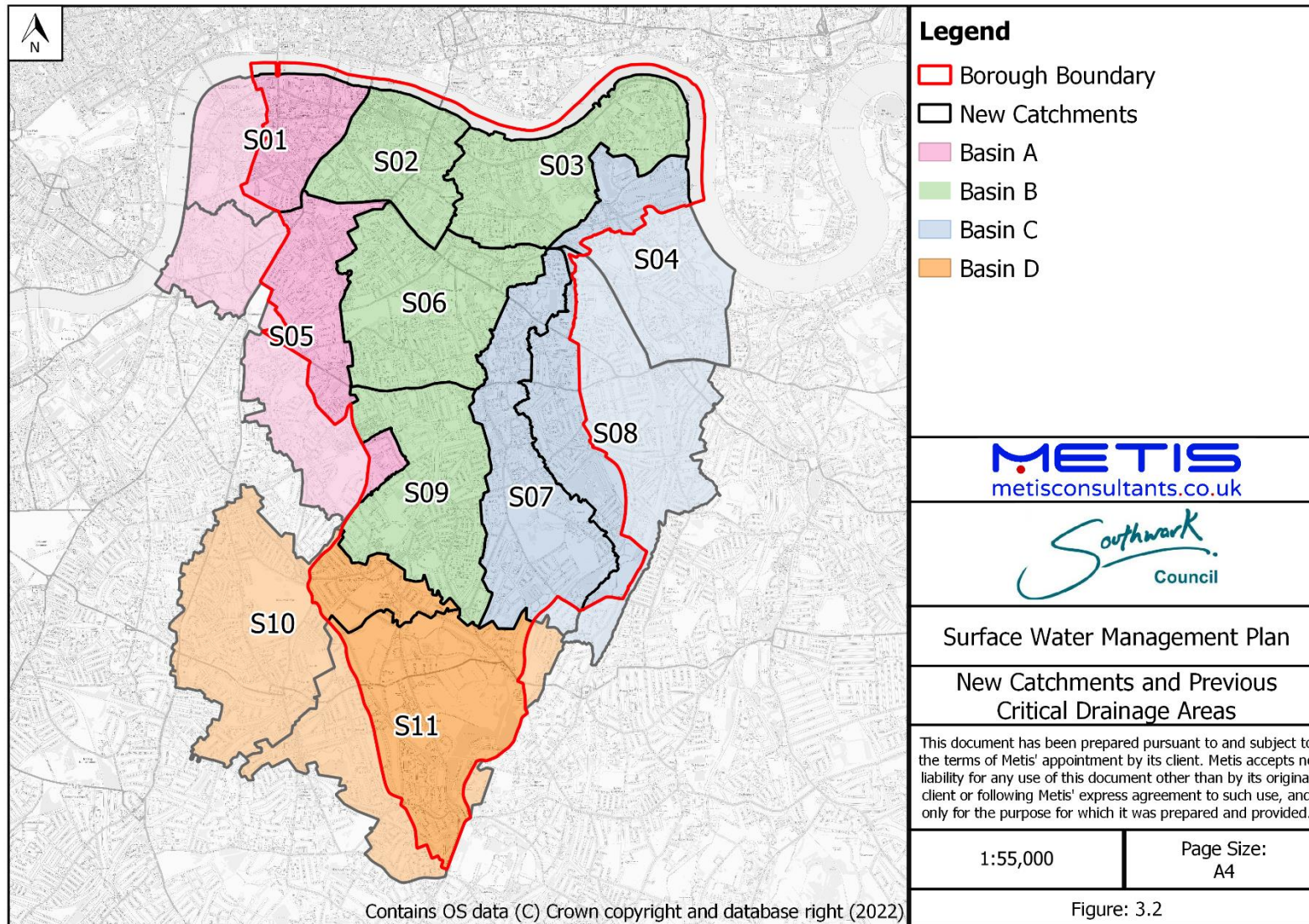


Figure 3-2 Hydrological Basins and Catchments in LB Southwark

3.2.1 Hotspot creation

The main part of the SWMP analysis was the creation of Hotspots - local areas of flood risk. These Hotspots were defined as *areas with 15 or more properties at RoFSW at ground or basement level in a 1 in 100-year event, as defined by EA modelling data*. The definition of ‘properties’ includes flats within a building, so 15 ground floor flats identified as at risk within one building would qualify as one Hotspot.

Each Catchment was analysed in turn to identify clusters of properties that contained 15 or more properties. The boundaries of each Hotspot were defined by:

- The location of identified properties at risk
- The local sewer system
- The EA’s RoFSW mapping
- Local features
- Historic flood incidents

Some of the Catchment boundaries may not align to the Basin boundaries due to this refinement process. *Table 3-1* provides a breakdown of the Basins and Catchments in the report.

Table 3-1 Basins and Catchments

Code	Basin	Catchment Code	Catchment Name	Cross-Boundary Authority
A	Southwark-Lambeth North	S01	Waterloo	LB Lambeth
		S05	Newington	LB Lambeth
B	Southwark Central	S02	London Bridge	N/A
		S03	Rotherhithe	N/A
		S06	Burgess Park	N/A
		S09	East Dulwich	N/A
C	Southwark-Lewisham	S04	Surrey Quays	LB Lewisham
		S08	New Cross	LB Lewisham
		S07	Peckham Rye	N/A
D	Southwark-Lambeth South	S10	Dulwich Village	LB Lambeth
		S11	West Dulwich	LB Lambeth; LB Croydon; LB Bromley

3.3 Cross boundary basins

Several of the identified Basins were not confined to the borough boundaries because of the hydrological catchment-based method used. Once refined, the Basins and Catchments were shared with neighbouring boroughs to ensure that the Catchment boundaries did not contradict with local modelling or strategic areas identified by neighbouring LLFAs. Where appropriate, Catchments were aligned with risk areas identified by LB Lambeth during their recent SWMP update. This is because LB Lambeth completed hydrological modelling as part of their methodology, meaning the hydrological catchments which they have defined will be more locally specific and up to date than the RoFSW mapping produced by the EA, or topography alone. Apart from this, neighbouring LLFAs were satisfied by the Basins and Catchments identified by the hydrological analysis.

3.4 Validation analysis

A high-level validation exercise was completed to check the Basins created through the Watershed analysis and refinement process. This was done by visually comparing the Basins with LB Southwark's historic flood reports and the EA's RoFSW mapping completed in 2013 for a 1 in 30-, 1 in 100- and 1 in 1000-year rainfall event. This mapping can be found in *Appendix 2.1-2.4*. The EA's RoFSW data was also used to quantify the number of properties at risk from surface water flooding in each Catchment.

3.4.1 Basin A

Basin A covers the northwest corner of the borough and is bordered by the River Thames from London Bridge to Vauxhall. Basin A also overlaps with the northwest of the Lambeth borough. This basin has various area of open semi-natural land which include Nelson Square Park and larger areas around the Imperial War Museum, as well as Myatt's Fields Park and Ruskin Park outside of Southwark but within the Basin A boundary.

There is a cluster of surface water flood incidents to the north of the Basin, particularly incidents along Blackfriars Road (A201) dating from 2006 to 2020. There are also several surface water flood incident records spread around the Elephant and Castle area from 2006 and 2016. This aligns with what is expected due to the topography which slopes from south to north; water will flow towards the River Thames and may cause surface water flooding on the way. The highest levels of Basin A are located in the south-eastern corner, with the lowest levels towards the River Thames except for some depressions located within the basin.

The predicted surface water flood risk is particularly high between Newington and Camberwell, and in the area to the south of the Tate Modern art gallery in the Southwark town area.

This Basin contains parts of old CDAs, including all of CDA 34 and parts of CDA 36 and 33.

3.4.2 Basin B

Basin B is the largest of the four Basins produced for Southwark and covers the central portion of Southwark. Basin B includes a large section of Southwark that borders the River Thames and also encompasses the area from Bermondsey south to East Dulwich. To the northeast of the catchment there are large areas of open semi-natural land which include Southwark Park and Stave Hill Ecological Park. Other large areas of open semi-natural land include Burgess Park in the centre of Basin B and Greendale Playing Fields located to the south of the Basin. This Basin also has some area of inland water which include, ponds/lake in Sunray Gardens, Burgess Park and Southwark Park.

There is a fairly sporadic coverage of surface water flooding incidents across the borough with a greater number located towards the north of Southwark where the topography slopes towards to the River Thames creating south to north flow paths through this Basin. There is a particular group of surface water flooding incidents located along the A200 (Lower Road) northwest of Surrey Quays station. These occurred in 2007 and 2015.

The Basin's topography shows that there are some low points located within the Basin however the Basin slopes south to north towards the River Thames where its lowest points are recorded.

The highest area of Basin B is located towards the East Dulwich Village area in the southeast of the Basin.

There are significant areas with a predicted surface water flood risk located in the centre of Basin B around, and including, Burgess Park, and the roads south of the park and towards Camberwell. This area has varying levels to the RoFSW rainfall events, but the validation analysis shows that this area is highly susceptible to flood risk from surface water.

Basin B includes several of the CDAs produced in previous analysis, these include CDAs 35, 36, 37, with some slight overlap with CDA 38.

3.4.3 Basin C

Basin C encompasses the eastern side of Southwark from Surrey Quays in the north to East Dulwich in the south. This basin also covers parts of the LB Lewisham, including New Cross. There are various areas of open semi-natural land within Basin C with Peckham Rye Park and Common as a key area to note within the Southwark borough boundary. There are also a couple of sites of inland water which can be found in Peckham Rye Park and Common and Canada Water. One Tree Hill is a moderate area of woodland located in Honor Oak to the southeast of Basin C.

There are only a few surface water flooding incidents within the Southwark area of this Basin which do not form any clusters or present any particular trends within the Basin. The topography of the Basin shows that the land slopes from south to north with the lowest points found in the northeast and the highest points located in the southeast towards Honor Oak. There are some exceptions where there are some depressions within Basin C and railway lines running through the Basin are often higher than the surrounding area.

The RoFSW extents within Basin C show that there is a clear flow path along the A2215 continuing along the B238 and into Peckham Rye Park and Common. There is significant surface water flood risk predicted along these routes and further north through minor roads linking to Peckham High Street. There are also a significant proportion of roads north of Peckham High Street which show high risk from such flooding.

There is only one major CDA to overlap with Basin C which is CDA 38, the CDA 32 having a very minor overlap at the southern edge of the Basin.

3.4.4 Basin D

Basin D is situated in the south of Southwark and covers areas of Herne Hill, Dulwich Village, and Dulwich. Basin D also covers a large area within the LB Lambeth. Basin D has the largest area of open semi-natural land within Southwark with key areas to note being Belair Park, Dulwich Park and Dulwich and Sydenham Hill Golf Club. Neighbouring the Dulwich and Sydenham Hill Golf Club in the southeast of the Basin is a key area of woodland encompassing Dulwich Woods and Sydenham Hill Woods. Inland water to note can be found in Belair Park and Dulwich Park.

There is only one instance of surface water flooding reported within Basin D however this is situated outside of Southwark's borough boundary and is from the LB Lambeth's records. Basin D is the highest of all Southwark's Basins and has higher areas located along its south-eastern border. The lowest points of this Basin are positioned in Herne Hill to the northwest.

Within Southwark there is notable predicted surface water flood risk in Dulwich Park which extends across open land connecting with Sydenham Hill Woods. There is also notable risk along the A205 and around Dulwich College and its Sports and Leisure Centre.

A number of old CDAs overlap with Basin D which include CDA 29, CDA 30, CDA 31, CDA 32 and CDA 33. However only two of these CDAs are within / overlap Southwark's boundary which are CDA 32 and CDA 31.

3.5 Results

To summarise there are higher areas located in the southeast of Southwark which slope away towards the River Thames and the north of Southwark. The lay of the land therefore influences the flow paths which run through Southwark and will impact the direction and pool of surface water. There are a few key areas of high predicted surface water flood risk and some areas with clusters of reported flood incidents. However, reports of flooding do not always show a consistent pattern or alignment to the RoFSW extents. By using a basin and catchment-based approach, surface water flow paths can be considered across the whole borough so that more effective mitigation measures can be put in place using a holistic view of the catchment. This improves on the previous CDA approach applied in the 2011 SWMP which only focused on high-risk areas where mitigation measures may be less effective. This will allow for more practical management of surface water flood risk within Southwark.

4 CATCHMENT S01 – WATERLOO

4.1 Updates since 2011 SWMP

This Catchment previously contained a small section of CDA Group7_035, in the top right-hand corner of the Catchment covering Southwark Cathedral and the London Bridge station area (CDAs can be seen in *Figure 3-1*). Since the previous SWMP LB Lambeth has undertaken detailed hydrological modelling within parts of this Catchment through their SWMP analysis. The modelling only extends into part of Catchment S01, covering the southwestern grounds of the Imperial War Museum, and some roads near the borough boundary such as Baron's Place and Webber Row. Within the borough boundary, LB Lambeth's modelling was consistent with the EA's RoFSW modelling and did not provide much additional detail. LB Lambeth did not identify any CDAs for their SWMP update within this Catchment. For these reasons and to maintain consistency with the rest of the report, the methodology for identifying Hotspots has been kept the same as in Catchments with no additional modelling.

There are no ongoing or completed FASs within this Catchment.

4.2 Catchment extents

The Waterloo Catchment covers the area of North Southwark between London Waterloo train station and London Bridge Train station. The River Thames forms this Catchment's northern and western boundary. Borough High Street (A3) forms the eastern boundary, and the Catchment extends south to the Imperial War Museum on Brook Drive. Major infrastructure in the area includes London Waterloo Station, Lambeth North underground station, Westminster Bridge, and Waterloo Bridge in the Lambeth half of the Catchment. In the Southwark half of this Catchment, the following infrastructure is located: Southwark underground station, Blackfriars Bridge, Southwark Bridge, St George's Circus and the major roads coming off of it including London Road (A201), Lambeth Road (A3203), Waterloo Road (A301), and Borough Road (A3202). Generally, this Catchment is heavily urbanised, but green spaces in the area include Bernie Spain Gardens, Jubilee Park and Gardens, Archbishop's Park in LB Lambeth, Mint Street Park, and the grounds of the Imperial War Museum. The Catchment maps can be found in *Appendix 3*.

4.3 RoFSW and historic flooding

A number of areas in this Catchment are located within the 1 in 1000-year rainfall event RoFSW mapping extent. Areas at risk from a 1 in 30-year rainfall event are particularly prevalent within highways in the northern half of the Catchment. Although the RoFSW does not seem to form flow paths in this Catchment, there are areas of potential pooling to the south of the Tate Modern art gallery, and between Blackfriars Road and the York Road / Waterloo Road roundabout which contains the Imax cinema.

There are several incidents of surface water flooding recorded by LB Southwark in the area including four along Blackfriars Road, one on Southwark Street and one near the railway line on Great Southwark Street. Maps of the RoFSW and surface water flood incidents can be found in *Appendix 3.1*. TWUL has provided information on the sewer flood incidents in Southwark at a postcode level, which can be viewed in *Appendix 1.6* and *Table 2-2*. This indicates that there have been four sewer flood incidents

in the postcodes within the Catchment. Some of the postcodes extend outside of the Catchment so not all of these incidents may have happened within the Catchment itself, although at least one internal flood incident has occurred in SE1 0 which is fully contained by the Catchment, and one has occurred in SE1 9 area the majority of which is within the Catchment. A summary of the properties and property types within the RoFSW is presented in *Table 4-1*.

Table 4-1 Properties at RoFSW in Catchment S01 - Waterloo

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	63	258	1055
Commercial	51	168	517
Other	47	165	511
Total	161	591	2083

4.4 Summary of Hotspots

The 11 Hotspots which have been identified through the analysis have been presented in *Appendix 3.2* and summarised in *Table 4-2*.

Table 4-2 Hotspots in Catchment S01 - Waterloo

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S01_01	Borough, Borough Bankside Ward	Copperfield Street	52
S01_02	Bankside, adjacent to Tate Modern Museum, Borough Bankside Ward	Emerson Street and Park Street	36
S01_03	Elephant and Castle, St George's Ward	Brook Drive	31
S01_04	Borough, Borough Bankside Ward	Southwark Bridge Road, Sudrey Street and Bittern Street	28
S01_05	Blackfriars, Borough Bankside Ward	Colombo Street and Meymott Street	26
S01_06	Bankside, Borough Bankside Ward	Clink Street, end of Stoney Street	23
S01_08	Waterloo, St George's Ward	Webber Row	18
S01_07	Elephant and Castle, St George's Ward	Brook Drive	18
S01_09	Southwark town, Borough Bankside Ward	Burrows Mews	17
S01_10	Borough, St George's Ward	Rushworth Street	17
S01_11	Southwark town, Borough Bankside Ward	Rushworth Street, King's Bench Street and Pocock Street	16

5 CATCHMENT S02 – LONDON BRIDGE

5.1 Updates since 2011 SWMP

This Catchment previously contained CDA Group7_35 which covers the area to the west of Tower Bridge Road, containing London Bridge station and Guys Hospital (CDAs can be seen in *Figure 3-1*). To date, no detailed hydrological modelling or updated flood risk modelling has been undertaken in this Catchment.

Since the previous SWMP, several schemes have been completed or are under investigation which may influence surface water flooding risk. Along Snowfields, Melior Street and at Lewes House in the London Bridge area of Southwark town, public realm and highway works are underway which will incorporate SuDS in highway buildouts, verges, and within the housing estate. These schemes aim to improve management of surface water, relieve pressure on the TWUL sewer capacity by providing storage above ground, and provide public realm improvements. At Holyrood Street investigations are underway to implement a similar scheme which would directly affect surface water flows heading towards Hotspot S02_10 identified in this Catchment.

5.2 Catchment extents

This Catchment contains the areas of Borough and Bermondsey. The southern boundary goes along New Kent Road and Old Kent Road. The western boundary is formed by Borough High Street (A3), and the northern boundary is the River Thames. The eastern boundary cuts through the area of Bermondsey, crossing over the railway line and extending up to St Saviour's dock at the riverside. The Catchment maps can be found in *Appendix 4*. The main infrastructural features in the Catchment include Guys Hospital, London Bridge railway station, London Bridge, Tower Bridge, Tower Bridge Road, and Borough High Street. Green spaces in the area include Potters Fields Park, Tabard Gardens, Guy Street Park, Leathermarket Garden, and Tanner Street Park. These can be seen in *Appendix 1.2*.

5.3 RoFSW and historic flooding

The RoFSW is widespread in this Catchment. Maps of the RoFSW and flood incidents recorded in this Catchment can be found in *Appendix 4.1*. Areas at risk of flooding in a 1 in 30-year rainfall event are particularly prominent either side of London Bridge station, and along Long Lane (A2198), Bermondsey Street (A2205), Tanner Street, Rockingham Street, Pardoner Street and between Willow Walk and Mandela Way. Although the RoFSW is quite patchy in this Catchment, flow paths form along the roads just mentioned, as well as a flow path along Borough High Street which forms the western boundary of this Catchment. Flow paths for the 1 in 1000-year rainfall event also form along the railway line at London Bridge.

There are numerous flood incidents in the area recorded by LB Southwark, including two to the north and east of London Bridge Station, and three more along roads close to the River Thames. There are five flood incidents along the southern boundary of the Catchment, on New Kent Road (A201), Old Kent Road (A2) and Dunton Road (B203). There is also one in the centre of the Catchment by Long Lane (A2198). TWUL has provided information about sewer flooding incidents at a postcode level,

which can be viewed in *Appendix 1.6* or *Table 2-2*. In this Catchment, postcode SE1 2 which borders the River Thames has three reported internal flood incidents within it.

Table 5-1 Properties at RoFSW in Catchment S02 - London Bridge

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	84	483	1867
Commercial	61	184	667
Other	38	173	670
Total	183	840	3204

5.4 Summary of Hotspots

The 18 Hotspots which have been identified through the analysis have been presented in *Appendix 4.2* and summarised in *Table 5-2*. The Hotspots are spread across the Catchment, with more Hotspots occurring in the northern half closest to the River Thames. Of particular note is Hotspot S02_01 which has over 100 properties at risk.

Table 5-2 Hotspots in Catchment S02 - London Bridge

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S02_01	Bermondsey, London Bridge West Bermondsey Ward	Bermondsey Street, Leathermarket Street, Morocco Street	115
S02_02	Tower Bridge, London Bridge West Bermondsey Ward	Tooley Street, Fair Street	47
S02_03	Borough, London Bridge West Bermondsey Ward	St Thomas Street, Kings Head Yard	46
S02_04	Bermondsey, London Bridge West Bermondsey Ward	Tanner Street, Riley Road, Pope Street	43
S02_05	Elephant and Castle, Chaucer Ward	Trinity Street, Trinity Church Square, Bedford Row	38
S02_06	Bermondsey, London Bridge West Bermondsey Ward	Tower Bridge Road, Newham's Yard	31
S02_07	Tower Bridge, London Bridge West Bermondsey Ward	Shad Thames, Horeslydown Lane	28
S02_08	Elephant and Castle, Chaucer Ward	Bath Terrace	27
S02_09	Borough, London Bridge	Borough High Street	23
S02_10	Borough, London Bridge West Bermondsey Ward	Bermondsey Street/ Tooley Street	21
S02_11	Elephant and Castle, Chaucer Ward	Newington Causeway, Borough Highstreet (roundabout)	20
S02_12	Borough, Chaucer Ward	Great Dover Street	20
S02_13	Borough, Chaucer Ward	Pardoner Street	19

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S02_14	Elephant and Castle, Chaucer Ward	Meadow Row, Rockingham Street	18
S02_15	Bermondsey, London Bridge West Bermondsey Ward	Leroy Street	16
S02_16	Bermondsey, South Bermondsey Ward	Old Kent Road	16
S02_17	Borough, London Bridge West Bermondsey Ward	Snowfields, Ship and Mermaid Row	16
S02_18	Tower Bridge, London Bridge West Bermondsey Ward	Shad Thames, Maguire Street, Curlew Street	16

6 CATCHMENT S03 – ROTHERHITHE

6.1 Updates since 2011 SWMP

The Rotherhithe Catchment does not contain any CDAs from the 2011 SWMP. To date, no detailed hydrological modelling or updated flood risk modelling has been undertaken in this Catchment. There are no ongoing or completed flood schemes within this Catchment.

6.2 Catchment extents

This Catchment extends across from Bermondsey to Rotherhithe. Mapping of the Catchment can be found in *Appendix 5*. The River Thames forms the northern and eastern boundaries. The southern boundary extends just north of South Bermondsey railway station and Surrey Quays underground stations, north to Canada Water underground station and loops around Surrey Quays Road and the Printworks event venue to meet the river just north of New Caledonia Wharf. *Appendix 1.2* shows the land use within the borough. This Catchment contains critical infrastructure including the railway line which cuts through the southwest corner of the Catchment; underground stations including Bermondsey, Rotherhithe and Canada Water; and the A200 which goes through the centre of the Catchment from the northwest to the south. This Catchment contains Southwark Park, Bermondsey Spa Gardens, King's Stairs Gardens, Lavender Pond Nature Reserve and Stave Hill Ecological Park.

6.3 RoFSW and historic flooding

Areas at particular RoFSW occur in the urban part of this borough, especially along Southwark Park Road, in roads to the north of Jamaica Road and along Rotherhithe Street. Flood incidents have occurred along the A200, as well as within and just south of the area of high RoFSW on Southwark Park Road. Visible flow paths in this Catchment can be seen along Rotherhithe Street adjacent to the River Thames, and along Southwark Park Road between Dunton Road and the railway line heading north from South Bermondsey station.

There have been surface water flood incidents recorded by LB Southwark outside and just to the south of Bermondsey underground station. The numbers and types of properties at risk in this Catchment can be seen in *Table 6-1*, and the RoFSW mapping and surface water flood incidents have been mapped in *Appendix 5.1*. TWUL has provided information on the sewer flood incidents recorded in the postcodes within this Catchment, which shows that up to eight sewer flood incidents have occurred in this Catchments. This data can be viewed in *Appendix 1.6* or *Table 2-2*. Some of the postcodes extend out of the Catchment, so some of the incidents may not have occurred within Catchment S03. The postcodes with the most incidents are SE1 2 and SE16 3 which are cross-Catchment postcodes that have three sewer flood incidents recorded within them each.

Table 6-1 Properties at RoFSW in Catchment S03 - Rotherhithe

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	56	260	1465
Commercial	23	53	278
Other	19	63	307
Total	98	376	2050

6.4 Summary of Hotspots

The seven Hotspots which have been identified through the analysis have been presented in *Appendix 5.2* and summarised in *Table 6-2*. Five of these Hotspots are in the Bermondsey area reasonably close to the railway line. The remaining two Hotspots (S03_02, S03_06) are in the northeast of the Catchment adjacent to the River Thames, along Rotherhithe Street.

Table 6-2 Hotspots in Catchment S03 - Rotherhithe

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S03_01	Bermondsey, South Bermondsey Ward	Southwark Park Road	35
S03_02	Rotherhithe, Surrey Docks Ward	Rotherhithe Street, Sovereign Crescent	29
S03_03	Bermondsey, North Bermondsey Ward	Old Jamacia Road, Thurland Road	29
S03_04	Bermondsey, South Bermondsey Ward	Lucey Road, railway line	26
S03_05	Bermondsey, South Bermondsey Ward	Lynton Road, Shephard Drive	18
S03_06	Rotherhithe, Surrey Docks Ward	Rotherhithe Street, Filigree Walk	18
S03_07	Bermondsey, North Bermondsey Ward	Southwark Park Road, Banyard Road	18

7 CATCHMENT S04 – SURREY QUAYS

7.1 Updates since 2011 SWMP

This Catchment does not contain any CDAs from the 2011 SWMP. To date, no detailed hydrological modelling or updated flood risk modelling has been undertaken in this Catchment. There are no ongoing or completed flood schemes within this Catchment.

7.2 Catchment extents

This is a cross-boundary Catchment which extends into LB Lewisham. The Catchment covers the areas of Surrey Quays and Deptford; mapping of the Catchment can be found in *Appendix 6*. The northern boundary includes Surrey Quays Road, containing Canada Water dock but avoids Surrey Quays underground station, and follows Hawkstone road and Rotherhithe New Road to South Bermondsey Station. The western boundary follows the branch of the railway line going southeast from South Bermondsey train station, and the Southern boundary follows New Cross Road to Deptford High Street. The eastern boundary extends north from Deptford High Street to the River Thames. The borough boundary cuts the Catchment just south of Surrey Quays underground station, meaning the majority of the Catchment is in LB Lewisham.

Land use in the borough can be viewed in *Appendix 1.2*. There are multiple overground railway lines in this Catchment. Other major infrastructure includes: Surrey Quays underground station; shopping, retail and entertainment surrounding Surrey Quays and Canada Water; and multiple docks including Canada Water, Surrey Quays, Greenland Dock and South Dock (Rotherhithe). The Catchment extends into LB Lewisham. This part of the Catchment contains New Cross underground station, Deptford railway station, and Evelyng Street (A200). Green spaces in this Catchment include Deptford Park, Folkestone Gardens, Pepys Park and Aragon Gardens which are all in LB Lewisham.

7.3 RoFSW and historic flooding

Within the borough boundary, in this Catchment there is RoFSW in a 1 in 30-year rainfall event surrounding Surrey Quays underground station, which is also where the only incident of surface water flooding has been recorded by LB Southwark in this Catchment. This was a result of heavy rainfall in the summer of 2007. There is also RoFSW in the 1 in 30-year event on Surrey Quays Road, Teredo Street in Surrey Quays Leisure Park, and Odessa Street next to New Caledonia Wharf. The main surface water flow paths follow the railway lines, with a particularly prominent flow path coming from the railway line that enters the Catchment at New Cross and spreads out to the east of Sanford High Street in LB Lewisham. Another flow path follows the northern part of Grove Street in LB Lewisham. Finally, there is a flow path following the railway lines heading north to Surrey Quays underground station, creating high RoFSW in the area surrounding the railway station. Mapping of the RoFSW is presented in *Appendix 6.1* and summarised in *Table 7-1*. TWUL have provided information on sewer flood incidents by postcode in this Catchment, specifically for the postcodes in LB Southwark. This can be viewed in *Appendix 1.6* or *Table 2-2*. Postcode SE16 2 has one external sewer flood incident recorded within it, but because this is a cross-Catchment postcode the incident may have occurred in Catchment S02 or S03.

Table 7-1 Properties at RoFSW in Catchment S04 - Surrey Quays

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	1	59	318
Commercial	0	13	53
Other	4	26	106
Total	5	98	477

7.4 Summary of Hotspots

There is only one Hotspot in this Catchment, which is summarised in *Table 7-2* and mapped in *Appendix 6.2*. This is south of Rotherhithe New Road and Rotherhithe Primary School.

Table 7-2 Hotspots in Catchment S04 - Surrey Quays

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S04_01	Surrey Quays, Rotherhithe Ward	Luxford Street, St Helena Road	25

8 CATCHMENT S05 – NEWINGTON

8.1 Updates since 2011 SWMP

This Catchment contains CDAs from the 2011 SWMP including Group7_36 Camberwell which is primarily in Southwark, and Group7_33 Brixton which is entirely in Lambeth. A comparison of the CDAs and new Catchments can be seen in *Figure 3-1*.

Since the previous SWMP LB Lambeth has undertaken detailed hydrological modelling within parts of this Catchment through their SWMP analysis. The modelling only extends into part of Catchment S05, but it is mostly consistent with the EA's RoFSW modelling in the areas covered. However, LB Lambeth's model provides further detail on small areas of flooding or ponding that may occur at street and property level. LB Lambeth did not identify any CDAs for their SWMP update within this Catchment. To maintain consistency with the rest of the report, the methodology for identifying Hotspots has been kept the same despite the availability of this more detailed modelling.

LB Southwark is currently investigating SuDS schemes within this Catchment to help alleviate RoFSW. Investigations are underway to implement SuDS features within courtyards of Local Authority Estate housing in Camberwell, particularly around Comber Grove. The scheme would aim to incorporate greening, conveyance swales and infiltration features to manage surface water flooding and reduce stress on the existing TWUL sewer network. LB Southwark has also delivered a SuDS pocket park in this area on the junction of Redcar Street and Comber Grove. This incorporates a swale and grassed areas to replace the previous paved spaces within the estate housing. Existing paved space south of the Comber Grove pocket park was replaced with permeable asphalt and reprofiled to alter the overland flow regime within a play area to get the most benefit from the scheme.

8.2 Catchment extents

This Catchment covers the areas of Vauxhall, Elephant and Castle, Kennington, Walworth, Newington, Camberwell and Denmark Hill. This is a cross-boundary Catchment which extends into Lambeth; the borough boundary segments the Catchment from north to south. Major infrastructure contained within this Catchment includes Walworth Road (A215), Camberwell New Road (A202), Elephant and Castle underground and railway stations, and Kennington underground station in Southwark. Major infrastructure in this Catchment in Lambeth includes Vauxhall Bridge, Vauxhall railway and Loughborough junction railway stations, Kennington Lane (A3204), Denmark Hill, Oval, and Vauxhall underground stations, and the Oval cricket ground. The green and open space in the Catchment can be viewed in Appendix 1.2, and consists of Vauxhall Pleasure Gardens, Kennington Park, Myatt's Fields Park and Ruskin Park.

8.3 RoFSW and historic flooding

Within the borough boundary, the most noteworthy areas at RoFSW are between Kennington Park and Burgess Park on: John Ruskin Street, Grosvenor Terrace, Grosvenor Park Road, Wyndham Road and Comber Grove. There are two areas in Walworth and Newington at RoFSW in 1 in 30-year rainfall events. These are around Brandon Street and Penrose Street respectively. Between these two areas

there is a record of several surface water flood incidents on Walworth Road (A217) in the SE17 postcode from June 2016, recorded by LB Southwark. Areas surround Palsey Park also have high RoFSW and there is a surface water flood incident from 2016 recorded by LB Southwark to the west of the park. Further flood incidents have been recorded by LB Southwark along or near to the main roads in the Catchment including Kennington Park Road, New Kent Road, Camberwell Road and Camberwell New Road. Outside of the borough boundary, the main areas of surface water flood risk appear around Oval Cricket Ground, roads at and to the northeast of Loughborough Junction, and roads to the north of Vauxhall Pleasure Gardens. There appears to be a south-to-north band of RoFSW stretching from Camberwell New Road at the railway line, up to the northern boundary of the Catchment at the Elephant and Castle underground station. There is another flow path going from Loughborough junction northwards, around Myatt's' Fields Park and joining this north-to-south band of RoFSW.

TWUL has provided information on sewer flood incidents that have occurred in postcodes in this Catchment, which can be viewed in *Appendix 1.6* or *Table 2-2*. The highest number of flood incidents occurred in postcode SE5 9, which has experienced seven internal sewer floods according to TWUL's records. This is in the southern part of the Catchment, and the majority of the postcode lies within LB Lambeth. Most of the other postcodes in this Catchment have experienced 0 or 1 sewer flood.

Mapping of recorded surface water flood incidents and the RoFSW have been presented in *Appendix 7.1*. The number and types of properties at risk within the Catchment inside the borough have been summarised in the table below (*Table 8-1*).

Table 8-1 Properties at RoFSW in Catchment S05 - Newington

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	80	346	1443
Commercial	2	24	206
Other	25	92	454
Total	107	462	2103

8.4 Summary of Hotspots

Hotspots identified through the analysis of the properties at risk within this Catchment have been presented in *Appendix 7.2* and summarised in *Table 8-2*. There are 11 Hotspots in this Catchment. Of particular note is Hotspot S05_01 which lies between Kennington and Camberwell on Grosvenor Terrace, Grosvenor Park and Urlwin Street. This Hotspot contains 133 properties in RoFSW in a 1 in 100-year rainfall event.

Table 8-2 Hotspots in Catchment S05 - Newington

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S05_01	Kennington/ Camberwell, Camberwell Green Ward	Grosvenor Terrace, Grosvenor Park, Urlwin Street	133
S05_02	Camberwell, Camberwell Green Ward	Wyndham Road, Comber Grove, Blucher Road	38
S05_03	Elephant and Castle, Newington Ward	Amelia Street, Peacock Yard, Crampton Street	36
S05_04	Elephant and Castle, North Walworth Ward	Brandon Street, Charleston Street, Larcom Street, Wansey Street, Cotham Street	31
S05_05	Kennington, Newington Ward	Kennington Park Road	23
S05_06	Kennington, Newington Ward	Carter Street	22
S05_07	Camberwell, Newington Ward/ Camberwell Green Ward	Warham Street	19
S05_08	Kennington, Newington Ward	Cooks Road	18
S05_09	Kennington, Newington Ward	Braganza Street, Tarver Road	17
S05_10	Kennington, Newington Ward	Manor Place, Penrose Street, Parsley Close	16
S05_11	Elephant and Castle, North Walworth Ward/ Newington Ward	Hampton Street, Howell Walk, Wollaston Close	15

9 CATCHMENT S06 – BURGESS PARK

9.1 Updates since 2011 SWMP

Detailed hydrological modelling has been undertaken in the area of Camberwell within this Catchment. This modelling was undertaken to aid the delivery of SuDS projects in the area which are detailed below. The model has not been used in the SWMP analysis so that the methodology remains consistent by using the EA's RoFSW model results across the borough to create Hotspots. The Catchment contains sections of three CDAs from the 2011 SWMP, which lie side to side on the southern half of the Catchment beneath Burgess Park. These CDAs are Group7_035 Camberwell, Group7_037 Central Southwark and Group7_038 East Southwark. CDA Group7_038 mainly lies in Catchment S07 – Peckham Rye (*Section 10*). A comparison of CDAs and new Catchments can be seen in *Figure 3-1*.

Since the previous SWMP several schemes which will have an influence on flood risk have been delivered or investigated within the Catchment. A FAS has been implemented in Coleman Road, surrounding roads and the St George Church of England school grounds. These areas all lie to the south of Burgess Park within Hotspot S06_02. The scheme has disconnected surface water from the existing combined sewer system and diverts the water to a below-ground attenuation tank under the school playground. This stores the water and releases back to the sewer system it at a reduced rate to “slow the flow”, which relieves pressure on the sewer during intense rainfall events. This protects these roads from flooding in events up to the 1 in 75-year rainfall event.

To the southeast of this scheme is another delivered SuDS project on Southampton Way. LB Southwark have built a SuDS pocket park with replenished planting, landscaping and the removal of topsoil to enhance the SuDS benefit. The scheme also involved replacing tarmac with self-binding gravel. This scheme is at the junction of Southampton Way and Peckham Grove. This area is not in a Hotspot but will relieve capacity issues in the TWUL sewers and prevent water from heading through the Catchment towards higher risk areas.

Finally, towards the north of the Catchment around the Old Kent Road, investigations are underway to implement SuDS features within courtyards of Local Authority Estate housing in Camberwell. The scheme would aim to incorporate greening, conveyance swales and infiltration features to manage surface water flooding and reduce stress on the existing TWUL sewer network.

9.2 Catchment extents

This Catchment covers Burgess Park and the surrounding areas, which is mapped in *Appendix 8*. The northern boundary stretches from the New Kent Road (A201)/ Old Kent Road (A2) roundabout in Bermondsey to South Bermondsey station. The southern boundary stretches from the Camberwell New Road/ Camberwell Road junction, along Peckham Road (A202) to the beginning of Peckham High Street at Peckham Library. The eastern and western boundaries connect these points along various roads and flow paths, capturing the whole of Burgess Park. Peckham Road and Old Kent Road represent major infrastructural features in this borough, along with the shops and entertainment venues which surround them. The Old Kent Road Fire Station is in this Catchment, and Peckham Fire Station is at the southern border of the Catchment. Burgess Park occupies the centre of the Catchment, forming a large area of green space in this area. The park connects to Jowett Street Park via the Surrey

Canal Path. Leyton Square Recreation Ground also provides some green space to the east of the Catchment. These features can be seen in *Appendix 1.2*, which displays land uses in the borough.

9.3 RoFSW and historic flooding

This Catchment contains 17.6% of the properties in Southwark which are at RoFSW in the 1 in 100-year rainfall event, making this a strategically important Catchment. RoFSW in the 1 in 30-year rainfall event covers a large area in the centre of the Catchment within and surrounding Burgess Park, particularly to the south of the park. The Watershed analysis suggested that there may be a flow path stretching from Peckham Road, travelling north through Southampton Way to the western part of Burgess Park and along Albany Road to the northeast. This is reflected in the RoFSW mapping, which shows a large area of risk along Albany Road, covering the south of Burgess Park.

Surface water flood incidents have occurred across this Catchment according to LB Southwark's records, most of which occurred in 2016 as a result of heavy rainfall. Most of these incidents were reported to the council from the London Fire Brigade who may have been called to respond as a category one responder in emergencies. A particular flood event of note occurred in June 2016, where Galleria Court experienced damaging surface water flooding. There are some surface water flood events which occurred in 2006 and 2007 along Peckham Road, but these were mostly as a result of localised ponding due to broken or blocked gullies. Surface Water flood incidents and the RoFSW have been mapped in *Appendix 8.1*. TWUL has provided RoFSW mapping for the area separated by postcodes, which can be viewed in *Appendix 1.6* or *Table 2-2*. The postcodes which are present in this Catchment have 12 sewer flood incidents recorded within them, with postcode SE17 2 containing eight of these. All eight of these incidents were internal sewer flood incidents. The types and numbers of properties at RoFSW in this Catchment have been presented below (*Table 9-1*).

Table 9-1 Properties at RoFSW in Catchment S06 - Burgess Park

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	478	988	2463
Commercial	22	68	234
Other	84	202	579
Total	584	1258	3276

9.4 Summary of Hotspots

This Catchment contains the second and third largest Hotspot in the borough, which are Hotspots S06_01 and S06_02 containing 433 and 420 properties respectively at RoFSW in the 1 in 100-year rainfall event. This Hotspot is located to the south of Burgess Park, where there is a record of multiple flood incidents occurring in this area in June 2016. These two Hotspots are also closely linked with Hotspot S06_03. These Hotspots are part of a large area of surface water flood risk. The Hotspots were separated out based on strategic local features such as Southampton Way Road and operational considerations such as TWUL sewer directions. All of the Hotspots identified in Catchment S06 have been mapped in *Appendix 8.2* and summarised in *Table 9-2*.

Table 9-2 Hotspots in Catchment S06 - Burgess Park

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S06_01	Camberwell, St Giles Ward/ Camberwell Green Ward	Elmington Road, Brisbane Street, Benhill Road, St Giles Road, Havil Street	443
S06_02	Camberwell, Peckham Ward/ St Giles Ward	Parkhouse Street, Wells Way, Tower Mill Road, Coleman Road, Peckham Grove	420
S06_03	Walworth, Faraday Ward	Mina Road, Bagshot Street, Smyrk's Road, Kinglake Street, Albany Road, Shorncliffe, Upnor Way	162
S06_04	Camberwell, Peckham Ward	Longhope Close, Chandler Way, Burcher Gale Grove, Ebley Close, Davey Street	106
S06_05	Burgess Park, Old Kent Road Ward	Longcroft Road, Cobourg Road	23
S06_06	Bermondsey, Old Kent Road Ward/ South Bermondsey Ward	Rolls Road, Marlborough Grove, St James's Road, Achilles Close	18

10 CATCHMENT S07 – PECKHAM RYE

10.1 Updates since 2011 SWMP

In the previous SWMP (2011), a large section of Catchment S07 was included in the CDA Group7_38 which covered the east of Southwark including the Old Kent Road area (CDAs can be seen in *Figure 3-1*).

In this Catchment there is a FAS being progressed across Peckham Rye Park and Common. This is a joint project between LB Southwark and the EA which aims to provide increased attenuation of overland and surface water flows generated within the Peckham area. This will be achieved through earth bunds, additional drainage, and controlled outflows into the existing TWUL sewer network, as well as landscaping works to incorporate permeable paving and selective planting around the Peckham Rye gyratory and Donkey Ride. These works will be centred around the park, with an additional second phase to be delivered by LB Southwark which will provide SuDS and public realm improvements in the Peckham Rye town area. These schemes aim to reduce the volume and intensity of surface water flows heading northwards through the Catchment, which will particularly benefit Hotspot S07_02, but also benefit the wider Catchment and Basin by capturing and holding water at the top of the hydrological Basin.

10.2 Catchment extents

The Peckham Rye Catchment is situated in east Southwark with a northern boundary east of South Bermondsey station and a southern boundary just north of London Road (A205). The eastern boundary passes through Peckham and Nunhead and borders Honor Oak. The western boundary passes through East Dulwich and keeps to the east of Peckham Rye train station before meeting the Old Kent Road (A2) and South Bermondsey train station at the north. The maps for this Catchment can be found in *Appendix 9*, and information on land uses in the borough as a whole can be viewed in *Appendix 1.2*. Major infrastructure contained by this Catchment includes Old Kent Road, Peckham High Street, Peckham Rye railway station and Peckham Police station. The main green space in this Catchment is Peckham Rye Park and Common to the south of the Catchment, as well as One Tree Hill and Brenchley Gardens in Honor Oak, and Camberwell Old Cemetery. The north of the Catchment is more urbanised and does not contain much green space.

10.3 RoFSW and historic flooding

Catchment S07 experiences RoFSW in a 1 in 30-year rainfall event along Copeland Road, the A2215 and in Peckham Rye Park and Common. There is also risk up to a 1 in 1000-year rainfall event in these areas, but this is also prevalent across the borough, particularly on road networks. In this Catchment there is a clear flow path stretching from south to north across the western edge of Peckham Rye Park and Common, through major roads, commercial and residential areas all the way up to the southern half of Old Kent Road. This flow path follows the path of the Lost River Peck, where there is still a topographical low point. A summary of the properties and property types at RoFSW is presented in *Table 10-1*.

There have only been nine surface water flooding incidents reported to LB Southwark in this Catchment. More reports were located in the northern half of the Catchment which is more urbanised. There are four reports from 2006, four from 2016 and one from 2019. Maps of the RoFSW and surface water flood incidents can be found in *Appendix 9.1*. TWUL has also provided a summary of sewer flooding incidents in this Catchment, which can be viewed in *Appendix 1.6* or *Table 2-2*. This data is separated by postcodes and shows that postcode SE22 0 to the south of the Catchment has experienced the most sewer flood incidents, with 37 incidents reported to TWUL. 34 of these were internal flood incidents and three were external incidents. The postcodes immediately north of this have experienced three to five incidents, and the others in the Catchment have experienced up to two with the exception of the northern most postcode SE16 3 having three incidents.

Table 10-1 Properties at RoFSW in Catchment S07 - Peckham Rye

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	218	806	2698
Commercial	65	191	505
Other	76	202	694
Total	359	1199	3897

10.4 Summary of Hotspots

The ten Hotspots identified through the analysis of this Catchment’s properties at risk data have been presented in *Appendix 9.2*. *Table 10-2* shows the summary of these Hotspots including the number of properties at RoFSW from the 1 in 100-year rainfall event. A greater concentration of Hotspots are situated north of Peckham High Street (A202). There are three significant Hotspots identified which have over 100 properties at RoFSW at a 1 in 100-year event. These are S07_S08_01, S07_02 and S07_03. The largest Hotspot, Hotspot S07_S08_01, is a joint Hotspot as it spans Catchment S07 Peckham Rye and S08 New Cross. The number represented in *Table 10-2* is the number of properties at risk within Catchment S07, but the total number of properties at risk in Hotspot S07_S08_01 is 462 across both Catchments, making it the largest Hotspot in the borough. Hotspot S07_S08_01 is directly downstream from the River Peck FAS, which has been awarded FCERM Grant in Aid funding from the EA.

Table 10-2 Hotspots in Catchment S07 – Peckham Rye

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S07_S08_01	South-side of Commercial Way, Old Kent Road Ward/ Peckham Ward	Commercial Way, Elcot Avenue, Nutcroft Road, Naylor Road and Fenham Road	239
S07_02	Peckham Rye, Rye Lane Ward	Rye Lane, Copeland Road, Bournemouth Road, Bournemouth Close and Philip Walk	198
S07_03	Dulwich, Dulwich Hill Ward	Underhill Road, Crebor Street, Marcus Garvey, St Aidan’s Road	114

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S07_04	Peckham Highstreet, Peckham Ward	Peckham High Street, B215	61
S07_05	Peckham Rye Park and Common, Goose Green Ward	Barry Road / B219 and B238	55
S07_06	Peckham Rye Park and Common, Goose Green Ward/ Dulwich Hill Ward	The Gardens	34
S07_07	South Bermondsey, Old Kent Road Ward	Ormside Street, Penarth Street, Hatcham Road	28
S07_08	Peckham, Nunhead Queens Road Ward	Carlton Grove, Hollydene	27
S07_09	Peckham, Peckham Ward	Marmont Road	20
S07_10	Peckham, Peckham Ward	Meeting House Lane	16

11 CATCHMENT S08 – NEW CROSS

11.1 Updates since 2011 SWMP

This Catchment contains CDAs from the previous SWMP, which can be viewed in *Figure 3-1*. The New Cross Catchment contains the CDA Group7_038 from the previous 2011 SWMP. Group7_038 crossed the boundary between Catchments S07 and S08. No further hydrological modelling has taken place since the previous SWMP for the area encompassed by this Catchment. There are no ongoing or completed flood schemes within this Catchment.

11.2 Catchment extents

Catchment S08 has a northern-most point at South Bermondsey station from which the eastern boundary follows the southern railway line until New Cross Road where the Catchment boundary extends further into Lewisham along the road. It then follows topographical flow paths southwards through Brockley to Honor Oak. The Catchments western boundary passes through Peckham and Nunhead, remaining east of Peckham Rye Park and Common. The southern boundary of Catchment S08 sits within Honor Oak just outside of Southwark's borough boundary.

Land use information on a borough scale can be found in *Appendix 1.2*. This shows that infrastructural features in this Catchment include Old Kent Road, New Cross Road, Queens Road, and the railway line running through South Bermondsey, New Cross Gate, Brockley and Honor Oak railway stations, and Queens Road Peckham railway station on the other branch of the line, which is in Southwark. Green spaces in the area are made up of Nunhead Reservoir, Nunhead Cemetery, Honor Oak Park, Brockley Nature Reserve and Bridgehouse Meadows. Mapping of this Catchment can be found in *Appendix 10*.

11.3 RoFSW and historic flooding

There is only one surface water flooding event recorded by LB Southwark within this Catchment area, which was recorded in 2006 off of Old Kent Road, caused by a blocked gully. TWUL have provided sewer flood incident data for Southwark at a postcode level, which can be viewed in *Appendix 1.6* or *Table 2-2*. This data shows that postcode SE15 3 has experienced the highest number of sewer floods, with three incidents recorded by TWUL. SE15 2 has also experienced one sewer flood incidents, and the other postcodes in the Catchment have either not experienced flooding or are within LB Lewisham, which data was not provided for.

There are few areas within the Catchment with a RoFSW at a 1 in 30-year rainfall event, mostly focused in East Peckham, north of Queens Road, as well as along the railway line passing through New Cross. The main surface water flow paths are found along the railway line and across the northern half of the Catchment; this flow path connects to the one flowing from Peckham Rye Park and Common in Catchment S08. A RoFSW at a 1 in 1000-year event does show that the East Peckham area would be at a high risk as the majority of the road network is covered under this risk level. The number of properties at risk under each of these rainfall events is presented in *Table 11-1*, categorised under property type. Maps of the areas at RoFSW can be viewed in *Appendix 10.1*.

Table 11-1 Properties at RoFSW in Catchment S08 – New Cross

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	258	752	2205
Commercial	7	24	124
Other	26	93	326
Total	291	869	2655

11.4 Summary of Hotspots

The eight Hotspots identified through the analysis of this Catchment’s properties at risk data have been presented in *Appendix 10.2*. *Table 11-2* shows the summary of these Hotspots including the number of properties at RoFSW from the 1 in 100-year rainfall event. Hotspot S07_S08_01 is a joint Hotspot spanning Catchment S07 Peckham Rye and S08 New Cross. When considering flood risk in this area this should be considered as one Hotspot. S07_S08_01 is the only Hotspot within Catchment S08 which contains more than 100 properties at RoFSW in a 1 in 100-year rainfall event. The number of properties at risk displayed for S07_S08_01 in *Table 11-2* are only the properties within Catchment S08, but Hotspot S07_S08_01 contains a total of 462 properties at RoFSW in the 1 in 100-year rainfall event across the two Catchments.

Table 11-2 Hotspots in Catchment S08 – New Cross

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S07_S08_01	Asylum Chapel, Old Kent Road Ward	Caroline Gardens, Albert Way, Studholme Street, Asylum Road, Clifton Crescent, Gervase Street, Leo Street and Drivers Place	223
S08_02	Crossall Park, Nunhead Queens Road Ward	Crossall Walk, Wood Road, Burchell Road	94
S08_03	Ivydale Road, Peckham Rye Ward	Limesford Road, Harlescott Road, Lanbury Road and Bellwood Road	79
S08_04	Peckham, Nunhead Queens Road Ward	Kings Grove and Asylum Road	63
S08_05	Nunhead, Nunhead Queens Road Ward	Kimberley Avenue and Evelina Road / A2214	37
S08_06	Peckham, Nunhead Queens Road Ward	Coll’s road	33
S08_07	Nunhead, Nunhead Queens Road Ward	Kimberley Avenue	24
S08_08	Queens Road, Nunhead Queens Road Ward	Evan Cook Close and Lugard road	15

12 CATCHMENT S09 – EAST DULWICH

12.1 Updates since 2011 SWMP

The area included within Catchment S09 was previously encompassed by three CDAs: Group7_036, Group7_037 and Group7_038 (*Figure 3-1*). This new Catchment includes the central area of Group7_037, and the boundary extends to include additional areas at risk from the neighbouring CDAs to improve the connectivity of flood risk management within this area of Southwark. There are no ongoing or completed flood schemes within this Catchment.

There has been some additional hydrological modelling produced by Lambeth since the previous SWMP which has been incorporated into the decisions of this Catchment boundary. “Railton Road CDA” has been identified in LB Lambeth’s detailed hydrological modelling completed as part of their SWMP update. The southern boundary of Catchment S09 has been aligned with the northern boundary of this LB Lambeth CDA to align these strategic areas. The detailed modelling undertaken by LB Lambeth extends into Catchment S09 at the southern boundary and north-western corner. The modelling is consistent with the EA’s RoFSW modelling in most areas. However, LB Lambeth’s model provides further detail on small areas of flooding or ponding that may occur at street and property level. This model includes the potential effect that flood alleviation works in Dulwich Sports Ground have on flood risk, creating these slight differences. There are also areas identified by the modelling to be at risk of flooding in a 1 in 100-year flood rainfall event by the Lambeth modelling that have not been picked up by the EA RoFSW modelling. To maintain consistency with the rest of the report, the methodology for identifying Hotspots has been kept the same despite the availability of this more detailed modelling.

12.2 Catchment extents

This Catchment has its northern boundary along the southside of Peckham Road (A202) between Denmark Hill (A215) and Bellenden Road. The Eastern boundary resides east of Peckham Rye railway station and west of East Dulwich. The Southern boundary is situated north of Dulwich Village and Herne Hill, and the western boundary mostly follows the Southwark borough boundary but excludes Denmark Hill railway station and part of Grove Lane. The Catchment maps for S09 – East Dulwich can be found in *Appendix 11*.

The main infrastructural features in this Catchment include East Dulwich railway station, Grove Vale Road, Lordship Lane (A2216) and Kings College Hospital. The railway line passes through the centre of this Catchment from southwest to northeast, and through the northern part of the Catchment from east to west. Greendale Playing Fields, St Francis Park, Goose Green and JAGS Sports fields make up the green space in this Catchment. *Appendix 1.2* displays land use information for the whole borough.

12.3 RoFSW and historic flooding

There is very little coverage of the 1 in 30-year rainfall event for this Catchment, mainly residing along Bellenden Road, on Greendale Playing Fields and around East Dulwich railway station. This is similarly the case for a 1 in 100-year event however further coverage can be identified along the railway line between Peckham Rye and East Dulwich railway stations, and along Lordship Lane (A2216). These

boundaries are all extended with the 1 in 1000-year rainfall event which also shows a RoFSW at Green Dale Fields. The main surface water flow path stretches from southwest to northeast across the Catchment. This spreads over Greendale Fields and travels northeast up Bellenden Road; this flow path was identified in the RoFSW mapping and the watershed analysis. Mapping of the RoFSW and flooding incidents can be viewed in *Appendix 11.1*, and *Table 12-1* summarises the numbers of properties at RoFSW under each risk scenario.

Two flood surface water flooding incidents have been recorded by LB Southwark which date 2016 and 2019 respectively for the sites of Dagmar Road and Bellenden Road. TWUL have provided sewer flood incident data at a postcode level, which shows that postcodes in the south of this Catchment have experienced more sewer flooding than postcodes in the north. This data can be viewed in *Appendix 1.6* or *Table 2-2*. Postcode SE24 9 has the highest number of reported flood incidents, with 11 incidents. However, this postcode stretches outside of the Catchment so all of the incidents may not have occurred within it. It's neighbouring postcode SE22 8 is mostly within the Catchment and has experienced nine flood incidents.

Table 12-1 Properties at RoFSW in Catchment S09 – East Dulwich

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	348	763	2287
Commercial	22	67	175
Other	80	169	509
Total	450	999	2971

12.4 Summary of Hotspots

The nine Hotspots identified through the analysis of this Catchment's properties at risk data has been presented in *Appendix 11.2*. *Table 12-2* shows the summary of these Hotspots including the number of properties at RoFSW from the 1 in 100-year rainfall event. There are three Hotspots which have over 100 properties at RoFSW at a 1 in 100-year rainfall event, these are S09_01, S09_02 and S09_03. There are significant number of Hotspots centred around the Bellenden Road which travels through the centre of this Catchment, with a focused area of significant Hotspots around the East Dulwich railway station.

Table 12-2 Hotspots in Catchment S09 – East Dulwich

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S09_01	East Dulwich Railway Station, Rye Lane Ward/ Goose Green Ward	Oxenford Street, Everthorpe Road, Hayes Grove, Vale End, Grove Vale (A2216), Oglander Road, Ondine Road, East Dulwich Road, Derwent Grove, Melbourne Grove	244
S09_02	Green Dale Fields, Champion Hill Ward	St Francis Road, Abbotswood Road, Talbot Road, Shaw Road, Burrow Road	112
S09_03	East Dulwich, Goose Green Ward	Melbourne Grove, Lytcott Grove, Playfield Crescent, Blackwater Street, Glengarry Road,	104

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S09_04	Peckham Rye, Rye Lane Ward	Bellenden Road, Choumert Road, Chadwick Road, Danbury Street	59
S09_05	East Dulwich, Goose Green Ward	Pellatt Road, Rodwell Road, Heber Road	56
S09_06	East Dulwich, Goose Green Ward	Lordship Lane, Nutfield Road, Frogley Road	47
S09_07	East Dulwich, Goose Green Ward	Bawdale Road, Whateley Road, Landcroft Road	44
S09_08	Peckham Rye, Rye Lane Ward	Bellenden Road, Oglander Road	41
S09_09	Peckham Rye, Rye Lane Ward	Holy Grove, Elm Grove, Bellenden Road	28

13 CATCHMENT S10 – DULWICH VILLAGE

13.1 Updates since 2011 SWMP

Catchment S10 contained three CDAs from the previous SWMP which can be seen in *Figure 3-1*. These CDAs were Group7_029, Group7_032 and Group7_033. There are no ongoing or completed flood schemes within this Catchment.

This Catchment has since been created from new hydrological modelling produced by Lambeth which has impacted upon the boundaries of this Catchment external to the Southwark borough boundary. Since LB Southwark's 2011 SWMP and the EA's RoFSW modelling in 2013, LB Lambeth have completed detailed hydrological modelling and created new CDAs for their borough. The "Railton Road CDA" and "Herne Hill CDA" were in close alignment to a Catchment S10 identified by the Watershed analysis completed as part of this report. Therefore, the S10 Dulwich Village Catchment boundaries have been aligned with these two CDAs combined to align the strategic areas between the two boroughs. The detailed modelling undertaken by LB Lambeth extends into the whole of Catchment S10. LB Lambeth's model provides further detail than the EA's RoFSW modelling. There are areas identified by the modelling to be at risk of flooding in a 1 in 100-year flood by the Lambeth modelling that has not been picked up by the EA RoFSW modelling, or only deemed to be at risk in the 1 in 1000-year event by the EA. Conversely, there are areas identified as at risk in the 1 in 30-year event by the EA around Dulwich Village that have not been identified by LB Lambeth's model. As there are inconsistencies in the models, it cannot be certain which model is more reliable. To maintain consistency with the rest of the report, the methodology for identifying Hotspots has been kept the same despite the availability of this more detailed modelling.

13.2 Catchment extents

The Catchment boundary within the Southwark borough boundary includes topographical flow paths from a north-west to southeast direction where the Catchment's southern boundary is met. Within this area is Dulwich Village and Herne Hill, and the Catchment goes on to extend beyond the Southwark Catchment boundary into the LB of Lambeth to follow suit with the LB of Lambeth's recent SWMP hydrological modelling. Mapping of this Catchment is displayed in *Appendix 12*.

Main infrastructural features in the Catchment within Southwark include North Dulwich railway station and various sports fields and clubs including Herne Hill Velodrome, Griffin Sports Club, Dulwich Tennis, Squash, Sport, Cricket and Runners Clubs and grounds. These sports grounds also make up the majority of the green space in the part of the Catchment within Southwark. Land use information for the borough can be seen in *Appendix 1.2*. In LB Lambeth, infrastructure includes Brixton Hill, Effra Road, Railton Road, Tulse Hill, Christchurch Road and Norwood Road. The Railway line travels across the Catchment near to the southern boundary, and Tulse Hill Railway Station is to the south of the Catchment. The largest green space in the Catchment is Brockwell Park, followed by Thurlow Park.

13.3 RoFSW and historic flooding

There is one flooding incident recorded by LB Southwark for this Catchment recorded in 2004 at Brockwell Park, indicating general flooding in the Herne Hill area. TWUL has provided sewer flood incident information for this Catchment, which can be viewed in *Appendix 1.6* or *Table 2-2*. Compared to the rest of the borough, this Catchment has a large number of sewer flood incidents, with postcode SE24 9 experiencing 11 sewer flood incidents, and postcode SE21 7 experiencing nine incidents. These postcodes cover the portion of the Catchment which is in Southwark. Sewer data was not provided for LB Lambeth, but the postcodes provided by TWUL which stretch into LB Lambeth have two and four sewer flood incidents recorded within them each (SE24 0, SE21 8).

There are moderately less areas at RoFSW within this Catchment compared to others within the borough. Areas at RoFSW in a 1 in 30-year rainfall event are mainly focused in the areas of the various sports grounds in Dulwich Village, and on Burbage Road. Within the wider Catchment there is high RoFSW in the roads to the northeast of Brockwell park and north towards the railway line. This connects to areas at RoFSW on Norwood Road and within Herne Hill and Dulwich village, forming a flow path across the Catchment there are a few areas at greater risk under a 1 in 100-year rainfall event which includes parts of the Honor Oak Cricket Club Grounds, and Village Way (A2214). There is however a greater area within Catchment S10 at risk to the level of the 1 in 1000-year rainfall event as this covers areas including Half Moon Way and side roads, Dulwich Village and Herne Hill. A summary of the properties at risk under each predicted rainfall event can be seen in *Table 13-1*, and depictions of these RoFSW areas for Catchment S10 can be seen in *Appendix 12.1*.

Table 13-1 Properties at RoFSW in Catchment S10 – Dulwich Village

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	33	176	518
Commercial	2	34	82
Other	8	35	81
Total	43	245	681

13.4 Summary of Hotspots

There are five Hotspots identified in this Catchment with Southwark’s borough boundary and these are presented in *Appendix 12.2*. The Hotspots were identified through the analysis of Catchment S10’s properties at risk data. A summary of these Hotspots can be seen in *Table 13-2* which includes the total number of properties at RoFSW at a 1 in 100-year event. Hotspot S10_S11_02 is along the border with Catchment S11 and should be considered as a joint Hotspot between the two Catchments, as it is connected via the flow path along Turney Road. The properties at risk presented in *Table 13-2* for S10_S11_02 are the number of properties within Catchment S10, but the total number of properties at risk within this Hotspot is 76.

Table 13-2 Hotspots in Catchment S10 – Dulwich Village

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S10_01	Herne Hill, Dulwich Village Ward	Half Moon Lane, Stradella Road, Milkwood Road / B222 and Dulwich Road	63
S10_S11_02	Dulwich Village, Dulwich Village Ward	Turney Road and Croxted Road / A2199	39
S10_03	Herne Hill, Dulwich Village Ward	Courtmead Close, Burbage Road and Delawyck Crescent	18
S10_04	Herne Hill, Dulwich Village Ward	Delawyck Crescent	17
S10_05	Herne Hill, Dulwich Village Ward	Elfindale Road and Holmdene Avenue	16

14 CATCHMENT S11 – WEST DULWICH

14.1 Updates since 2011 SWMP

Since the previous SWMP LB Lambeth has undertaken detailed hydrological modelling within this Catchment through their SWMP analysis. Catchment S11 boundaries have been aligned with the risk area identified by LB Lambeth as “West Dulwich CDA”, with the exception of the northern boundary which was adjusted to align with flow paths identified through the Watershed analysis that were more consistent with topographical features. The modelling is consistent with the EA’s RoFSW modelling in most areas. However, LB Lambeth’s model provides further detail on small areas of flooding or ponding that may occur at street and property level. To maintain consistency with the rest of the report, the methodology for identifying Hotspots has been kept the same despite the availability of this more detailed modelling.

CDAs from the 2011 SWMP reside within the boundary of Catchment S11. CDA Group7_032 covers the majority of Catchment S11. Catchment S11 also borders with the CDA of Group7_030. These can be seen in *Figure 3-1*.

Since the previous SWMP a FAS has been implemented in the Herne Hill area. This scheme was delivered in partnership with the EA to provide increased attenuation of overland and surface water flows generated within the Herne Hill area. This was achieved through a series of new drainage features within park spaces, flow control valves, weirs, the incorporation of existing ponds within Belair Park and Dulwich Park, attenuation tanks within Dulwich Sports Ground and Dulwich Park, and earth bunds within Dulwich Park. These features protect the area from flooding up to a 1 in 75-year rainfall event.

14.2 Catchment extents

Catchment S11 is a large Catchment at the southern tip of Southwark. Dulwich is at the centre of this Catchment and the Catchment incorporates West Dulwich within its boundaries to the western perimeter. Honor Oak is situated just outside the northeast corner Catchment boundary. The eastern perimeter of the Catchment mostly follows the Southwark borough boundary, and the southern border enters into the LB of Lambeth following its borough boundary with the LB of Croydon. The western boundary of Catchment S11 passes east of West Norwood but extends further into the LB of Lambeth before residing east of Tulse Hill. Maps of this Catchment are displayed in *Appendix 13*.

Land use information on a borough scale can be viewed in *Appendix 1.2*. This shows that the infrastructural features in this Catchment include Dulwich common road (A205), Sydenham Hill, Gypsy Hill and West Dulwich railway stations. Crystal Palace sits just south of the Catchment. This Catchment is dominated by green space, namely Dulwich Park, Dulwich Woods, Sydenham Hill Woods, Dulwich Common, Dulwich and Sydenham Gold Club, Belair Park, Old Alleynians RFC, and various sports grounds and school grounds.

14.3 RoFSW and historic flooding

LB Southwark currently has no records of surface water flooding within Catchment S11. However, a significant flood event was experienced in this area in April 2004. 60mm of rainfall fell over two hours, flooding 200 properties in the area. The flood scheme mentioned above was introduced in order to store water in the park space instead of flooding properties in the future.

Appendix 13.1 shows the RoFSW for the Catchment and a summary of the number of properties at risk for each estimated rainfall event can be viewed in *Table 14-1*. A surface water flow path stretches from West Norwood in the southwest of the Catchment to Dulwich village. This shows RoFSW on roads in West Dulwich which have a RoFSW in a 1 in 30-year rainfall event, although these areas lie mostly within LB Lambeth. There is another flow path in LB Lambeth which flows south to north through the Catchment from Gypsy hill towards Dulwich Village also. High RoFSW is also present around West Dulwich railway station, Belair Park and areas through Old Alleynian Rugby Football and Cricket Club, the Dulwich and Sydenham Hill Golf Club into Sydenham Hill Wood. Within Southwark these areas connect to form another flow path which stretches in a north-westerly direction towards Dulwich Village. However, many of these areas are now protected somewhat by the Herne Hill FAS described in *Section 14.1*.

Table 14-1 Properties at RoFSW in Catchment S11 – West Dulwich

Property Type	Properties at RoFSW – 1 in 30-year Rainfall Event	Properties at RoFSW – 1 in 100-year Rainfall Event	Properties at RoFSW – 1 in 1000-year Rainfall Event
Residential	56	141	365
Commercial	2	6	21
Other	27	50	104
Total	85	197	490

TWUL has provided information on sewer flooding incidents in the Catchment, which can be viewed in *Appendix 1.6* or *Table 2-2*. This information is grouped by postcode. It shows that there have been a high number of sewer flooding incidents in this Catchment. Postcode SE21 7 and SE22 8 have both experienced nine sewer flooding incidents each, and postcode SE22 0 has experienced 37, although the extent of this postcode falls mostly in Catchment S07 – Peckham Rye. The northern postcodes in this Catchment have experienced more flooding than the postcodes to the south.

14.4 Summary of Hotspots

A map of the two Hotspots identified for this Catchment are presented in *Appendix 13.2*. A summary of these Hotspots is displayed in *Table 14-2* which includes the number of properties at RoFSW from the 1 in 100-year rainfall event. Hotspot S10_S11_02 is along the border with Catchment S10 and should be considered as a joint Hotspot between the two Catchments, as it is connected via the flow path along Turney Road. The properties at risk presented in *Table 14-2* for S10_S11_02 are the number of properties within Catchment S11, but the total number of properties at risk within this Hotspot is 76. The other Hotspot is along Croxted Road which is a major flow path at the edge of the borough.

Table 14-2 Hotspots in Catchment S11 – West Dulwich

Hotspot	Location	Flow Path or Streets Affected	Properties at RoFSW from the 1 in 100-year Rainfall Event
S11_01	West Dulwich railway line, Dulwich Village Ward	Croxted Road / A2199	40
S10_S11_02	Dulwich Village, Dulwich Village Ward	Turney Road and Croxted Road / A2199	37

15 BOROUGH-WIDE MITIGATION OPTIONS

15.1 Mitigation options

Following the identification of the most at-risk areas in the previous chapters, the options to mitigate this risk from surface water flooding have been evaluated. High-level options have been categorised into three types of intervention based on the source-pathway-receptor model.

- *Source* – Capturing water at the top of the Catchment to prevent it from travelling towards areas of greater risk. Potential options include swales, detention basins, or wetlands.
- *Pathway* – Managing the routes through which water moves towards areas of increased risk. This could include improved maintenance of gullies and drains, managing overland flow via preferred paths, or de-culverting watercourses to slow their flow through the Catchment.
- *Receptor* – Influencing land-use within the areas at risk to prioritise low-risk activities. This could be achieved by influencing the type of developments in the area through planning or increasing education and awareness about flooding in the area to encourage activities compatible with the risk level such as Property Flood Resilience (PFR) measures.

An opportunity assessment has been conducted using the 'Red, Amber, Green' (RAG) method. Red (R) represents that the measure is not deemed applicable due to its perceived ineffectiveness in providing sufficient flood alleviation within the area. Amber (A) shows that intermediate flood alleviation can be expected from the proposed measure, and green (G) indicates estimated benefits in terms of flood damages avoided. High-level, generic options have been suggested based on a desktop assessment. No site-specific feasibility or economic viability work has been undertaken. These options are listed in *Table 15-1*.

The options below can be used as a prioritised list of options when identifying flood alleviation solutions for specific Catchments and Hotspots. In future, further feasibility work must be conducted to identify suitable options for each locality which are in line with the LLFA's available resources. Issues such as site constraints or funding availability may mean some of these options are unfeasible at certain sites. Possible constraints and risks for each option are presented alongside each option (*Table 15-1*).

Table 15-1 Mitigation Options Long-List

Type	Measure	Opportunity Assessment	Description	Constraints / Risks
Source	Blue / green roof	Green	Generic measure, could be integrated into new developments or retrofitted into older buildings.	Can only be implemented on developments with flat roofs. May cause structural / loading issues on some buildings
	Soakaway	Yellow	Specific measure, could be implemented in geologically suitable areas.	Not suitable for areas with impermeable geology or constrained sites where they cannot be sited more than 5m away from buildings
	Swales	Green	Specific measure, could be introduced in open areas within key areas of interest as a means to channel water to storage features or temporarily hold surface water.	Not suitable for constrained sites or where there are existing underground infrastructure / utilities
	Permeable paving	Green		Not suitable where there are existing underground infrastructure / utilities
	Rainwater harvesting	Green	Generic measure, could be introduced across most car parks and in new developments.	Some developments may not have a requirement for recycled water. Rainwater harvesting tanks may cause structural /loading issues on some buildings
	Detention basin / dry pond	Green		
	Pond	Green	Specific measure, could be introduced across most open areas within key areas of interest.	Not suitable for constrained sites or where there are existing underground infrastructure / utilities
	Wetland	Green		
	Rain garden	Green	Specific measure, most suitable to open spaces or on footways with min 3m width.	Not suitable for constrained sites or where there are existing underground infrastructure / utilities
Pathway	Increase capacity in drainage system / watercourse	Yellow	Existing drainage or watercourse channel storage capacity could be increased to accommodate additional surface water and prevent peak flooding.	This may not be feasible if the downstream network does not have sufficient capacity to accommodate the additional surface water
	Separation of foul and surface water sewers	Yellow	Sewer system almost completely combined.	Only beneficial for areas where the drainage system is combined

Type	Measure	Opportunity Assessment	Description	Constraints / Risks
	Diversion of drainage system / watercourse		Watercourse channels could be diverted through areas that could intermittently flood as an exceedance measure.	Not suitable for constrained or heavily urbanised areas
	Improved maintenance regimes		Ensuring the drainage network is properly maintained removes the incidence of blockages and consequent flooding.	N/A
	Managing overland flow - online storage		Storage areas could be created for temporary storage in open spaces with slow release back into the surface water sewer network at a restricted rate.	Not suitable for constrained or heavily urbanised areas
	Managing overland flow - preferential flow paths		Diverting flows to open areas such as parks or roadside swales with possible kerb raising.	
	Land management practices		Management of runoff rates and volumes from upstream catchments.	Only applicable to rural areas
	Deculverting watercourse(s)		Returning watercourses to a more natural state would prevent flooding upstream of culverts.	Not suitable for constrained or heavily urbanised areas
Receptor	Improved weather warning		Could provide great warning time of flooding to residents.	In instances of flash flooding, it is unlikely that sufficient warning time would be able to be provided to residents
	Planning policies to influence development		Generic measure which could be applied to all catchments to reduce flooding from new developments.	N/A
	Temporary or demountable flood defences		Specific measure which could be installed in areas of significant risk of flooding with adequate warning.	In instances of flash flooding, it is unlikely that there would be sufficient time to install flood defences
	Social change, education and awareness		Generic measures, focusing on community engagement and the need for property level protection.	N/A
	Improved resilience and resistance measures		Commercial and residential property level measures.	N/A

Land management practices have not been deemed a suitable measure for LB Southwark due to Hotspots generally being heavily urbanised. Improved weather warnings have also been removed as an option due to the localised nature of intense rainfall and surface water flooding, which means that improved weather warnings may not be as effective for surface water flooding as it would be for other kinds of flooding. Also, improved weather warnings are more likely to be achieved successfully by other agencies such as the EA or the Met Office. Finally, de-culverting watercourses is deemed unsuitable because there are only two ordinary watercourses in Southwark, and they are both mainly un-culverted. However, there may be opportunities to open up or de-culvert 'lost' watercourses such as the River Peck and River Effra which have been incorporated into sewers. No main rivers flow through Southwark other than the River Thames.

Infiltration options such as soakaways must be considered on a site-by-site basis using information on the underlying geology and infiltration test pits to indicate the suitability of this option. A more detailed review of the existing drainage system and a feasibility study should be undertaken if the 'Increase capacity in drainage system / watercourse' option is proposed. It is suggested that asset owners are engaged to consider existing maintenance regimes and potential constraints of upgrading drainage infrastructure. This would also be necessary if the 'Separation of foul and surface water sewers' or 'Diversion of drainage system / watercourse' options are carried forward. *Section 15.4* includes a stakeholder engagement plan to outline how this might best be done. It should also be noted that green roofs do not typically store high volumes of water. Blue roofs with higher attenuation capacity should be considered instead of green roofs where large volumes of water can be stored.

In some cases, residents will not have the financial capability to implement rainwater harvesting or PFR measures, and many residents will not own the property that they live in. In these cases, emphasis should be placed on creating resilient communities by engaging with residents to increase awareness of the flood risks in their area. This could involve outreach programmes and resident engagement events which educate residents on the local flood risk. LB Southwark can provide transparent, accessible information on flood risk to create flood-resilient communities. These measures can go hand-in-hand with RMA-led FAS projects and investigations.

15.2 Options for high-risk Hotspots

Hotspots identified in each Catchment have been identified as High, Medium, and Low risk based on the number of properties at risk within each Hotspot, as defined below.

- Less than 50 properties at RoFSW in the 1 in 100-year rainfall event → Low risk
- From 51 to 149 properties at RoFSW in the 1 in 100-year rainfall event → Medium risk
- 150 or more properties at RoFSW in the 1 in 100-year rainfall event → High risk

These thresholds have been determined through analysing the number of properties at risk within the Hotspots and placing only the most at-risk Hotspots into the high-risk category. This will enable LB Southwark to prioritise mitigation efforts to the most urgent Hotspots within the borough. This method also creates thresholds which are unique to LB Southwark and this SWMP update, which take the local risk level into account. These thresholds may be edited in the future if risk levels change due to the implementation of flood alleviation schemes or updated flood risk modelling.

This document has identified a total of 86 Hotspots, six of which are high-risk Hotspots. *Table 15-2* shows the flood alleviation options which have been deemed suitable within these high-risk Hotspots.

These options have been appraised by assessing the land use and availability of green space in or around the Hotspot which may facilitate or eliminate the possibility of each mitigation option identified in *Table 15-2*. This information has also been included in *Appendix 14*, which lists every Hotspot and its risk rating. It is recommended that in future feasibility studies for these Hotspots, an economic appraisal approach is used to assess and score the high risk proposed options (please refer to the recommendations in *Section 16*).

Within *Table 15-2* the development and regeneration areas which align with high-risk Hotspots have been identified. These areas are laid out in Southwark’s [Local Plan](#) and more information is available on Southwark’s website page on [Area Action Plans](#). LB Southwark can use this information to integrate flood risk management features into existing plans and strategies to regenerate these areas. This would allow cost savings to be made as flood alleviation can be achieved as part of wider Council works within the borough.

Table 15-2 High-risk Hotspot Options Assessment

Hotspot ID	Type	Properties at Risk	Previous CDA	Option Description	Development Area
S07_S08_01	Combination	462	38	<ul style="list-style-type: none"> Overland flow paths could be redirected to green open spaces such as Bird in Bush Park, Caroline Gardens or Brimington Park to be attenuated in ponds or detention basins. Raingardens, swales and planters in footways, roadsides and areas of open space. Retrofit flat roofs with green/blue roofs. Retrofit public buildings with raingardens, planters and permeable paving. This area has suitable underlying geology for infiltration methods subject to site specific testing. Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options 	Old Kent Road Opportunity Area
S06_01	Combination	443	36	<ul style="list-style-type: none"> Raingardens, swales and planters in footways, roadsides and areas of open space such as Brunswick Park. Retrofit flat roofs with green/blue roofs. Retrofit schools with raingardens, planters and permeable paving. This area has suitable underlying geology for infiltration methods subject to site specific testing. 	Camberwell Action Area

				<ul style="list-style-type: none"> Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options. 	
S06_02	Combination	420	37	<ul style="list-style-type: none"> Raingardens, swales and planters in footways, roadsides and areas of open space such as Paterson Park. Retrofit flat roofs with green/blue roofs. Retrofit schools with raingardens, planters and permeable paving. This area has suitable underlying geology for infiltration methods subject to site specific testing. Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options. 	Camberwell Action Area
S09_01	Source	244	37	<ul style="list-style-type: none"> Raingardens, swales and planters in footways, roadsides and areas of open space such as Goose Green. Retrofit flat roofs with green/blue roofs. Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options. 	Camberwell Action Area
S07_02	Source	198	38	<ul style="list-style-type: none"> Raingardens and planters in footways and roadsides such as in Philip Walk. Permeable paving in carparks. Retrofit flat roofs with green/blue roofs. Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. Encourage residents to use rainwater harvesting and implement permeable 	Peckham and Nunhead Action Area

				paving in driveways by raising awareness of these options.	
S06_03	Combination	162	NA	<ul style="list-style-type: none"> • Overland flow paths could be redirected to green open spaces such as Surrey Square Park or Burgess Park to be attenuated in ponds or detention basins. • Raingardens, swales and planters in footways, roadsides and areas of open space. • Retrofit schools with raingardens, planters and permeable paving. • This area has suitable underlying geology for infiltration methods subject to site specific testing. • Residents and commercial property owners should be educated on the flood risk in their area and made aware of resilience measures and PFR. • Encourage residents to use rainwater harvesting and implement permeable paving in driveways by raising awareness of these options. Retrofit flat roofs with green/blue roofs. 	Aylesbury Action Area

All of the high-risk Hotspots except S06_03 and S05_01 are within CDAs from the 2011 SWMP. However, this analysis defines more specific areas than the CDAs where the surface water flood risk is particularly high, as surface water flooding tends to be locally specific. LB Southwark can utilise these Hotspots to prioritise areas to conduct feasibility studies and seek funding such as FCERM Grant in Aid and Local Levy to carry these out.

Several of these high-risk Hotspots have ongoing FASs and SuDS projects within or near to them which may influence flood risk in the future. Hotspot S06_02 contains the Coleman Road SuDS project which protects the road from a 1 in 75-year rainfall event. This scheme goes through the centre of the Hotspot. Hotspot S7_02 (and to some extent S07_S08_01) may also benefit from flood risk reduction resulting from the ongoing Lost Peck FAS in Peckham Rye Park and Common. This demonstrates that LB Southwark has made good progress towards identifying and alleviating flooding from the most at-risk areas, utilising the knowledge gained from the previous SWMP. Although these schemes will reduce flood risk to numerous properties in each area, schemes can only be designed to relieve flooding in certain rainfall events due to constraints on the available space for water storage and attenuation. For example, the Coleman Road FAS has been designed to protect the area from flooding in all rainfall events up to a 1 in 75-year rainfall intensity. Therefore, despite being protected in extreme rainfall events up to this intensity, these areas may still experience flood risk in rainfall events greater than the design event of each scheme. Furthermore, flood risk will still be present in the

surrounding contributing catchment which does not benefit from the scheme (i.e. upstream from it). LB Southwark can use the more detailed information presented in this new SWMP to target residual and upstream flood risk in these flooding Hotspots. Residual and upstream risk should be managed through measures identified in the mitigation options, particularly by introducing additional SuDS features, retrofitting measures, and the education and empowerment of residents within Hotspots to encouragement community resilience and PFR. The ability of residents to implement PFR measures should be considered when engaging communities in specific Hotspots, as residents who live in houses owned by landlords or the council will not be able to take these steps. In these areas it is more important to increase awareness and empower the residents with transparent and accessible flood-risk information. Therefore, these mitigation options must be considered and implemented with the requirements and capabilities of residents in mind.

It is recommended that a consistent prioritisation mechanism is used at the initial assessment stage to ensure that focus is given to the options with the most potential benefits in each location. This document has aimed to prioritise SuDS which offer a range of benefits alongside flood mitigation. LB Southwark can use SuDS features in a variety of projects through which they can collaborate with stakeholders and the community to deliver flood risk mitigation. Once FASs have been completed in high-risk Hotspots, LB Southwark may wish to edit the categorisation of high/ medium/ low-risk Hotspots in future updates of the SWMP in order to re-prioritise Hotspots. This is because the level of risk will go down in current high-risk hotspots as a result of FASs being implemented within or upstream of them.

15.3 Action Plan

An Action Plan has been created to prioritise the potential mitigation options identified. It provides a structure through which the LLFA and key partners can deliver surface water flood risk management to meet their requirements under the FWMA 2010, and other national, regional and local objectives and policy. The Action Plan sets out tasks for managing surface water across the borough incorporating each action's priority and time frame, which is split into short-term (1-2 years), medium term (2-5 years), and long term (5-10 years) actions.

The types of actions proposed are categorised as follows:

- **Communication / Partnerships** – actions used internally or externally to communicate risk or create / improve flood risk related partnerships.
- **Financial / Resourcing** – actions used to internally or externally secure funding to support works or additional resources to deliver actions.
- **Flood and Water Management Act / Flood Risk Regulations** – actions which are aligned to legislative duties or powers under the FWMA 2010 or FRR 2009.
- **Flooding Mitigation** – actions relating to maintenance or capital works done to mitigate flood risk.
- **Investigation / Feasibility / Design** – actions which include or enable further investigation / feasibility studies / design of mitigation options to occur.
- **Policy** – actions which improve planning or development control activities.

A summary of 'High Priority' actions is displayed in *Table 15-3*, and the full Action Plan is presented in *Appendix 15*. A RAG progress tracker is displayed within the Action Plan. Green actions are those which LB Southwark have already implemented, and they will continue to implement these or strengthen

their approach. Amber actions are those which LB Southwark are planning to conduct and should be actioned when appropriate. Red actions are those which are not currently in progress and should be carried forward. The SWMP Action Plan should be reviewed and updated to capture updates such as investigatory work and changes in policy, strategy or infrastructure which may influence the surface water flood risk within Southwark. Actions with asterisks in *Table 15-3* are dependent on sourcing funding.

Table 15-3 Action Plan Summary

ID	Action	Key Focus	Priority Ranking	Timeframe	Action Type	Lead RMA	Partner RMAs
1	Co-operation between authorities in exercising functions under the Flood and Water Management Act (2010), Flood Risk Regulations (2009), and all other relevant legislation.	<p>Attending key strategic meetings to share best practices and manage common challenges.</p> <p>Engage with RMAs through cross borough boundary projects to work collaboratively to achieve local flood risk objectives.</p>	High	On-going	Flood and Water Management Act	Southwark LLFA	Environment Agency, Thames Water, Neighbouring Local Authorities, Transport for London, GLA
3*	Perform an economic appraisal for each proposed mitigation option for the high-risk Hotspots, and revise the ranking given to reflect each mitigation options economic viability.	<p>The economic appraisal should include a cost benefit analysis of the scheme over its lifetime.</p> <p>A programme should be produced outlining how and when viable schemes will be taken forward.</p>	High	Short-term	Investigation / Feasibility / Design	Southwark LLFA	Environment Agency
4*	Undertake detailed flood risk modelling, if required, to better assess the benefits of the mitigation options on the Hotspots with a high priority ranking.	<p>Reviewing or updating current internal flood risk modelling whilst keeping up to date with changes to modelling from external organisations, e.g. Environment Agency.</p>	High	Medium-term	Investigation / Feasibility / Design	Southwark LLFA	Internal Southwark Departments, Environment Agency, Thames Water, Neighbouring Local Authorities, Transport for London

ID	Action	Key Focus	Priority Ranking	Timeframe	Action Type	Lead RMA	Partner RMAs
5*	Consider taking forward the most likely to be successful mitigation options for further appraisal and cost refinement, preparing and submitting funding applications to obtain funds to deliver the most viable options.	Choosing the most appropriate and feasible options to carry forward in funding applications.	High	Medium-term	Investigation / Feasibility / Design	Southwark LLFA	Environment Agency, Thames Water, Neighbouring Local Authorities, Transport for London
6	Identify potential funding contributors and secure funding for scheme options to enable delivery.	Maintain a list of potential funding sources to refer to when looking to secure funding.	High	On-going	Financial / Resourcing	Southwark LLFA	Internal Southwark Council Departments, Environment Agency, Thames Water, Neighbouring Local Authorities, Transport for London
8	Record incidents of surface water flooding in a timely and consistent manner ensuring the exact location of flooding is documented.	Maintain accurate records of surface water flood risk within Southwark.	High	On-going	Flood and Water Management Act	Southwark LLFA	Thames Water

ID	Action	Key Focus	Priority Ranking	Timeframe	Action Type	Lead RMA	Partner RMAs
9	Conduct maintenance of the drainage system such as ensuring gullies and drains are regularly maintained to allow the drainage network to operate at capacity in Hotspots.	Maintenance works should be carried out in order of risk ranking for Hotspots.	High	On-going	Flood and Water Management Act	Southwark LLFA	Southwark Highways, Thames Water, Transport for London, Highways England
11	Ensure all new developments, particularly in Hotspots, contribute to measures to reduce surface water flood risk in their catchment by incorporating the use of rainwater harvesting and green blue infrastructure.	Engage with the Southwark Planning Team to incorporate extra requirements for planning applications within Hotspots.	High	Short-term	Policy	Southwark LLFA Planning	Southwark LLFA
21	Create and maintain asset register for flood risk assets across Southwark.	Establish an up-to-date list of all the assets which may influence flood risk, including their owner and condition.	High	On-going	Policy	Southwark LLFA	Thames Water, Environment Agency, Transport for London, Riparian Landowners, Port of London Authority, Network Rail, Southwark Highways

15.4 Stakeholder engagement plan

A borough-wide stakeholder engagement plan has been created to help LB Southwark increase awareness of the SWMP and increase opportunities for collaborative flood risk management work across the borough. The plan explains how different partners can use the new SWMP to enable effective and ongoing collaborative working with LB Southwark in the future.

15.4.1 Stakeholder mapping

To identify the stakeholders who should be engaged in carrying out the Action Plan, relevant organisations and groups have been mapped according to their interest in surface water flood risk management and influence on future work.

Stakeholders with high levels of interest and influence should be targeted for collaboration as they would be valuable to further investigations. Stakeholders who would be more affected by policy changes but are perceived to have less influence in decision-making should be consulted. Care should be taken to ensure this category of stakeholder has a voice, to reduce the risk that their issues might be overlooked even if they are likely to be substantially affected by the outcomes. Lobbying and campaigning organisations such as local charities should be involved to provide valuable input in terms of knowledge and funding. Academic or research focused organisations linked to water policy, such as the BGS or Non-Governmental Organisations (NGOs) might be informed and called upon to provide expert input as and when necessary. These strategies have been summarised in *Table 15-4*.

Table 15-4 Stakeholder Strategy

Interest	Influence	Strategy	Actions
High	High	Collaborate	<ul style="list-style-type: none"> Stakeholder panels Steering groups Facilitated meetings
High	Low	Consult	<ul style="list-style-type: none"> Surveys Meetings Interviews
Low	High	Involve	<ul style="list-style-type: none"> Workshops Forums Focus groups
Low	Low	Inform	<ul style="list-style-type: none"> Briefings Electronic documents Exhibitions

As demonstrated in the table above, there are multiple dynamic ways to engage stakeholders when implementing the SWMP Action Plan. It is recommended that the stakeholders identified against each action are engaged in a manner appropriate to their interest and influence level. The stakeholders have been mapped according to these criteria so that LB Southwark can easily identify who to collaborate with, consult, involve or inform when carrying out actions. The stakeholder analysis may then provide both a management tool and rationale as to why certain stakeholder groups are invited to participate in certain stages of the process and others not. Each stakeholder was given a score between one and five based on their level of interest and level of influence. The

combination of these two scores was used to plot the stakeholders' position on the map in *Figure 15-1*. A score of 4 - 5 indicates high interest or influence, and a score of 1 - 2 indicates low interest or influence. Stakeholders should also be encouraged to regularly feedback about how they would like to contribute to flood risk management in the borough. This means that relationships between the LLFA and stakeholders can adapt to changing levels of interest and influence, as well as reacting to changing policies, strategies, funding streams and organisation-specific targets.

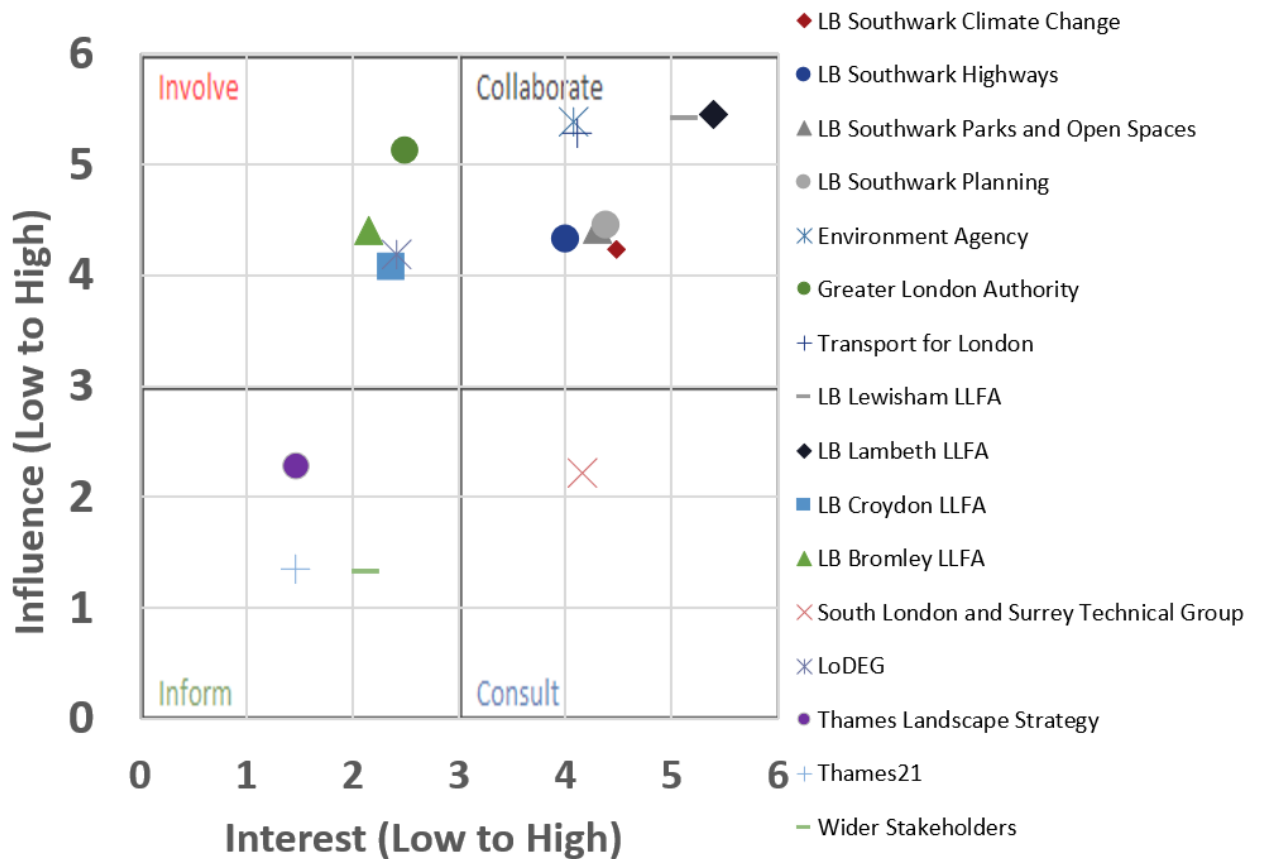


Figure 15-1 Stakeholder Map

15.5 Stakeholder groups and engagement

15.5.1 LB Southwark

Several departments in LB Southwark have been identified as key collaborators with the LLFA. Internal departments including Highways, Parks and Open Spaces, Planning, and the Climate Change departments can work collaboratively alongside the LLFA to deliver joint flood risk management projects (Actions 5 and 7, *Appendix 15*), or develop plans and strategies which integrate flood risk management (Action 12, *Appendix 15*). The LB Southwark departments can also be engaged through education and training provided by the LLFA to increase awareness of SuDS and flood resilience measures within the Council (Action 16, *Appendix 15*). Internal collaboration may occur through the LB Southwark Internal Flood Group where issues surrounding flooding are discussed. Alternatively, the appropriate departments can be engaged on a project-by-project basis.

LB Southwark's Highways, Climate Change, Planning and Parks and Open Spaces departments will be essential in helping to identify and design FASs which deliver multiple benefits to the borough whilst remaining financially viable (Action 7 and 18, *Appendix 15*). One of the multiple benefits could include carbon emissions reductions that can be achieved through carbon neutral flood risk schemes and flood damage prevention (Action 17, *Appendix 15*). Internal departments may also help to identify potential funding contributors to implement these schemes (Action 6, *Appendix 15*).

The Planning department are named as the lead stakeholder in promoting / introducing SuDS retrofitting policies through the planning process (Action 13, *Appendix 15*). This action would be heavily supported through the LLFA and their statutory consultee role on planning applications.

LB Southwark Highways department will be instrumental in helping the LLFA to assess the resilience of highway assets and critical infrastructure (Action 15, *Appendix 15*), and should also be engaged to ensure flood-critical assets are captured within the LLFA's asset register (Action 21, *Appendix 15*).

Finally, LB Southwark's Communications department can facilitate engagement with the public about flood risk to increase community resilience to the effects of flooding and increase the uptake of property level flood resilience measures (Action 14, *Appendix 15*).

15.5.2 Key organisations

Several key organisations have been identified that LB Southwark should engage with closely to strengthen surface water flood risk management in the borough (Action 1, *Appendix 15*). These organisations include:

- EA – Environment Agency
- TWUL – Thames Water
- TfL – Transport for London
- GLA – Greater London Authority

These organisations should be considered as main stakeholders in many of the actions identified in *Appendix 15*. However, the following actions are highly recommended as per *Table 15-3*. All of these key stakeholders should contribute to building an accurate and up-to-date register of assets which contribute to flood risk, mainly through providing data (Action 21, *Appendix 15*). It is highly recommended that the EA, TWUL and TfL are engaged when considering FASs, including during the modelling and appraisal process, and to identify or supply funding for implementation where appropriate (Actions 4, 5 & 6, *Appendix 15*).

LB Southwark should work with TWUL to build a thorough and consistent record of flooding in the borough to help inform suitable locations for FASs and build knowledge of flooding in the borough (Action 8, *Appendix 15*). LB Southwark should also work closely with TWUL and TfL to ensure proper function of the drainage system through regular maintenance (Action 9, *Appendix 15*).

Finally, LB Southwark can engage with the EA to conduct economic appraisals for potential flood alleviation projects across the borough, particularly in or around high-risk Hotspots (Action 3, *Appendix 15*).

15.5.3 Cross-boundary local authorities

The London boroughs of Bromley, Croydon, Lambeth and Lewisham were contacted during the creation of this SWMP to ensure that the document reflects a catchment-based collaborative approach to flood risk management. It is vital that collaboration with these authorities is continued throughout the enactment of the Action Plan so that this approach is continued. As shown in *Figure 15-1*, it is particularly important to collaborate with LB Lambeth and LB Lewisham, as they share the majority of the borough border with LB Southwark. However, LB Bromley and LB Croydon must still be involved so that flood risks are managed in a way that does not impact those areas. For example, they should be engaged for any schemes proposed in Catchment S10 – Dulwich Village, as this Catchment may be hydrologically linked across the borough boundary. These boroughs should also be engaged in the creation of future local and regional plans to integrate surface water flood risk reduction measures throughout the wider area (Action 12, *Appendix 15*).

These authorities are already engaged through the South-Central London Flood Group and the South London and Surrey Technical Group. However, LB Southwark must continue to collaborate with them to exercise functions under the FWMA 2010 and all relevant legislation as fellow LLFAs (Action 1, *Appendix 15*). Cross-boundary areas of flood risk should be investigated in conjunction with neighbouring boroughs, and recommendations should be made that address the concerns of both authorities (Action 2, *Appendix 15*). Neighbouring boroughs should also be engaged in identifying, assessing, designing, and sourcing funding for appropriate FASs, particularly when they are located on or close to administrative boundaries (Actions 4, 5, 6 & 7, *Appendix 15*).

15.5.4 Other groups

There are numerous stakeholders and groups which also have an interest in surface water flood risk management that may not fall into the above groups. Many individuals and organisations are likely to be affected by the decisions made by LB Southwark LLFA. Therefore, these stakeholders should be considered in a dynamic way to ensure that the correct groups are being involved where appropriate. Such organisations include:

- Thames 21
- London Drainage Engineers Group (LoDEG)
- Thames Regional Flood and Coastal Committee
- Non-neighbour local authorities
- Local members of the public
- Local businesses
- Residents Associations and Neighbourhood Forums
- “Friends of” groups
- Volunteers
- Allotments societies
- Sports groups
- Landowners
- Riparian owners

These stakeholders, and any others that are identified, can be engaged in various actions and flood management practices, and should be informed about relevant projects at the appropriate stages.

16 RECOMMENDATIONS

Through the formation of this SWMP document, six 'High Risk' Hotspots have been identified across LB Southwark. These are areas with more than 150 properties which may experience surface water flooding in the 1 in 100-year flood event. It is recommended that, subject to securing funding, standalone feasibility studies are conducted for the Catchments containing the shortlisted Hotspots, prioritising those with the highest number of properties at risk. Recommended tasks for these studies are as follows:

1. The newly created and prioritised Catchment and Hotspot information should be used to create sub-catchments to enable inclusion of the contributing and benefitting areas of each Hotspot.
2. Gather further information about significant recorded flood incidents and validate against predicted surface water flood risk extents.
3. Identify potential benefactors and constraints.
4. Conduct locally specific long-list and short-listing exercises to identify potential mitigation options, accounting for any existing or planned FASs in the area.
5. Determine the feasibility of each potential mitigation option using a multi-criteria decision matrix.
6. Conduct an economic appraisal for each Catchment through cost benefit analysis. This should include identification of flood and non-flood risk related benefits, flood damage calculations, and consideration of whole life costs. This should also define the benefitting area and identify the volume of surface water that could be stored in a 1 in 30-year surface water flood event for each option.
7. Use the results of the economic appraisal to revise the current risk rating for each Catchment. The options with the highest refined rating which are shown to be feasible could then be prioritised for further detailed investigation.
8. Options which are prioritised for further detailed investigation should undergo detailed modelling and a business case should be prepared and submitted to determine potential for continuation through detailed design to construction.

Flood alleviation activities for other Hotspots should be progressed through a similar set of tasks if LB Southwark determines that they should be prioritised. This should be determined by LB Southwark's LLFA according to any increased information about local flood risks or improved potential for a collaborative FAS. Alternatively, the other Hotspots should be prioritised to carry out FASs based on the number of properties at risk within them; Hotspots with a higher number of properties at risk should be investigated for potential mitigation options before those with a lower number of properties at risk.

Additional recommendations identified through this SWMP update include:

LB Southwark LLFA should continue to work with neighbouring boroughs and strategic stakeholders, building on engagement made during this SWMP update, to manage the flood risks holistically where catchments overlap political boundaries.

LB Southwark LLFA should continue to work with stakeholders and partners to identify potential funding contributions and secure funding for FASs.

LB Southwark LLFA should ensure that flood incidents are recorded consistently and accurately and conduct investigations of repeat or significant flood incidents which have occurred in Hotspots.

- LB Southwark or other maintenance owners should conduct regular maintenance of gullies and drains, prioritising those within Hotspots.
- LB Southwark LLFA should liaise with LB Southwark's Planning team to ensure that new developments incorporate rainwater harvesting and green blue infrastructure, particularly within Hotspots.
- LB Southwark LLFA should liaise with strategic stakeholders to create and maintain a register of assets across Southwark which influence flood risk, including their owner and condition.

In addition to the above bullet points it is recommended that this document is updated when significant work in reducing flood risk is completed and / or when significant improvements in the knowledge and understanding of local flood risk are identified. This may result in changes to the number of Hotspots with 'High' risk ratings. The SWMP should also be updated in line with major changes to national, regional, or local policy affecting flood risk, such as the National Flood and Coastal Erosion Risk Management Strategy.

17 CONCLUSION

Since the previous SWMP published in 2011, understanding of flood risk from surface water and other kinds of flooding has improved. Therefore, this SWMP has been created to reflect a deeper understanding of flood interactions and provide a new way of assessing surface water flood risk. In the previous SWMP, CDAs were identified as areas at increased risk of surface water flooding utilising the modelling undertaken throughout the Drain London project. These CDA areas did not account for the surrounding areas which may contribute hydrologically to flooding within them. Since 2011, updated modelling has been provided by the EA, LB Southwark and LB Lambeth. Several flood alleviation and SuDS projects have also been undertaken, including the Herne Hill FAS. Therefore, the new SWMP utilises a borough-wide Basin and Catchment based approach to represent hydrological flows within the local watershed.

Four Basins and 11 Catchments have been identified by analysing the local topography, watercourses, sewer systems, and other major infrastructure which may interrupt the flow of water. This allows the contributing areas in the hydrological catchments to be identified more accurately and consistently than the 2011 SWMP and aligns with national planning policy and the EA's fluvial flood risk management Catchment-based approach. The new approach identifies Basins and Catchments which cross political boundaries, increasing the potential for collaborative work with neighbouring boroughs, authorities, local organisations and other stakeholders in the surrounding area. The updated EA RoFSW modelling has been used to identify the number of properties at RoFSW in different rainfall scenarios for the borough as a whole as well as each Catchment. The total number of properties identified as being at risk of flooding in the 1 in 100-year rainfall event is 7,130 across the borough (*Section 2.4.3*).

To better understand the risk of flooding within the borough, flooding Hotspots have been identified where there are more than 15 properties at risk of surface water flooding from the 1 in 100-year rainfall event at ground or basement level. A total of 86 Hotspots have been identified including 64 at low risk (<50 properties at risk), 16 at medium risk (50 – 149 properties at risk) and six at high risk (150+ properties at risk). The Hotspots identified as high risk should be prioritised when implementing FASs. Potential options to mitigate the RoFSW have been identified at a high-level for these six Hotspots:

- S07_S08_01
- S06_01
- S06_02
- S09_01
- S07_02
- S06_03

These options have been identified using the source-pathway-receptor method. The options proposed are initial attempts to identify potential opportunities to reduce local flood risks as sustainably as possible, and mostly involve installing a mixture of SuDS such as rainwater harvesting, rain gardens, swales, blue/green roofs, and permeable paving. Due to the primarily urban nature of the areas at risk, these mitigation options should be considered at a local scale considering constraints in that area.

It is recommended that each option undergoes an economic appraisal to revise the risk rating given at this stage through a cost benefit analysis, starting with the options for the Hotspots most at risk. The economic appraisal exercise should define the benefitting area and identify the volume of surface water that could be stored in a 1 in 30-year surface water flood event for each option. The options with the highest rating could then be prioritised for further detailed investigation. Options with the most potential

benefits are more likely to qualify for and attract grant funding to enable further investigation work at detailed design stage. Options within Hotspots with a lower risk rating should not be discounted as these may become more viable through collaborative working with stakeholders leading on other, non-flood risk schemes which can deliver multiple benefits. This, along with the Action Plan, gives the LB Southwark a high-level initial programme of potential local flood risk mitigation schemes.

18 REFERENCES

British Geological Survey. BGS Geology Themes. Available from: <https://www.bgs.ac.uk/datasets/bgs-geology/bgs-geology-themes/>

DEFRA (2013) Catchment Based Approach: Improving the quality of our water environment. *Policy Framework*. Available from: [Catchment Based Approach: Improving the quality of our water environment \(publishing.service.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/2485/Catchment_Based_Approach_Improving_the_quality_of_our_water_environment.pdf)

EA (2019) What is the Risk of Flooding from Surface Water map? Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/842485/What-is-the-Risk-of-Flooding-from-Surface-Water-Map.pdf

APPENDICES

Appendix 1 – Borough-wide flood mapping

Appendix 1.1 – LiDAR Representation of Topography

Appendix 1.2 – Land Use

Appendix 1.3 – RoFSW Depth with Surface Water Flooding Incidents

Appendix 1.4 – Potential Elevated Groundwater Levels

Appendix 1.5 – Geological Map of Southwark

Appendix 1.6 – Sewer Flooding Incidents

Appendix 1.7 – Watercourses and Fluvial Zones

Appendix 1.8 – Flood Risk from Artificial Sources

Appendix 1.9 – Recorded Fluvial Flooding Extents

Appendix 1.10 – Historic Flood Records

Appendix 2 – Basin maps and methodology

Appendix 2.1 – Basin A Validation Analysis

Appendix 2.2 – Basin B Validation Analysis

Appendix 2.3 – Basin C Validation Analysis

Appendix 2.4 – Basin D Validation Analysis

Appendix 2.5 – Methodology for properties at risk of surface water flooding

- Appendix 3 – Catchment 01 Waterloo Mapping**
- Appendix 4 – Catchment 02 London Bridge Mapping**
- Appendix 5 – Catchment 03 Rotherhithe Mapping**
- Appendix 6 – Catchment 04 Surrey Quays Mapping**
- Appendix 7 – Catchment 05 Newington Mapping**
- Appendix 8 – Catchment 06 Burgess Park Mapping**
- Appendix 9 – Catchment 07 Peckham Rye Mapping**
- Appendix 10 – Catchment 08 New Cross Mapping**
- Appendix 11 – Catchment 09 East Dulwich Mapping**
- Appendix 12 – Catchment 10 Dulwich Village Mapping**
- Appendix 13 – Catchment 11 West Dulwich Mapping**
- Appendix 14 – High Level Options Analysis**
- Appendix 15 – Action Plan**