

Local Flood Risk Management Strategy

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Cover photo: Flooding in 2004 at Herne Hill / Half Moon Lane junction

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Flooding on Turney Road, Dulwich in 2004 (credit to Alastair Macdonald)

FOREWORD

In the summer of 2007, severe flooding in England, particularly in Yorkshire, Worcestershire, Gloucestershire and Oxfordshire had damaging social and economic impacts. Records estimate the cost of damages at about £3.2bn in total. The average cost of damages per residential property and business was between £23,000 - £30,000 and £75,000 - £112,000 respectively. The floods had far reaching impacts on local government, emergency services, agriculture, schools and water supply (approximately 350,000 people without clean drinking water for 16 days). These floods also had implications on the health of the people who lived in the affected communities¹.

In the London Borough of Southwark, flooding events, most notably in 1984, 2004 and 2007 have provided evidence of the risk and impact of surface water inundation to businesses, communities and public infrastructure. The most significant of these events occurred as a result of a high intensity rainstorm in 2004 which particularly affected the Herne Hill and Dulwich areas. The probability of that event occurring in any given year varied widely across the borough, however, recent data made available indicates that in the Dulwich area, it was estimated at 1 in 10. The cost of damages due to the flooding event was estimated at about £1 million excluding insurance claims, costs to businesses and residents. The 2007 floods affected neighbouring boroughs but no significant flooding was recorded in Southwark besides Network Rail's report that Surrey Quays Station was closed for 3 hours due to surface water flooding.

Although an event of similar magnitude has not been experienced since, localised problems due to surface water flooding continue to be experienced. Areas affected include College Road and neighbouring roads in Dulwich Village. On Christmas Day 2012, the fire brigade was required to clear the roundabout at the junction of College, Burbage and Gallery Roads which had flooded mainly due to large volumes of runoff generated from Dulwich Park.

The most recent flooding in August 2013 due to a burst water main, whilst different in character, was similar in scale to the 2004 event, caused an estimated £4M of damage. This has once again highlighted the vulnerability of the Herne Hill area to flooding due to the local topography and has once more raised concerns among people in the local community.

Following the floods of 2007, the government commissioned an independent review of flood risk management led by Sir Michael Pitt². The commission recognised that there was need for a more proactive and collaborative approach to understanding and managing the risks and impacts of flooding, whether from the sea, rivers, surface water, groundwater or ordinary watercourses. Among the key recommendations was the need for Local Authorities to lead on the coordination of local flood risk with the support of relevant organisations.

The EU Floods Directive (Directive 2007/60/EC) was enacted to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. It was later transposed into domestic law in England and Wales under the Flood Risk Regulations 2009 ("the Regulations"). Under the Regulations, Southwark Council was designated 'Lead Local Flood Authority' (LLFA) with duties to identify areas at risk of flooding, prepare flood hazard / risk maps, flood risk management plans and co-operate with other risk management authorities in managing flood risk.

The Flood and Water Management Act 2010 ("the Act"), which came into effect in April 2011, empowered LLFAs to take on the responsibility of leading the co-ordination of flood risk management in their areas. LLFAs are responsible for managing flood risk from surface water, groundwater and ordinary watercourses. Flood risk from major river bodies and sewers remain the responsibility of the Environment Agency (EA) and Thames Water respectively.

In response to the new responsibilities under the Act, Southwark Council has set up the Flood and Drainage Team (FDT) to provide the necessary skills and capacity required for effectively discharging its responsibilities. Under Section 9 of the Act, Southwark Council is required to develop, maintain, apply and monitor a Local Flood Risk Management Strategy (LFRMS) for the borough. The LFRMS ("the Strategy") should provide strategic direction in proactively managing flood risk in Southwark and to meet the requirements of the Act. The Strategy ("this document") will be developed in consultation with key internal and external stakeholders, and will be reviewed every 6 years in consonance with the periodic reviews of Southwark Council's Preliminary Flood Risk Assessment (PFRA) as required under the Regulations.

1 <http://www.environment-agency.gov.uk/news/115038.aspx>

2 <http://webarchive.nationalarchives.gov.uk/20100402231741/archive.cabinetoffice.gov.uk/pittreview/thepittreview.html>

Glossary of Acronyms and Terms

Term	Definition / Meaning
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
Civil Contingencies Act (2004)	This is an Act of the UK Parliament that establishes a coherent framework for emergency planning and response ranging from local to national level.
Critical Drainage Area	A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.
EA	Environment Agency
Environment Agency	An executive non-departmental body responsible for the protection and improvement of the environment, and for the promotion of sustainable development.
ERA	Extreme Rainfall Alert
FDT	Flood and Drainage Team. This is the Southwark Council team that provides the technical and strategic lead on flood risk management matters in the borough, in order to fulfil the council's obligation under the Flood and Water Management Act 2010.
Fluvial Flooding	Flooding due to water levels exceeding river bank levels.
FRR	Flood Risk Regulations
FWMA	Flood and Water Management Act
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GLA	Greater London Authority
LFRA	Local Flood Risk Assessment
LFRMS	Local Flood Risk Management Strategy
LFRZ	Local Flood Risk Zone
LiDAR	Light Detection and Ranging. LiDAR is a remote sensing technology that measures the distance to objects (and other properties) using beams/pulses of light. It is often used in topographic surveys.
LLFA	Lead Local Flood Authority
Local Flood Risk Management Strategy	This is a plan that describes what needs to be done by all organisations involved in flood and coastal erosion risk management and also mitigate the impacts from any such occurrences. These bodies act to reduce the risk of flooding and coastal erosion and include local authorities, internal drainage boards, water and sewerage companies, highway authorities, and the Environment Agency.
Local Flood Risk Zone	A discrete area of flooding that does not exceed the national criteria for a 'Flood Risk Area' but still affects houses, businesses or infrastructure. It is defined as the actual spatial extent of predicted flooding in a single location.
MAFP	Multi Agency Flood Plan
Main River	A watercourse shown as such on the Main River Map and for which the Environment Agency has responsibilities and powers.
Ordinary Watercourse	All watercourses that are not designated Main River and which are the responsibility of Local Authorities, and may include canals, streams, ditches and small reservoirs.

Term	Definition / Meaning
PFRA	Preliminary Flood Risk Assessment
Pluvial Flooding	Flooding resulting from water flowing over the ground surface. This is usually occurs when heavy rainfall coincides with saturated ground and overloaded sewers.
Pluvial modelling	Mathematical modelling (using computer software) to determine the likelihood and magnitude of overland flow due to rainfall events. It uses hydrological, hydraulic and topographic parameters for the area of interest.
RMA	Risk Management Authority
Risk Management Authority	As defined by the Floods and Water Management Act.
SAB	SuDS Approving Body, as defined by the Flood and Water Management Act 2010.
SEA	Strategic Environmental Assessment as defined by the EU Strategic Environmental Assessment Directive.
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage System
SWMP	Surface Water Management Plan
Urban Greening	The provision/inclusion of green infrastructure in the urban environment; this includes tree planting, green open spaces, collective gardens etc.



1 BACKGROUND

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1.1 Scope and Purpose of the Strategy

Southwark Council's Local Flood Risk Management Strategy (LFRMS) outlines the general approach to managing flood risk across the borough consistent with the Flood and Water Management Act 2010 ("the Act"). The Council's primary purpose for this strategy is to ensure that, as far as is reasonably practicable, the risk of flooding to human health and life, the environment, economic activity, infrastructure and cultural heritage arising from surface water, groundwater and ordinary watercourses is minimised. This document does not cover flood risk from sewers, water mains and reservoirs which remain the responsibility of Thames Water while the Environment Agency (EA) manages flood risk from major river bodies. It however gives due consideration to interaction among various sources of flooding.

The strategy will be reviewed every six years in line with the Preliminary Flood Risk Assessment (PFRA). However, there will be a minor annual review of the action plan to take account of any changes that may have occurred in the course of each year.

The document comprises 3 parts;

1. the summary and guidelines on the use of the Strategy
2. the Strategy
3. the Action Plan

The key objectives of this Strategy are to;

- a. ensure a clear understanding of local flood risks, so that investment in risk management can be prioritised and implemented most effectively;
- b. develop and maintain community and partnership based engagement in the management of flood risk and encouraging beneficiaries to invest in the management of risk where possible;
- c. set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about managing residual risks;
- d. encourage innovative management of flood risk, taking account of the needs of communities and the environment;
- e. promote sustainable measures to reduce flood risk and provide multiple benefits to local communities;
- f. develop links between the local flood risk management strategy and local spatial planning;
- g. co-operate with neighbouring LLFAs to ensure effective risk management of Flooding and compliance with the Water Framework Directive.
- h. increase environmental protection and integrate considerations into the preparation and implementation of policies and programmes that promote sustainable development;
- i. ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond properly to flood warnings; and
- j. help communities to recover more quickly and effectively from flooding incidents.

1.2 How the Strategy will be Used

The London Borough of Southwark is a Lead Local Flood Authority (LLFA) under the Act and has a duty to develop, maintain, apply and monitor a LFRMS to manage the risk of flooding from surface water, groundwater and ordinary watercourses.

The Local Flood Risk Management Strategy must be consistent with the **National Flood and Coastal Erosion Risk Management Strategy**. It must complement and support the national strategy to ensure that flood risk is managed in a coordinated way, balancing the needs of communities, the economy and the environment.

The London Borough of Southwark will exercise skill, care and diligence in outlining the principal objectives of the LFRMS, and in specifying measures to meet the objectives with due consideration to resources and aspirations of local communities.

The areas indicated to be at risk of flooding are derived from intermediate level assessments (including 2D pluvial modelling), and should be read and understood with the view that further investigations are underway to enhance the understanding of flood risk in the borough. Southwark Council has developed this strategy to prioritise engagement with local communities on the understanding of flood risk, focus investigations and assessments on the most susceptible areas, and develop action plans (with communities and stakeholders) that are robust and achievable within the limitations of resource availability. Where a significant degree of judgement has been used to interpret flood risk, further investigations will be incorporated in the measures identified to understand and mitigate the risk. Measures identified in this strategy will be applied either to localised areas or borough wide as specified.

1.3 Relevant Legislation

The following is a summary of the main legislation relevant to this strategy. Details of further legislation is provided in Appendix B.

1.3.1 The EU Floods Directive (Directive 2000/60/EC)

The *EU Floods Directive (Directive 2000/60/EC)* was created to establish a framework for member states to take concerted, consistent and coordinated action to assess and manage the risk of flooding across the EU. The *Flood Risk Regulations 2009 ("the Regulations")* transposed the requirements of the EU Floods Directive into domestic law in England and Wales, and together with the Flood and Water Management Act 2010 ("the Act"), provide the legislative framework for the effective assessment and management of flood risk in England and Wales.

Wider environmental protection obligations are required of all flood risk management activities, and are considered in this Strategy. The *EU Water Framework Directive (Directive 2000/60/EC)* requires the consideration of likely effects on aquatic environments from the preparation and implementation of plans to manage the water environment.

1.3.2 Flood Risk Regulations 2009

The Regulations incorporated the EU Floods Directive requirements. They define a Lead Local Flood Authority (LLFA), and require it to identify areas at risk of flooding and undertake assessments to map and manage the risk. In London, the Lead Local Flood Authorities are defined as the councils of the London Boroughs. The Regulations require the following to be produced:

- Preliminary assessment reports (e.g. Preliminary Flood Risk Assessments) leading to the identification of flood risk areas by 22 December 2011;
- Publish flood hazard and flood risk maps for flood risk areas by 22 December 2013; and
- Flood risk management plans for flood risk areas by 22 December 2015.

In accordance with the statutory requirements of the Regulations, Southwark's PFRA was submitted through the EA in December 2011. The PFRA included:

- Local Flood Risk Assessment (LFRA)
- a preliminary assessment report
- flood risk areas

These documents shall be reviewed and updated every six years. As Southwark Council has already prepared and published its initial PFRA, a second version of the report will be published in 2017.

In addition to satisfying the legal requirements, completing the PFRA has enabled the Council to:

- enhance its understanding of local flood risk issues;
- take the opportunity to forge working partnerships and engage in information sharing with other local authorities; and
- develop expertise on local flood risk issues.

Following the development of the PFRA and flood maps, the Council has developed a better understanding of flooding mechanisms in the borough and has produced a Surface Water Management Plan (SWMP). The SWMP broadly sets out the Council's general approach to managing flood risk in the borough in areas identified as having higher risk of surface water flooding. It also establishes an initial action plan that will influence engagement/understanding, planning, investment and development to manage surface water in the borough.

1.3.3 Flood and Water Management Act 2010 (FWMA)

With effect from the 1st of April 2011, Southwark Council became the LLFA under the Act with statutory responsibility for coordinating the efforts of key Risk Management Authorities (RMAs) to manage the risk of flooding from surface water, groundwater and ordinary watercourses.

Section 9 of the Act states that a "Lead Local Flood Authority for an area in England must develop, maintain, apply and monitor a strategy for local flood risk management in its area" and prepare a summary of the strategy. The Act defines the sources of "local flood risk" as surface runoff, groundwater and ordinary watercourses.

The Local Flood Risk Management Strategy must specify the following:

- a. the risk management authorities in the LLFA area;
- b. the flood and coastal erosion risk management functions that may be exercised by those authorities in relation to the area;
- c. the objectives for managing local flood risk (including any objectives included in the LLFA flood risk management plan prepared in accordance with the Regulations);
- d. the measures proposed to achieve these objectives;
- e. how and when the measures are expected to be implemented;
- f. the costs and benefits of those measures, and how they are to be paid for;
- g. the assessment of local flood risk for the purpose of the Strategy;
- h. how and when the Strategy is to be reviewed; and
- i. how the Strategy contributes to the achievement of wider environmental objectives.

The Act requires the LLFA to consult other RMAs and the public on the Strategy. This Strategy will therefore be subject to consultations with the relevant Authorities and the public prior to its adoption.



2 ASSESSMENT OF LOCAL FLOOD RISK

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2.1 Introduction

The London Borough of Southwark is located in central London, extending from the River Thames in the north to Dulwich in the south and covers an area of approximately 29km². It is a large inner city borough, with many distinct districts including Bermondsey, Borough and Bankside, Camberwell, Dulwich, Nunhead, Peckham Rye, Peckham, Rotherhithe and Walworth. The Community Council boundaries of Southwark are shown in **Figure C.1** in Appendix C. It is also one of the greenest boroughs in London, having more than 130 green spaces including Belair Park, Dulwich Park, Southwark Park, Burgess Park, Peckham Rye Common and many sports grounds and squares. The borough has a total population of approximately 285,000, with 112 schools³ and around 117,000 households of which about half are in public sector housing. The population is projected to grow over 19% in the next 15 years.

The study area falls within the Thames River Basin District (RBD) [as defined by the Environment Agency] and is located in the Environment Agency South East Region. Historically, there have been some recorded tidal flooding incidents in Southwark dating back as far as (and possibly beyond) 1828 from the River Thames. There was a significant surface water flooding incident that affected the Dulwich area in 1984. Records also show that there was a minor flooding incidence in 2001. On 27 April 2004, there was flooding from surface water that primarily affected the Dulwich area. Available information indicates that the flooding event of 2004 cost £1M in damages, excluding the cost to residents and loss of income to businesses.

It is also on record that it took over six months for some residents to return to their homes, with some businesses unable to operate until after three months. Such extreme events are likely to increase due to climate change and developments in flood prone areas.

Although an event of similar magnitude to the 2004 incident has not been experienced since, localised problems due to surface water flooding continue to be experienced. On 25 December 2012, the fire brigade was required to clear the roundabout at the junction of College, Burbage and Gallery Roads which experienced flooding mainly due to large volumes of runoff generated from Dulwich Park. The most recent flooding in August 2013 due to a burst water main, while different in character, was similar in scale to the 2004 event, causing an estimated £4M of damage. This has once again highlighted the vulnerability of the Herne Hill area to flooding due to the local topography and has once more raised concerns among people in local community.

The PFRA showed that 33,220 residential properties and 2,870 non-residential properties in the London Borough of Southwark could be at risk of surface water flooding of greater than 0.03m depth during a rainfall event with a 1 in 200 annual chance of occurring. Of those, 560 residential properties and 80 non-residential properties are estimated to be at risk of flooding to a depth greater than 0.5m during the same modelled rainfall event.



Flooding on Turney Road, Dulwich in 2004.

³ Best available estimates at time of publication. See London Councils Website for further information.

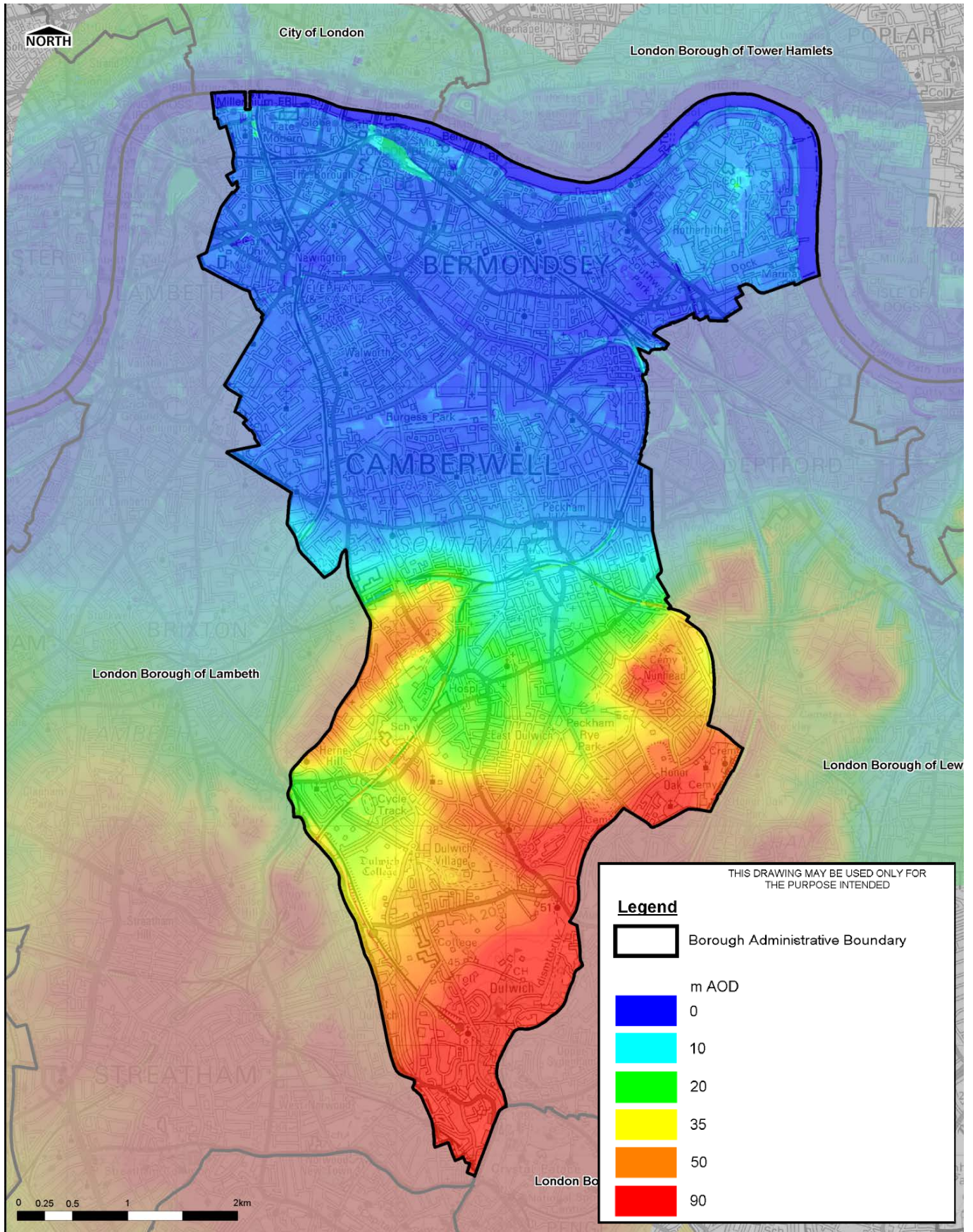
2.2 Topography of the Area

The topography in Southwark is characterised by a distinct line on the 5m AOD⁴ contour (approximated along the east-west trending A202 highway), with a basin of low lying land to the north and relatively undulating land, rising away in the south of the borough. This 'basin' area north of the A202 has ground levels as low as 0m AOD. There are also some topographical corridors that run from south to north through the borough and represent pathways of the 'lost' rivers of London including the River Effra and River Peck. The thematic map in **Figure 2.1** illustrates the topography of Southwark, and simplistically indicates a generally northerly gradient across the borough.

The London Borough of Southwark, with a dense urban development/population, lies in the lower reaches of the River Thames where the rise and fall of sea tides affect water levels in the river. The Thames Tidal Defence provides raised flood defence walls that modify the river's corridor along most of its stretch through London, and protects the urban areas situated in former floodplains from tidal/fluviial flooding. The topography and underlying geological formations present an elementary means of identifying those areas in which surface water runoff is most likely to flow to and accumulate. Locations that have highly impermeable soils and low (basin) profiles are the most likely to have a potential risk of localised flooding.

⁴ AOD refers to above ordnance datum, in accordance with the Ordnance Survey of Great Britain.

Figure 2.1: LiDAR topographical survey used for the Surface Water Management Plan



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2.3 Geology of the Area

The bedrock⁵ geology of Southwark consists of the chalk formation (Upper Chalk), which is overlain by the thanet sand formation (fine grained sand), lambeth group (clay inter-laid with sand) and london clay formation (clay and silt).

Superficial⁶ geological formations consisting of various river terrace deposits, alluvium (silty, peaty, sandy clay), peat, head (clay, silt, sand and gravel), langley silt member, interglacial lacustrine deposits, and sand and gravel of uncertain age cover most of the northern half of the borough. The area covered by these superficial deposits has ground levels less than 10m AOD, with the southern half of the borough at higher levels and blanketed by bedrock formations described above.

The thanet sand and lambeth group formations are considered to be a continuous groundwater system, known as the basal sands aquifer, and in hydraulic continuity with the chalk formation.

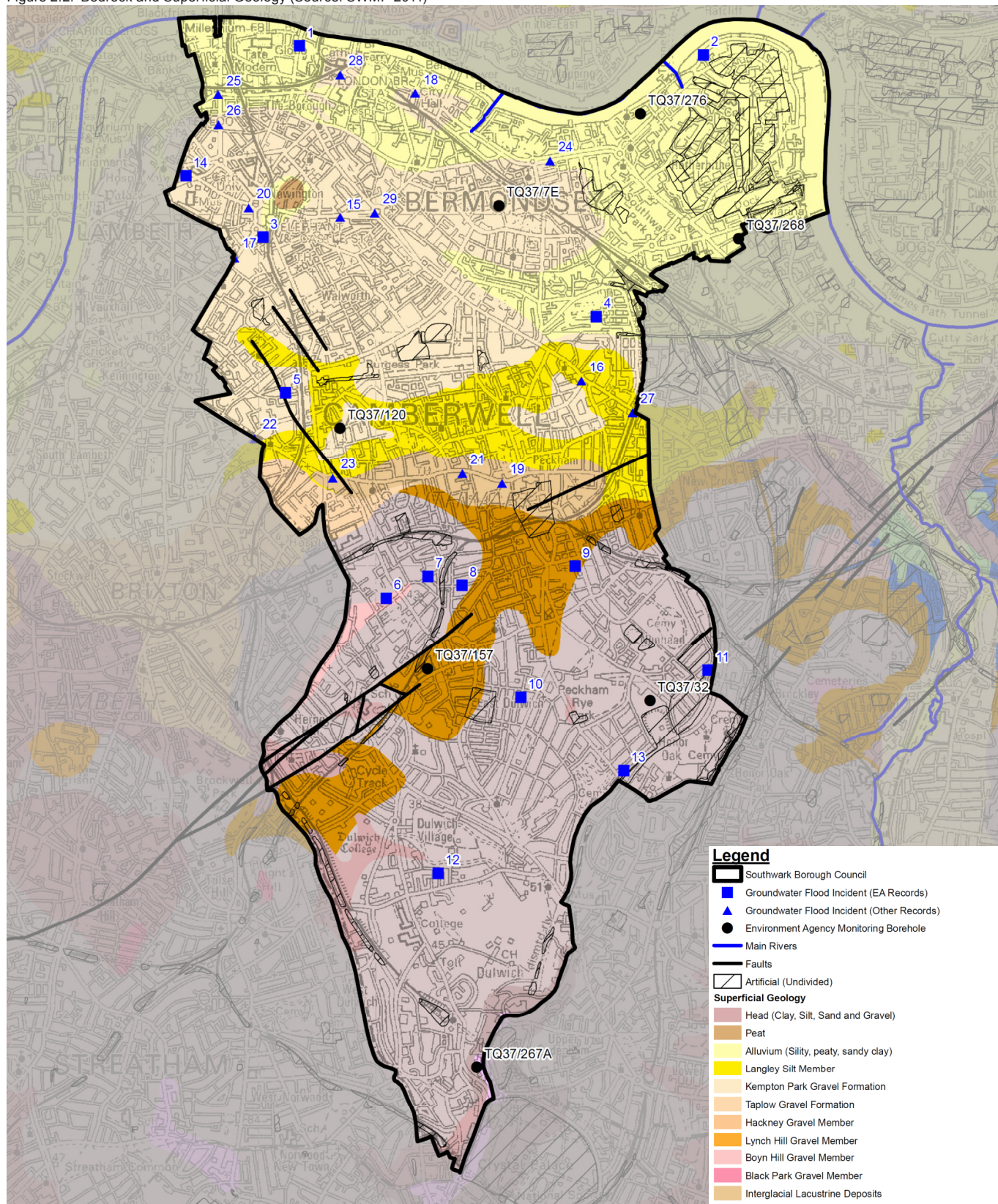
The london clay formation, mostly exposed in the north west and southern half of the borough, is regarded by the Environment Agency as an aquiclude and does not allow groundwater to flow through it. The impermeable nature of the soils in the south, associated with the london clay, can increase the susceptibility of the area to surface water flooding in the event of heavy (or flash) rainfall. It also confines the water table in the bedrock basal sands and chalk formation in the north.

Overlying these bedrock formations, the water-bearing superficial deposits of alluvium, head and in particular, river terrace deposits are expected to form perched aquifers over the london clay aquiclude in the low lying areas in the northern half of the borough. Groundwater levels in the chalk formation are monitored by the Environment Agency, and indicate water table levels close to ground level in the north eastern area of the borough. The potential for superficial / bedrock groundwater interactions may exist in this area, although this type of interaction requires further investigation. **Figure 2.2** provides an overview of Southwark's geology and of the reported instances of groundwater flooding.

⁵ Bedrock Geology - solid unweathered rock that lies beneath the loose surface deposits of soil, alluvium, etc.

⁶ Superficial Geology – the youngest natural rock deposits (on the Geological Timescale), mostly comprised of unconsolidated river-channel/floodplain/on-shore sediments such as gravel, sand, silt, clay, glacial drift and moraine.

Figure 2.2: Bedrock and Superficial Geology (Source: SWMP 2011)



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2.4 Previous Flooding Events

Although the borough has experienced some recorded flooding incidents dating back as far as the tidal event of 1828, records of flooding occurrences are generally inadequate.

A summary of previous recorded floods is provided in **Table 2.1** below, based on historical records collected and discussions with the key stakeholders as part of the Drain London Project⁷.

Table 2.1: Summary of past flooding events

Flood Event	Description
1915	Complaints were made by tenants of houses on the south-east side of Turney Road of the flooding of land, houses and gardens attributed to a blockage of the outfall drain to the sewer in Turney Road. This outfall was built when Turney Road was first formed and constructed, for the purposes of diverting the course of the Effra. However, since then, landowners have diverted additional land areas into this outfall drain by modification and extension of the sewer.
April 2001	Minor flooding occurred in Dulwich area caused primarily by run off from large areas of open spaces and recreational land including Dulwich, Belair and Brockwell Parks. (Floods in Southwark Report March 2005)
27th April 2004 (Surface Water Flooding)	Extensive surface water flooding in the south of the borough resulting from high intensity rainfall (reported 60mm over 1 hour) caused disruption to traffic and damage to resident's homes, businesses, public infrastructure especially in Dulwich, East Dulwich and Herne Hill. Some residential and commercial properties had to be vacated for several months. The costs of flooding were estimated at approximately £1 million, excluding those incurred by residents, businesses and possible insurance claims ^a .
10th December 2005 (Tidal Flooding associated with River Thames)	The Thames Barrier (which protects the borough from tidal flooding) was not shut, and sufficient flood warning was not provided to vulnerable communities close to the flood gates. This resulted in flooding to property frontages and basements, to depths of 4 – 6 inches in some instances ^b .
14th June 2006 (Surface Water Flooding)	Heavy rainfall (1.5 inches in an hour) caused surface water flooding in some parts of the borough and resulted in the closure of Rotherhithe Railway Station.
20th July 2007 (Surface Water Flooding)	Heavy rainfall caused Surrey Quays railway station to be closed for 3 hours due to flooding on 20th July 2007 (as reported by Network Rail).
August 2013	A burst water main on Half Moon Lane. Whilst different in character, this was similar in scale to the 2004 event, caused an estimated £4M of damage. This highlighted the vulnerability of the Herne Hill area to flooding due to the local topography. It is estimated 32 businesses and 2 residents were directly affected by the flood, mainly in Southwark.

^a Floods in Southwark Report March 2005 as referenced in Southwark LCLIP Report

^b Report on Planning 188 Southwark Council March 2009 as referenced in Southwark LCLIP Report

⁷ Drain London is a working partnership project funded by Defra to improve understanding of surface water flood risk in London, promote development and implementation of interventions to reduce surface water flooding

2.5 Description of Local Flood Risk

The Council, working with its consultant, has undertaken a Preliminary Flood Risk Assessment for the whole borough. The process which involved direct rainfall modelling has been undertaken

across the entire Borough for five specified return periods (1 in 30, 1 in 75: 1 in 100, 1 in 100 plus an allowance climate change, and 1 in 200). **Table 2.2** provides further information on how these return period flood events are used by other parties.

Table 2.2: Rainfall return periods and their suggested use

Rainfall Return Period	Suggested Use
1 in 30 probability of rainfall event occurring in any given year (3.3% AEP)	Since 1980, with the introduction of Sewers for Adoption, Thames Water sewers are required to be designed to accommodate a 3.3% AEP rainfall event with a likelihood of 1 in 30 years or less. Areas that are susceptible to regular flooding in these conditions could be targeted by highway teams to improve maintenance regimes.
1 in 75 probability of rainfall event occurring in any given year (1.3% AEP)	In areas where the likelihood of flooding is 1 in 75 years or greater, insurers will not guarantee to provide cover to property in the event of damage from flooding. Predicted flooding on this rainfall should be used to inform spatial planning.
1 in 100 probability of rainfall event occurring in any given year (1% AEP)	Can be overlaid with Environment Agency Flood Zone 3 GIS layer to show areas at risk under the same event from both tidal and surface water runoff sources. Can be used to advise planning teams.
1 in 100 probability of rainfall event occurring in any given year (1% AEP) plus 30% climate change	The National Planning Policy Framework requires that the impact of climate change is fully assessed for new developments. Predicted impacts (flood outlines) from these rainfall events should inform spatial planning.
1 in 200 probability of rainfall event occurring in any given year (0.5% AEP)	To be used by emergency planning teams when formulating emergency evacuation plans from areas at risk of flooding.

The output of the modelling exercise has been used to identify Local Flood Risk Zones (LFRZs) where flooding affects properties, businesses and/or infrastructure. Those areas identified to be at more significant risk have been delineated into Critical Drainage Areas (CDAs) representing one or several LFRZs as well as the contributing catchment area and features that influence the

predicted flood extent. Within the London Borough of Southwark, five CDAs have been identified as shown in **Figure 2.3**. The assessment identified that the southern part of the borough is at a higher risk than the northern part with four of the CDAs in the central to southern part of the borough and one in the northern part.

2.5.1 Local Flooding Mechanisms

The chief mechanisms for flooding in the London Borough of Southwark can be broadly divided into the following categories:

River Valleys - Across the study area, the areas particularly susceptible to overland flow are formed by narrow corridors associated with topographical valleys which represent the routes of the 'lost' rivers of London including the River Peck and River Effra. This results in large areas of deep surface water ponding in the Herne Hill and Peckham areas;

Low Lying Areas - areas such as underpasses, subways and lowered roads beneath railway lines are more susceptible to surface water flooding;

Railway Embankments and Cuttings - discrete surface water flooding locations along the up-stream side of the raised Network Rail embankment (running roughly west to east through the centre of the borough) and several railway cuttings throughout the borough including railway lines near to Denmark Hill and Surrey Quays Stations;

Borough Central Belt – the most extensive areas of surface water flooding in the borough are located along the central belt of the borough north of the A202 (e.g. Camberwell and Old Kent Road); this coincides with the southern extent of the River Thames Flood Zone 3; and

Sewer Flood Risk – primarily in areas south of the borough where historical records indicate surface water flooding resulting from the influence of sewer flooding mechanisms interacting with surface water runoff and groundwater sources. Herne Hill and Dulwich are believed to have been affected by this flood mechanism.

2.5.2 Predicted Flooding and Implications

Analysis of the number of properties at risk of flooding throughout the borough has been undertaken for the rainfall event with a 1 in 100 probability of occurrence in any given year (1% Annual Exceedance Probability, AEP). A review of the results demonstrate that about 30,280 residential properties and 2,530 non-residential properties in the London Borough of Southwark could be at risk of surface water flooding to a depth greater than 3cm depth during the 1% AEP rainfall event. Of those, 230 residential properties and 45 non-residential properties could be at risk of flooding to a depth of greater than 0.5m during the same modelled rainfall event.

Flood risk in the borough has been classified in accordance with the source (e.g. surface water) and scale (e.g. LFRZs, CDAs, Policy Areas and Indicative Flood Risk Zones). For the purpose of this Strategy, Southwark has focussed on the Local LFRZs and CDAs. The LFRZs identified in the borough are listed⁸ below;

Local Flood Risk Zones in Southwark

Herne Hill

Dulwich

London Bridge Station & Guy's Hospital

Comber Grove

Brunswick Park

King's College Hospital (Lambeth)

Railway Cutting West of Denmark Hill Station

Coleman Road / Newent

South Old Kent Road Area

These locations can be grouped together to define an area or catchment where flood mitigation measures can be implemented, thus creating the CDA. A review of the borough's flooding statistics, coupled with local knowledge of the study area, identifies that the following CDAs are at a greater risk of significant flooding (greater than 0.5m deep) from the 1% AEP rainfall event:

⁸ Obtained from the Surface Water Management Plan for the London Borough of Southwark

Table 2.3: CDAs at Greatest Risk of Surface Water Flooding in (or interacting with) the London Borough of Southwark

CDA	Flooded Receptors (>0.03m)			Flooded Receptors (>0.5m)		
	Residential	Non-Residential	Total	Residential	Non-Residential	Total
Group7_032 (Herne Hill)	6,201	339	6,540	158	33	191
Group7_037 (Central Southwark)	5,709	363	6,072	71	2	73
Group7_038 (East Southwark)	7,940	303	8,243	57	3	60
Group7_036 (Camberwell)	2,962	160	3,122	56	1	57
Group7_035 (London Bridge)	410	396	806	0	2	2

Within the London Borough of Southwark, the highest number of receptors at risk from significant surface water flooding (>0.5m flood water depth) are along the route of the 'hidden' River Effra (Herne Hill area), the River Peck and tributaries (Central and East Southwark); these hidden river routes grade from south to north through the Borough.

Significant ponding of surface water is also modelled along the central belt of Southwark in the Camberwell, Central Southwark and Peckham areas. Historical surface water flooding records support the flooding predicted in the pluvial model for the Herne Hill area, and also indicate a risk of sewer flooding in the Dulwich area. Due to the topography in the Borough of Southwark, surface runoff generated in pluvial events flows from Dulwich and Herne Hill impacts (floods) downstream receptor areas in the London Borough of Lambeth in south Brixton.

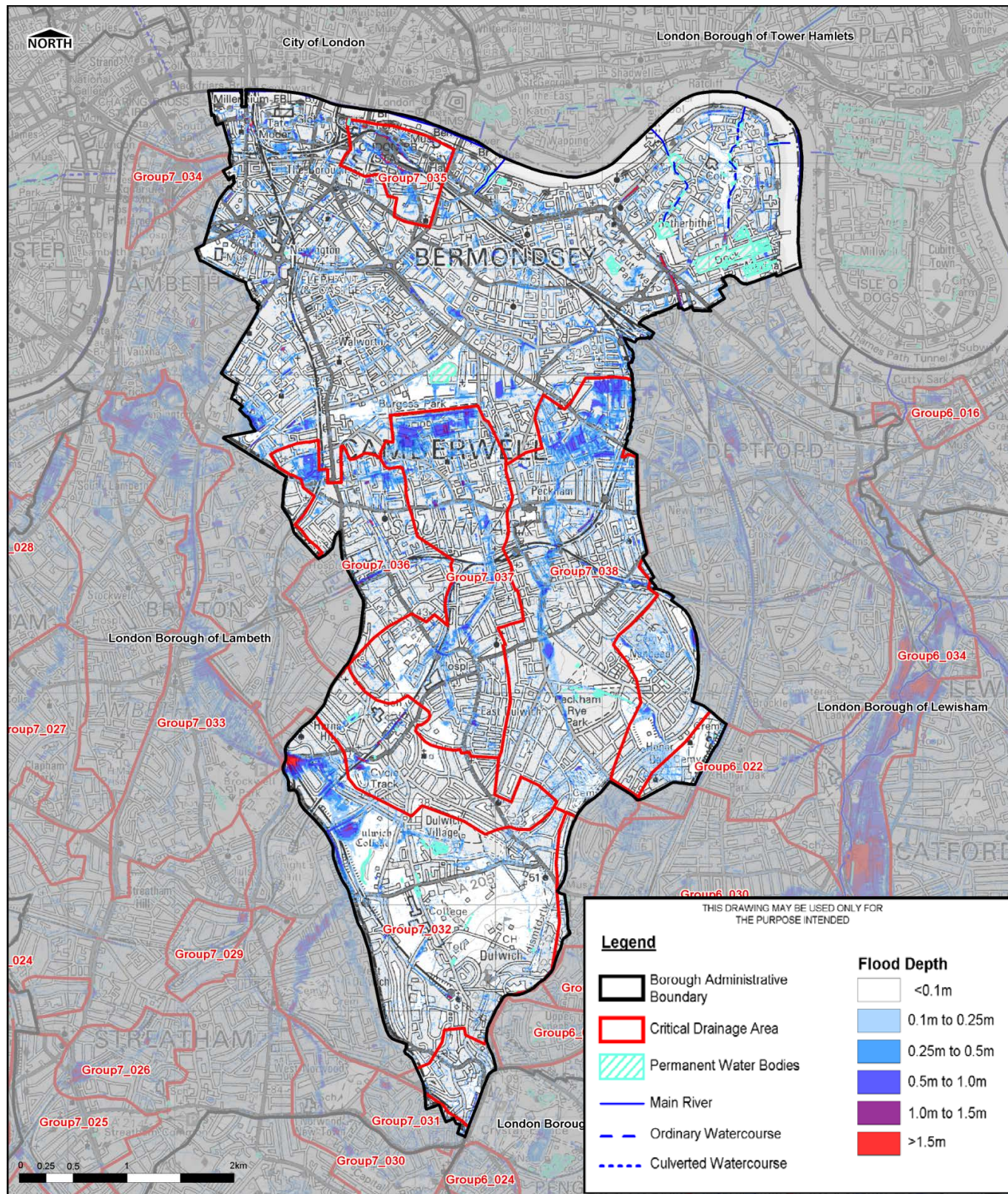
Two CDAs within the London Borough of Southwark cross the adjoining London Borough of Lambeth administrative boundary; Herne Hill and Camberwell CDAs. Southwark Council jointly manages the Herne Hill CDA with the London Borough of Lambeth; in a collaborative partnership in which Southwark Council is defined as the 'Lead Borough'. As a significant amount of surface water flooding occurs along much of the Southwark / Lambeth border the two Boroughs will work closely to manage the risk and implement flood mitigation measures in these areas. Less significantly, Southwark shares another CDA with Lewisham Council and collaborative working with the borough will be explored.

Pluvial modelling undertaken as part of the SWMP has identified that flooding within the London Borough of Southwark is typically shallow and widely dispersed across much of the borough, but deeper flooding is predicted across the central belt of the borough (north of the A202), which is typically heavily urbanised. There is also significant flood risk predicted to impact the Herne Hill area. Historical records indicate that flooding is largely a result of the local drainage network and lack of capacity in the Thames Water sewer network. The majority of the borough is served by combined sewers which, in many cases, were designed and built in the late 1800s. Subsequent urbanisation and cross-connection means the sewers across the London Borough of Southwark will have varying standards of capacities, particularly in the north of the borough.

The River Thames runs along the northern boundary of the London Borough of Southwark, and is the only source of tidal flooding in the borough with the northern part of the borough in Flood Zone 3. However, the area is defended to the 0.1% AEP (1 in 1,000 probability of occurring in any one year) design standard in 2030.

Breach modelling was undertaken as part of the SFRA. From this analysis, it is estimated that approximately 76, 178 residential and 9,864 non-residential properties are at a low (0.5% chance in any one year) tidal risk of flooding.

Figure 2.3: CDAs and Surface Water Flood Depth (Source: SWMP 2011)



1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the surface water management plan for a complete description of limitations and accuracy of the flood/hazard extents shown.
3. This map provides a strategic overview of surface water flood risk and may be subject to further analysis in the future.

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2.6 Flooding Interactions

An initial overview of the flooding issues in the London Borough of Southwark, based on the Environment Agency's flood maps for surface water and historic flooding records in the borough, indicate that several areas, including Dulwich, Herne Hill, Peckham and Camberwell are affected by multiple sources of flood risk. These include complex interactions between urban watercourse routes, direct surface water ponding, overland flow paths, groundwater springs and the combined sewer system.

There are also several cross-boundary surface water flooding issues, particularly with the Boroughs of Lambeth (Herne Hill and Camberwell areas) and Lewisham (near Honor Oak). Surface water from West Dulwich (in Lambeth) flows into Southwark along Turney Road and then flows back into Lambeth from Southwark along Half Moon Lane / Dulwich Road.

There is less significant flow of surface water between Lambeth and Southwark in the Camberwell (Ruskin Park) area, and Lewisham and Southwark near Brockley and along the administrative boundary.

When combined public sewer systems (carrying both foul and surface water) are overwhelmed, foul water may spill from the sewers and flood the streets. The resulting flood is a mixture of surface water and untreated sewage which produces a more severe health hazard. This can happen when the urban catchment receives rainfall that exceeds the capacity of the sewer systems, which are often designed to provide capacity for removal of up to a 1 in 30 year runoff.

Pluvial flooding can also be combined with river flooding and/or coastal flooding, depending on the location. Although Southwark benefits from tidal flood defences, this combination of flooding interactions could occur in the unlikely event of a breach of the defences.

It is also important to consider the impact of groundwater level conditions on other types of flooding e.g. fluvial, pluvial and sewer. High groundwater level conditions may not lead to widespread groundwater flooding. However, they have the potential to exacerbate the risk of pluvial and tidal flooding by reducing rainfall infiltration capacity, and to increase the risk of sewer flooding through sewer / groundwater interactions.

It is a recommendation of this Strategy that a holistic approach to surface water management be adopted in order to adequately assess these flooding interactions. This includes intermediate assessments of sources and mechanisms of flooding to complement the work already undertaken in the SWMP, with detailed assessments required for sources and pathways that affect areas highly susceptible to flood risk. It is also important to ensure that the solutions that are considered in reducing flood risk do not merely address one source to the detriment of another.



3 IMPACT OF CLIMATE CHANGE

3 IMPACT OF CLIMATE CHANGE

Available scientific evidence supports the current understanding that global warming causes climate change. This has an adverse impact on weather patterns (including rainfall intensities and frequencies), and effort needs to be made to address this.

Globally, average temperatures and sea levels have risen since the 19th century, and more considerably in the past few decades. The IPCC (Intergovernmental Panel on Climate Change) reports that while average temperatures throughout the world have risen by about 8 degrees Celsius since the 19th century; this has accelerated to approximately 2 degrees Celsius per decade in the past 25 years. Global sea level rises now average 3mm per year. According to the IPCC's Fourth Assessment Report (2007), a significant proportion of these effects are a result of a rise in man-made greenhouse gas (GHG) emissions and other human activities; with the most contributing effects on temperature rises.

Since the mid-20th century, annual average temperatures in the UK have risen between 1–1.7 degrees Celsius, with the largest increases in the south and southeast of England and lowest in Scotland. All UK regions have experienced an increase in winter rainfall over the past half-century, with more intense wet spells. Seasonal rainfall is highly variable. However, summer rainfall patterns appear to be marked with fewer events but greater intensities. Some of the changes might reflect natural variation; however the broad trends are in line with projections from climate models.

GHG levels in the atmosphere are likely to cause higher winter rainfall intensities in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. It is expected that lower emissions going forward could reduce the rate of climate change further into the future, but changes are still projected at least as far ahead as the 2080s. There is sufficient confidence in large scale climate models to merit a plan for change. Although there is more uncertainty at a local scale, model results can still help with planning to adapt. For example it is understood that rain storms may become more intense, even if we can't be sure about exactly where or when.

By the 2080s, the latest UK climate projections (UKCP09) suggest there could be around three times as many days in winter with heavy rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance or rarer) could increase locally by 40%.

3.1 Key Projections for the Thames River Basin District

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are:

- Winter precipitation increases of around 15% (very likely to be between 2 and 32%);
- Precipitation on the wettest day in winter up by around 15% (very unlikely to be more than 31%);
- Relative sea level at Sheerness very likely to be up between 10 and 40cm from 1990 levels (not including extra potential rises from polar ice sheet loss); and
- Peak river flows in a typical catchment is likely to increase between 8 and 18%.

3.2 Implications for Flood Risk

Climate change can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability. Wetter winters may increase river flooding in both rural and heavily urbanised catchments. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected. Rising sea or river levels may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. There is a risk of flooding from groundwater-bearing chalk and limestone aquifers across the district. Recharge may increase in wetter winters and decrease in drier summers.

Where appropriate, local studies will be undertaken to understand climate impact in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

3.3 Adapting to Climate Change

Past carbon emissions, particularly from human activities, mean that some climate change into the foreseeable future is inevitable. It is therefore essential that we respond by planning ahead to adapt to climate change implications, and to mitigate the causes of such change. We can prepare by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long-term sustainable benefits. Planning policy provides an important tool for addressing the increased risk of flooding due to climate change and minimising our vulnerability.

Although the broad climate change picture is clear, there is need to make local decisions taking cognisance of the degree of uncertainty. The council will therefore consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that vulnerability to flooding is not increased.

3.4 Pluvial Modelling Including Allowance for Climate Change

As part of the pluvial modelling completed for the Surface Water Management Plan for the London Borough of Southwark, scenarios have been modelled to include an allowance for climate change in a 100 year design horizon; i.e. 30%¹² allowance on predicted peak rainfall intensities.

As part of the SWMP, a property count was undertaken using the Environment Agency's National Receptors Dataset (NRD). It estimated that 34,010 residential properties and 2,960 non-residential properties in the London Borough of Southwark could be at risk of surface water flooding to greater than 3cm depth during a rainfall event, with a 1 in 100 annual chance of occurring including an allowance for climate change. Of those, 660 residential properties and 90 non-residential properties are estimated to be at risk of flooding to a depth of greater than 0.5m during the same modelled rainfall event. Further information on the property count methodology and property counts for other return periods are provided in the London Borough of Southwark SWMP.

¹² Annex B of Planning Policy Statement 25.



4 APPROACH TO MANAGING FLOOD RISK

4 APPROACH TO MANAGING FLOOD RISK

4.1 Our Roles and Responsibilities as Lead Local Flood Authority

The Flood and Water Management Act which received Royal Assent on 8 April 2010 introduced a new approach to flood and coastal erosion risk management by designating Southwark Council Lead Local Flood Authority (LLFA). Our primary roles and responsibilities as LLFA under the Act are applicable to managing risk from surface water run off, groundwater and ordinary watercourses as summarised below.

4.1.1 Power to Request Information

We have statutory powers to request information from all persons in order to effectively fulfil our flood risk management responsibilities.

4.1.2 Flood Incident Investigation

- We are required to investigate and record details of significant flooding incidents in Southwark that we become aware of and publish the results of the investigation.
- Identify which partner authorities have relevant flood risk management functions and establish the action taken or intended to be taken in response.
- Notify other risk management authorities where necessary and publish the result of any investigation carried out.

4.1.3 Assets Register

- We are required to identify and collate details of structures that are likely to have significant effect on the management of flood risk.
- Maintain a register of structures or features considered to have a significant effect on local flood risk.
- Keep record of information about such structures or features, including information about ownership and state of repair at the minimum. The register should be made available for inspection. Contents of the register and records may be varied by regulations made by the Secretary of State.

4.1.4 Flood Risk Management Strategy

The Act requires us to develop, maintain, apply and monitor a strategy for local flood risk management. Local flood risk sources include surface runoff, groundwater and ordinary watercourses (including lakes and ponds but excluding reservoirs and main

ivers). This document is in fulfilment of this obligation.

4.1.5 Works Powers

We have statutory powers to carry out works to manage flood risk from surface runoff, groundwater and ordinary watercourses consistent with the Local Flood Risk Management Strategy.

4.1.6 Powers to Designate

Along with the EA, we have powers to designate private or third party structures and features affecting flood risk, in particular those features on private land.

Owners of designated structures must seek Southwark Council's formal approval in advance of undertaking any alteration, demolition or replacement works on these structures.

Where an individual/organisation does make a change to a designated feature without formal approval, Southwark Council may issue an 'enforcement notice' setting out the steps to be undertaken to restore the feature. An individual may appeal against a designation notice, refusal of consent, conditions on consent or an enforcement notice.

4.1.7 Sustainable Drainage Systems Approval Body (SAB)

Southwark Council is required to establish a SuDS Approving Body (SAB) with responsibility for assessing and approving proposed drainage systems in new developments and redevelopments, subject to exemptions and thresholds. The SAB must approve all designs before the developer commences construction.

SuDS will be subject to national standards being developed by Defra (not published yet).

The SAB will be responsible for adopting and maintaining SuDS serving more than one property subject to satisfactory completion. SuDS in public roads will be expected to be maintained by highways authorities.

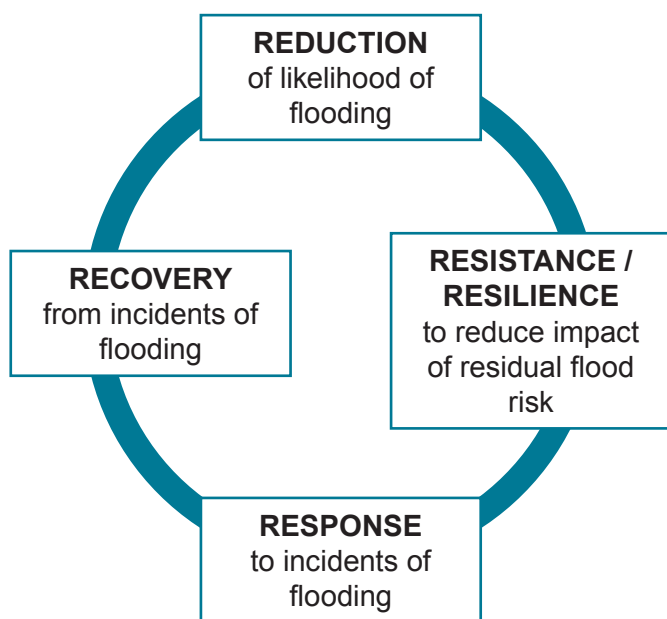
4.2 Methodology

Southwark Council's flood risk management approach derives from the National Flood Risk Management Strategy, and considers current and future flood risks. It involves planning, implementing proportionate risk-based measures and enhancing access to flood forecasting for emergency response and recovery.

The management of local flood risk requires a collaborative approach among RMAs, key stakeholders, businesses and communities. This will ensure that risks are well understood and that proposed interventions provide multiple benefits to stakeholders and beneficiaries who would be encouraged to contribute towards the cost of providing measures to reduce flood risk.

The key activities involved in managing flood risk are illustrated in **Figure 4.1** below.

Figure 4.1: Key Activities - "The Five R's of Strategic Flood Risk Management"



4.2.1 Reduction of Likelihood of Flooding

A better understanding of local flood risk has been developed through detailed flood studies, collaborative working (e.g. stakeholder partnerships, community engagement) and asset inspections. Through the PFRA and SWMP, areas at significant risk of flooding have been identified and delineated. A range of measures to reduce flood risk have been identified in the SWMP, and resources in relation to these measures will focus on the areas most susceptible to flooding.

Large scale measures in the form of flood alleviation schemes are being developed to reduce the risk of flooding in CDAs. The CDAs are made up of LFRZs and define an area or catchment where mitigation measures may be implemented to reduce flooding in the LFRZ. The outputs (i.e. action plan) from the SWMP have formed the baseline for further modelling and feasibility investigations in each specific CDA, which have resulted in the following potential flood alleviation projects;

- **Herne Hill and Dulwich** – a combination of urban greening interventions in streets and public open spaces, and flood storage through sustainable drainage systems (SuDS).
- **Peckham Rye** – interception of highway surface runoff and conveyance to new flood storage areas using SuDS. This will be integrated with Urban Greening interventions in streets and water storage in surrounding open spaces and parks.
- **Camberwell and Peckham** – mostly comprising of Urban Greening interventions in streets and open spaces.

Opportunities for flood alleviation have been identified for the above locations. These will be developed further into full schemes through local community engagement and consultation for possible implementation subject to funding availability. Schemes developed will also be sympathetic with existing character and usage of parks and open spaces and will involve stakeholder groups such as friends of the parks. Other parts of the borough at less risk of flooding will also be investigated and opportunities for flood alleviation identified subsequently. Flood maps for predicted rainfall events are provided in the SWMP. Appendix A provides a detailed list of interventions under development.

It is however worth highlighting that in view of maintenance challenges associated with proposed SuDS solutions, interventions will be highly targeted and widespread adoption of SuDS will only be promoted after a successful trial and will be subject to satisfactory maintenance budget allocation.

4.2.2 Resistance/Resilience to Impact of Flood Risk

Resistance involves planning and implementing measures to prevent the ingress of flood water into residential and commercial properties. It could include property level protection such as flood doors/gates, flood barriers, air-brick covers etc.

Resilience involves adaptive measures to reduce the impact of flood water that enters residential and commercial properties. While it does not prevent flood water from entering buildings, it enables forward planning for the eventuality of ingress of water through measures such as moving critical equipment to levels above flooding thresholds (e.g. from basement/ground level to first floor), water-proof plaster etc.

The Council has initiated a process of communication and engagement with local communities to enhance public awareness about causes, likelihood and consequences of local flooding, and the potential benefits of local communities taking ownership of actions to improve resilience. Communities at a relatively higher risk of flooding are being engaged to consider developing Community Flood Plans. These are on pilot basis and it intended to roll this out to other communities in the future.

Resilience measures could include;

- Raising threshold levels
- Flood doors/gates
- Air brick covers
- Door panels
- Toilet pan seals

It is recommended that any flood protection products used at property level must be Kitemark¹³ approved. Local businesses and communities are encouraged to refer to the National Flood Forum's blue pages¹⁴ for general information and guidance on resilience / resistance measures and products.

¹³ The Kitemark is a registered certification mark owned and operated by the British Standards Institute (BSI). It is one of the most recognised symbols of quality and safety and offers true value to consumers, businesses and procurement practices

¹⁴ <http://www.bluepages.org.uk/>

4.2.3 Response to Flooding Incidents

Involves the preparation and implementation of an emergency response strategy to reduce the impact of flooding on communities and businesses. The Emergency Planning and Resilience team has developed Southwark Council's Multi-Agency Flood Plan, which facilitates the coordination actions of all relevant agencies/organisations that have responsibilities under the Civil Contingencies Act 2004.

Southwark Council will work with communities at high risk of flooding in the preparation of Community Flood Plans, which will identify local actions in raising awareness and preparing for floods, improving community resilience / resistance, and emergency response. The establishment of flood wardens as part of the community flood plans to coordinate response activities will be encouraged through local communication and engagement.

4.2.4 Recovery from Flooding

Loss/injury and property damage from flooding can be a very traumatic experience for individuals and support from the Local Authority could be an important step in helping people to recover from such events. Recovery from a severe flood will be coordinated by the Council's Recovery Coordinating Group, with a lead from the Council's Gold group.

Local communities and businesses could seek further guidance on response and recovery from the following;

- **National Flood Forum's** flood resilience information
www.floodforum.org.uk
- **Environment Agency's** publication "What to do before, during and after a flood"
www.publications.environment-agency.gov.uk/PDF/FLHO1110BTFK-E-E.pdf
- **British Damage Management Association's** "Flood Recovery Guidelines"
www.bdma.org.uk/Technical/Guidelines
- **Association of British Insurers**
www.abi.org.uk

4.3 Surface Water Runoff Management Model

Southwark Council takes the view that sustainable drainage systems (SuDS) must be a primary consideration for the management of surface water on green and brownfield developments, as well as on highways and local re-generation schemes. Equally, there is scope and opportunity to retro-fit SuDS interventions (measures) at property level in order to reduce the surface runoff rates and volumes contributed by the surrounding areas. This would have the cumulative effect of reducing peak surface runoff to areas susceptible to flooding.

In order to manage surface runoff in the borough, particularly in high risk zones within CDAs, a concept of surface runoff prevention and control has been adopted from the SWMP. The prevention of runoff from sites requires a good design in residential, commercial and public infrastructure development that includes measures to eliminate as much of the discharge of surface runoff through appropriate rainwater infiltration (e.g. permeable paving), attenuation and harvesting/reuse (e.g. water butts) techniques. Such prevention opportunities should be included in the development plans.

New developments, particularly in high flood risk areas, need to demonstrate that due considerations have been given to Sustainable

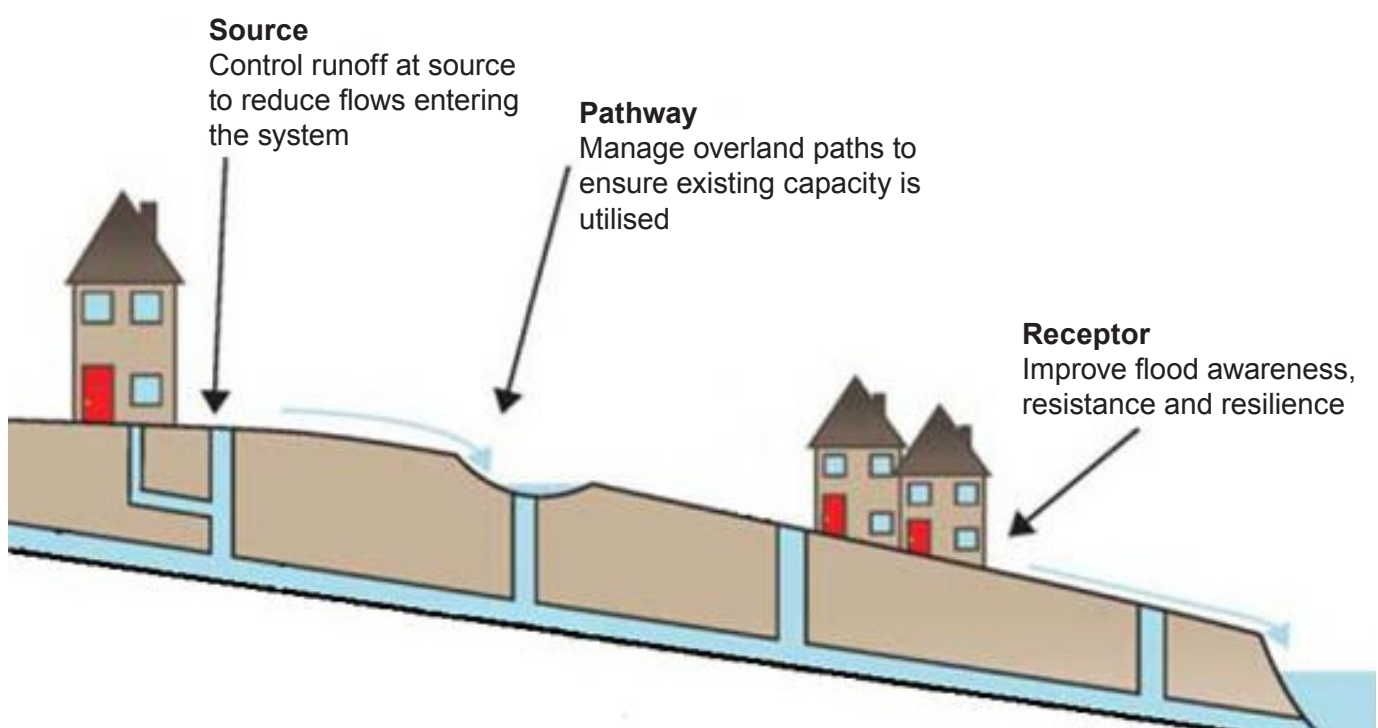
Drainage Systems (SuDS) options in their drainage proposals. New developments should aim to achieve green field run-off rates from site, and manage surface run off as close to the source as possible using the options listed below in order of preference.

- Harvest rainwater for use at a later time
- Apply infiltration techniques where soil conditions will permit
- Use ponds or open water features to attenuate rainwater for gradual release after the storm
- Attenuate rainwater by storing in tanks or sealed water features for gradual release after the storm
- Discharge rainwater direct to a watercourse where possible
- Discharge rainwater to the sewer network

The above is consistent with the Mayor of London's Planning Strategy for London (The London Plan) in relation to planning decision making.

It will become increasingly important for new developments to demonstrate that climate change and its impacts (such as increasing variations in rainfall patterns) are considered in new development proposals. In simplistic terms, the interventions model considers the causes and effects of flooding at different stages of the surface runoff cycle, and can be summarised in **Figure 4.2** below.

Figure 4.2: Source-Pathway-Receptor Runoff Management Model (Source: SWMP 2011)



A baseline set of standard measures to consider under this model is provided in **Table 4.1** below.

Table 4.1: Standard Measures for Surface Runoff Management

Source	Pathway	Receptor
Green roof	Increasing capacity in drainage systems	Improved weather warning
Soakaways		Planning policies to influence development
Swales	Separation of foul and surface water sewers	Temporary or demountable flood defences
Permeable Paving	Improved maintenance regimes	
Rainwater Harvesting	Managing overland flows	Social change, education and awareness
Detention Basins	Land management practices	
		Improved resilience and resistance measures

The specific interventions (or measures) that have been identified in this Strategy are detailed in Appendix A.

4.4 Engaging Local Communities

Individuals, businesses and communities can play a key role in ensuring an improved understanding and management of local flood risk. The uncertainty of future housing insurance against damages from flooding may drive more property owners to acquire knowledge and tools to ensure protection of their assets. Equally important is the ability of property owners/occupants to efficiently respond and recover from flooding events.

A 'quick-win' in engaging the local communities will involve raising awareness on flood risk in affected areas, disseminating potential resilience, resistance and recovery measures.

The objective with local communities will be to empower them to:

- take ownership of developing measures to reduce flood risk (e.g. installation of permeable paving, water butts etc);
- be involved in flood strategies (public consultation on the Local Flood Risk Management Strategy);
- increase their preparedness to reduce the impact of flooding and improve recovery in the aftermath (i.e. developing Community Flood Plans); and
- improve resilience and resistance to the impact of flooding.

4.5 Internal Flood Risk Partnership

To ensure Southwark executes its roles and responsibilities required under the Act and the Regulations a flood and drainage team has been set up. It comprises of a Flood Risk Manager, a Flood and Drainage Engineer and a Drainage Technician. Additional staff will be recruited if deemed necessary upon the commencement of Schedule 3 of the Act which requires the Council to set up the SuDS Approval Body (SAB).

Southwark Council also has an Internal Flood Risk Partnership (IFRP), which was established on 1st April 2011. Actions from the SWMP have been assigned to relevant departments within the borough to address. The partnership meets quarterly to review progress towards the implementation of the SWMP. Key among them is the need to establish clear lines of maintenance responsibility among the various departments. **Table C.1** in Appendix C outlines the roles and responsibilities of the departments represented on the partnership.

4.6 External Flood Risk Partnership

Southwark will be collaborating with other risk management authorities in exercising its functions under the Act. These include; the EA, other lead local flood authorities, water companies and other highway authorities. Together these constitute the Central South Flood Partnership. **Table 4.2** below details the risk management authorities and what they are responsible for.

Table 4.2: Types of Flooding and Authorities Responsible

Source of Flooding	Authority responsible
Tidal (River)	Environment Agency
Reservoir	Thames Water
Burst Water Main	Thames Water
Sewer	Thames Water
Pluvial – Surface Water	Southwark Council (and neighbouring Councils)
Groundwater	Southwark Council (and neighbouring Councils)
Ordinary Watercourses	Southwark Council (and neighbouring Councils)

4.6.1 Environment Agency

The EA is responsible for managing tidal flood risk from the River Thames. The EA is also working with Southwark in identifying and presenting flood alleviation schemes for funding through the Regional Flood and Coastal Committee.

4.6.2 Thames Water

Thames Water has a duty to provide, maintain and extend its network. In the event of an operational failure or exceedance, Thames Water will attend the site to restore services and assist with any clean-ups following such reported instances. Thames Water also works with developers and landowners to manage surface water flows where there is a proposal to connect to the public sewer.

4.6.3 Lambeth Council

Southwark and Lambeth share two Critical Drainage Areas (CDAs) across their borders. Through this partnership, the boroughs have forged a collaborative working relationship that has enabled an integrated approach to assessing, surface runoff interactions and risks across the administrative boundaries, and exchanging of information. The two boroughs share Councillor representation on the Thames Regional Flood and Coastal Committee (RFCC) who is currently the Cabinet Member for Environment, Transport and Recycling.

4.6.4 Lewisham Council

Southwark and Lewisham share one CDA across their borders. Opportunities will be sought to work together to address the common risk.

4.6.5 Thames Region Flood and Coastal Committee

The RFCC is a committee established by the EA (under the Act) to bring together members appointed by LLFAs and independent members with relevant experience to:

- Ensure there are coherent plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines.
- Promote efficient, targeted and risk-based investment in flood and coastal erosion risk management that optimises value for money and benefits for local communities.
- Provide a link between the EA, LLFAs, other risk management authorities, and other relevant bodies to engender mutual understanding of flood and coastal erosion risks in its area.

4.6.6 Highway Authority

Transport for London exercises highway authority responsibility for a network of strategic roads in Southwark and will be responsible for maintaining highway drainage and roadside ditches under the Highway Act 1980.



5 BOROUGH-WIDE ACTION PLAN

5 BOROUGH-WIDE ACTION PLAN

Through previous flood risk studies, the Council has identified a number of opportunities for measures that could be implemented across the borough to address surface water flood risk. These measures form an Action Plan which is a live programme of measures and activities to improve the understanding of flood risk, alleviate flooding, raise awareness to improve community resilience and facilitate emergency response and recovery. It is recognised that flooding within the borough is not confined just to the CDAs, and therefore, the council will seek opportunities for the implementation and testing of some measures which could be applied throughout the borough upon satisfactory outcomes while engaging local communities.

The measures detailed in Appendix A, are classified as follows;

5.1 Capacity Building

Southwark Council has invested in human resources setting up the FDT to provide the necessary skills and knowledge base required as a LLFA. The FDT has established internal and external partnerships with relevant Risk Management Authorities and other key stakeholders.

5.2 Communication, Partnerships and Community Engagement

This involves increasing awareness of flood risk and its consequences within the relevant communities, and engaging stakeholder groups to develop community flood plans. A key element will be to make the best use of internal and external resources through established and new partnerships where necessary. A **stakeholder engagement plan** has been developed to consider how stakeholders (both internal and external) will be informed and involved in managing surface water flood risk in the borough. Some of its objectives are to meet statutory requirements for public consultation on the strategy and maximise the benefit of local input. An approach of targeted engagements (e.g. Lead Council Member briefings, public meeting presentations etc.) will be executed to fulfil these objectives. Community Council meetings have been and will continue to be a good avenue to disseminate information on flood risk.

5.3 Improving Community Resilience¹⁵ and Resistance¹⁶

Since the floods of 2007 that affected residential properties and critical infrastructure across the UK, the Government has introduced the Strategic Framework and Policy Statement on Improving the Resilience of Critical Infrastructure to Disruption from Natural Hazards, which establishes an interim standard for resilience to flooding that critical infrastructure should meet. The framework emphasises the need for infrastructure providers to maintain overall service provision and to take account of the importance of specific sites within infrastructure networks¹⁷.

The improvement of community resilience and resistance of existing and new infrastructure can be undertaken to reduce damage from flooding using measures such as:

- Improved weather warning.
- Temporary or demountable flood defences/guards.
- Social change (e.g. positive behaviours towards preparing and responding to flood risk), education and awareness.
- Improved investment in local resilience.
- Improved investment in local resistance measures. This can involve the coordinated supply and instalment of property level defences such as flood doors, gates etc. through recommended industry merchants/trades.

5.4 Emergency Response and Recovery

Planning for emergency response and recovery is an important component of developing community resilience. It is associated with enhancing awareness, coordination and ownership of activities to protect human life and prevent/minimise economic loss and environmental damage. The SWMP and LFRMS identify the probable flow paths and receptors for surface runoff where resultant flooding is predicted; these areas are defined as susceptible to flooding.

¹⁵ Measures designed to reduce the impact of water that enters property and businesses; e.g. as raising electrical appliances

¹⁶ Measures designed to keep flood water out of properties and businesses; e.g. flood guards

¹⁷ Sourced from the National Flood and Coastal Erosion Strategy guidance

Southwark's Multi-Agency Flood Plan is intended to coordinate response and recovery services from statutory and voluntary emergency teams at a borough-wide level in emergency situations. At a more local level, **Community Flood Plans** will be developed for high risk areas to help communities determine practical actions to take before, during and after flooding. The Community Flood Plans will make use of local knowledge and experience on flooding, devolve ownership of resilience activities to local people/businesses, and promote an improved understanding/participation in flood risk management. They will also enable the most vulnerable members of communities to be identified and prioritised for support. Moreover, it will identify / provide safe routes of access and egress, and practical measures for the prevention of flooding.

5.5 Development and Spatial Planning Policies

This Strategy sets out a flood risk management framework to inform current and future capital investment in developments, infrastructure maintenance and land-use planning throughout the borough and neighbouring areas with shared surface water catchments.

5.5.1 Future Development

The London Borough of Southwark's Core Strategy was adopted by the Council Assembly in April 2011, and outlines how the council will meet housing needs for the next 15 years by delivering 24,450 homes by 2026. Growth will be concentrated in the following areas:

- Bankside, Borough and London Bridge Opportunity Area - 1,900 extra homes.
- Elephant and Castle Opportunity Area - 4,000 extra homes and 45,000sqm of commercial space.
- Canada Water (and Rotherhithe) Action Area - 2,500 extra homes and 35,000sqm of commercial space.
- Aylesbury Action Area - 1,450 extra homes.
- Peckham and Nunhead Action Area - 2,000 extra homes.
- Camberwell Action Area - Less amount of housing/commercial development than other action areas but no amount agreed.

- Old Kent Road Action Area - No specific housing and commercial development figures agreed.

Whilst plans for future development present a surface water management challenge, they also bring an opportunity to address outstanding issues in reducing flood risk in the affected and adjacent areas. This includes strategic upgrades to the drainage system working in partnership with relevant stakeholders.

This LFRMS recommends that current and future developments must provide sustainable drainage systems to minimise surface runoff from sites (favouring methods that mimic the natural processes e.g. infiltration/detention ponds) and practical measures for the prevention of basement flooding.

5.5.2 Planning Policy

Ideally, the LFRMS would be a precursor to the Core Strategy which sets out the Council's vision for growth in the borough up until 2026. However, there will be further opportunity to update planning policies in relation to flood risk management through the forthcoming Local Plan review which is due to begin in 2013. Further detail can also be set out in area based documents such as Area Action Plans (AAPs) and Supplementary Planning Documents (SPDs).

The LFRMS should therefore be used to:

- identify locations of different types of land use in sites and surrounding areas;
- encourage developers to provide space for surface water runoff flows/storage;
- discourage development in areas at high risk of flooding or in designated flood storage areas;
- ensure mandatory incorporation of resilience/resistance measures in developments in higher risk areas;
- develop the case for linkages between nearby developments on integrated surface water management; and
- inform the planning policy.

The general requirements for surface water discharge rate from new developments depend on site characteristics such as ground slope and whether it is a greenfield or brownfield site. For greenfield sites it is expected that the existing discharge rate should be maintained or improved

where possible. For brownfield sites new developments should aim to achieve at least 50% reduction in discharge rate.

The surface water management model detailed in section 4.3 should be applied in achieving reduction in discharge rate. Measures lower in the order should be applied only if it's proven that other higher order measures cannot be applied.

5.6 Flood Investigations and Alleviation

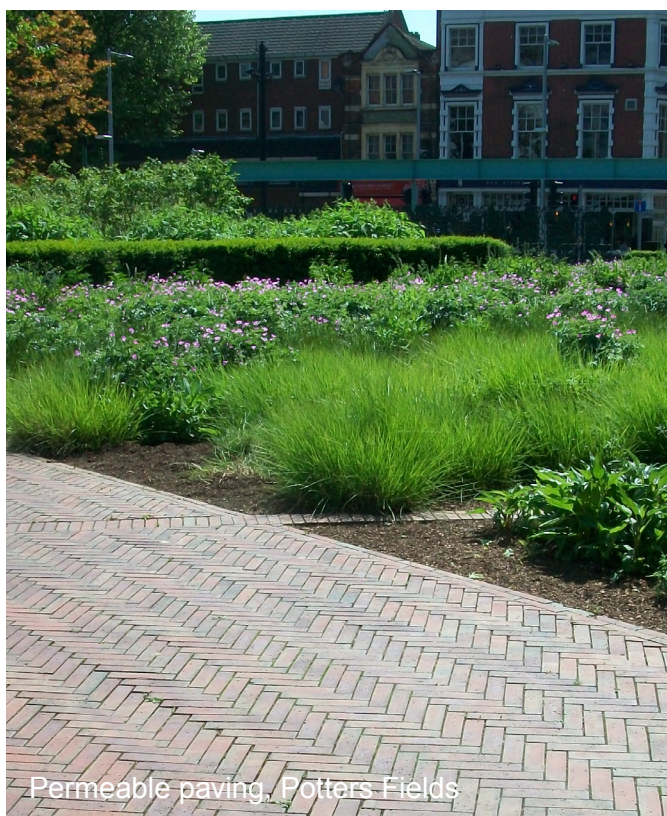
Our SWMP recommended potential actions for the alleviation of flooding in areas at high risk.

These recommendations are being developed through detailed flooding investigations and modelling assessments, detailed designs and consultations with local communities and stakeholders. Potential schemes would combine urban greening and hard engineered interventions including source control, conveyance and flood storage. The available flood alleviation measures applicable to the borough are listed on the following page; for descriptions of each measure, refer to Appendix A.

All interventions in the public highway will need to meet the adoptable highway standard or be approved by the highway authority prior to implementation.

Source Control
Green Roofs
Rainwater Harvesting
Water Butts
Porous / Permeable Paving
Local Greening Projects
Pathway Control
Swales
Geocellular Storage Tank
Carriageway Raised Entry (Speed Table) Treatment
Rain Gardens
Capacity Improvement of Sewers
Carriageway Permeable Parking Bays
Receptor Control
Detention Basins
Existing Ponds

For full descriptions please see Appendix A.



5.7 Funding

Numerous sources are available for funding of potential flood alleviation schemes, examples of which are as follows:

- Developers
- Other partners, e.g. Environment Agency, Thames Water etc.
- Levy funding
- Greater London Authority
- Funding as part of highway improvement schemes

The funding for each scheme will depend on the nature and location of the particular project.

5.8 Maintenance of Drainage Systems

Southwark Council is the Highways Authority with a duty to ensure that surface water is removed from the highway and that highway drainage assets are maintained as necessary. These assets are primarily road gullies and outlet pipes that are

owned by the Council up to the point of connection to public sewers. Maintenance of the surface water drainage system in the borough is ongoing, with small scale improvements identified and implemented to provide better (and more reliable) removal of surface runoff from public roads, footways and paths.

The improved maintenance regime targets areas that are known and/or predicted to be susceptible to surface water flooding, as well as locations known to have a history of frequent blockage of highway drains. This approach ensures that resources are focused on more vulnerable areas of the borough in order to reduce the likelihood of flooding. Opportunities to raise community awareness on the responsibilities and importance of good house-keeping on surface water drains are being undertaken through ongoing communication and engagement with local communities and other stakeholders. The aim is to reduce the incidence of blocked surface water gullies/drains caused by leaves, fly tipping and other obstructions.



Flooding in Snowfields



6 LOCAL COMMUNITY ACTION PLANS

6 LOCAL COMMUNITY ACTION PLANS

The development of local flood risk awareness, understanding and response can be best informed and delivered through local communities (i.e. community council areas).

Southwark Council, through its Surface Water Management Plan and flood alleviation studies, is focusing flood risk investigations and interventions specific to community council areas as this fits in well with the community engagement and collaborative working approach. Therefore, in addition to the borough-wide action plan briefly described in the previous section, specific measures aimed at each community council area will be promoted as discussed in this section.

The borough is administered through the following community council areas:

Dulwich - consisting of College, East Dulwich and Village wards

Borough, Bankside and Walworth - consisting of Cathedrals, Chaucer, East Walworth, Faraday and Newington wards

Peckham and Nunhead - made up of Nunhead, Peckham, Peckham Rye and The Lane wards

Camberwell - comprising Brunswick Park, Camberwell Green and South Camberwell wards

Bermondsey and Rotherhithe - comprising Grange, Livesey, Riverside, Rotherhithe, South Bermondsey and Surrey Docks wards

6.1 Dulwich Community Council Area

Local Flood Risk

According to the risk assessment undertaken in the SWMP, discrete areas of Dulwich community are at risk of flooding from surface water, groundwater and sewer surcharging. These areas have been defined as Local Flood Risk Zones (LFRZ), and are indicatively illustrated in Figure 6.1.

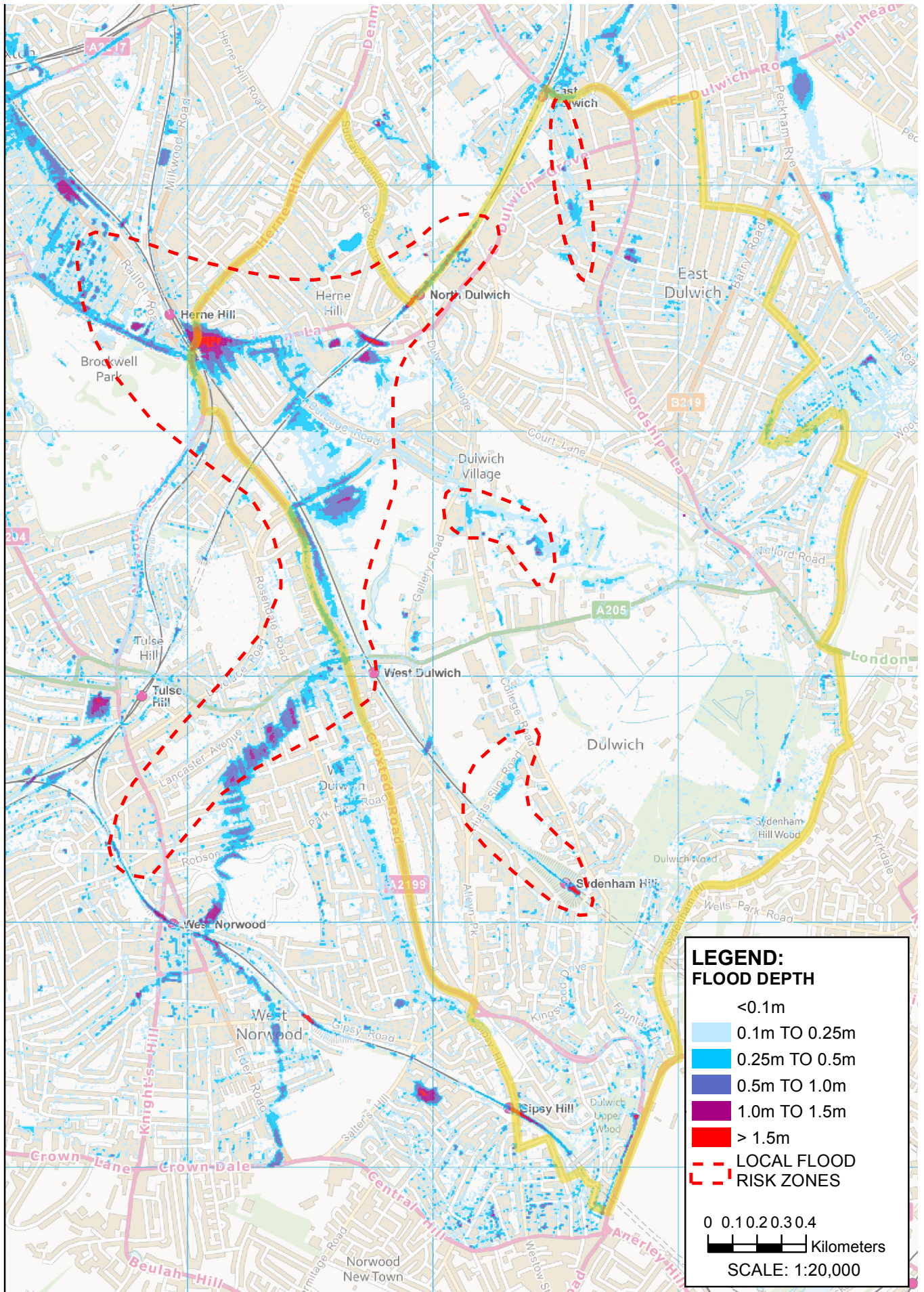
The SWMP suggests that in heavy rainfall, surface water from Dulwich Village is directed towards Herne Hill (predominantly following the topographical grade of the area) and backs up as the flow path becomes constricted at the railway underpasses in Turney Road and Half Moon Lane. There is also a flow path from West Dulwich (Lambeth) along the route of the hidden 'River Effra' watercourse which flows to Herne Hill. The surface water receptors in these areas are mostly residential properties, with hydraulic modelling projecting flood depths of above 1.5m (in a 1 in 100 year rainfall event including climate change) in Herne Hill. It is predicted that receptors at risk include:

- Critical infrastructure
 - Elm Lodge Surgery (Burbage Road)
 - Half Moon Dental Centre (Half Moon Lane)
 - Local shops along Half Moon Lane
- 6,201 residential and 339 non-residential properties flood to a depth >0.03m
- 158 residential and 33 non-residential properties flood to a depth >0.5m

The SWMP validated its findings from over 100 records of sewer flooding (due to lack of capacity) incidents, and surface water flooding records in Herne Hill and West Dulwich areas in 1984 and 2004.

Recent community council meetings have provided some anecdotal evidence of flooding from residents' testimonies. The evidence suggests a history of flooding due to heavy rainfall runoff often interacting with sewer surcharge. A further understanding of the magnitude and extent of projected flooding in Dulwich is being developed through detailed surface water modelling and further evidence gathering through engagement with the local community.

Figure 6.1: Map showing indicative local flood risk zones in the Dulwich Community Council Area



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Dulwich Community Council Area Action Plan

i. Improve Community Awareness, Resilience and Resistance

Flood risk management presentations have been made to the Dulwich community at public meetings, and meetings held with Turney Road and Burbage Road Residents Associations. This engagement is ongoing and has set the tone for involving the local community in understanding the level of flood risk to residents and properties, particularly in Herne Hill and surrounding areas. It also provides opportunities for individuals and groups to contribute towards the identification and development of opportunities to eliminate/reduce flood risk.

Through communication and ongoing engagement with Dulwich community, the following measures shall be implemented as part of the LFRMS:

- **Preparation, Response and Recovery (Community Flood Plan)**

This will be developed with interested community groups. The Community Flood Plan will supply relevant, step-by-step information on preparing for a flood, improving resilience through property-level protection and dealing with the aftermath of a flood event. The aim is to enable the community to be actively involved in flood risk management. Activities could include appointing flood wardens to help identify the most vulnerable individuals in their community, coordinate actions on flood preparation and response.

- **Improving Resilience**

Residents in Herne Hill will be encouraged to implement community-level and property-level flood resilience measures to reduce the impact of flooding on properties. As Herne Hill is predicted to be at a relatively higher risk of surface water flooding and has also been known to have suffered severe floods in the past, properties with basements need particular attention. Most of the area predicted to be at risk of flooding comprises of commercial and residential properties.

ii. Improve Policy Action on Spatial Development

The Dulwich Estate owns a significant number of private roads, residential and commercial properties in Dulwich. The LFRMS identifies Dulwich Estate as an important partner and recognises the need to engage the managers of the estate in the development and implementation of flood risk management proposals within its administrative boundary. Throughout the Dulwich community, Southwark Council will encourage and support innovative measures that residents and businesses can use to retain rainwater and reduce runoff; such as extension of soft-landscaping, repaving driveways/car-parks with permeable surfacing, installation of water butts etc. The LFRMS will drive the incorporation of appropriate sustainable drainage and flood risk management in the forthcoming Local Plan Review. This will ensure that future developments consider sustainable attenuation of surface runoff on site to reduce potential impacts on downstream receptors, especially considering that the southern part of the community council area is a watershed.

Significant levels of growth are not anticipated in Dulwich. However, the LFRMS recommends that small developments should consider opportunities to reduce surface water runoff leaving or entering sites, and provide resilience and resistance measures where necessary. The LFRMS should be used to inform future planning documents for the area, such as the supplementary planning document for Dulwich which is due to be consulted on in early 2013.

Dulwich Community Council Area Action Plan

iii. Provide Flood Alleviation

The measures outlined below identify the development and implementation actions for alleviating flooding in the Herne Hill CDA.

Source Control

- **Green Roofs**

Residential and commercial property owners, especially in the upstream areas of Dulwich Community should be encouraged to retrofit green roofs, which could benefit from the reduction of rainwater released into a public sewer system that experiences overload in wet conditions.

- **Rainwater Harvesting**

Rainwater harvesting in Dulwich will rely on engaging and persuading local communities and businesses to invest in this system. There are active residents groups such as Turney Road Residents Association (TRRA) and Burbage Road Residents Association (BRRRA) that have taken the initiative in organising the community to increase awareness and understanding of local flood risk issues. Such initiatives present opportunities to drive source control measures such as rainwater harvesting.

- **Water Butts**

The take up and implementation of water butts will rely on voluntary interest from residential and commercial property owners, with local community groups (e.g. TRRA and BRRRA) providing an opportunity to sell such ideas to residents/businesses.

- **Porous / Permeable Paving**

This could be introduced to reduce surface runoff from car parks at Dulwich Sports Club, Edward Alleyn Sports Club, James Allen School, Dulwich College, housing estates and private residences. The council will work with the owners of such facilities to identify opportunities to alleviate flooding using their wide open spaces.

- **Detention Basins**

The Open Spaces Strategy identifies the following sites in Dulwich that could be improved in quality and use/value: Dawson Heights, Long Meadow and Herne Hill Cycle Stadium (Velodrome). Dulwich and Belair Parks and open spaces provide further opportunities for open runoff storage to attenuate surface runoff volumes at source. The Herne Hill Flood Alleviation Scheme will incorporate detention basins and will significantly reduce flood risk in the area.

Pathway Control

- **Swales**

There is potential to introduce swales in some grass verges to attenuate surface runoff, particularly in open spaces in the Dulwich community council area.

- **Geocellular Storage Tank**

It may be feasible to divert surface runoff to and from Burbage Road and Turney Road towards the vicinity of the privately owned Southwark Community Sports Trust (SCST) and Edward Alleyn Club among others by providing underground geocellular storage to attenuate the flows and volume.

- **Rain Gardens**

The Dulwich area provides opportunities to introduce rain gardens in public highway using build-outs. Opportunities have been identified in Half Moon Lane, Burbage Road, Village Way and Red Post Hill.

Dulwich Community Council Area Action Plan

Receptor Control

- **Existing Ponds**

In the Dulwich Estates owned Belair Park, there is an existing shallow pond located in the southern area of the park. The team intends to work closely with the Friends of Belair Park to identify opportunities to intercept and divert surface runoff flows from surrounding roads into the park for temporary storage. The area around the pond could be re-profiled to create an extended floodplain that would allow the flood water to spill from the existing banks and be contained during the peak of rainfall events, with an allowable discharge into the public sewer.

Dulwich Park also lies on a runoff pathway predicted by modelling. There is an existing boating lake that could be used to provide storage for surface runoff diverted into the park. Further investigations into the feasibility of flood storage in Dulwich Park will be undertaken as part of the flood alleviation project for Dulwich. It is intended that any re-landscaping and planting will seek to improve the natural habitats of the areas, and will be done in consultation with Friends of Belair Park, Dulwich Estates, Friends of Dulwich Park and local communities.

iv. Improve Maintenance of Drainage Assets

In line with the borough-wide plan to improve maintenance of surface water drainage assets, the frequency of gully cleansing has been increased in high flood risk locations including Half Moon Lane, Village Way, Melbourne Grove, Red Post Hill, Turney Road and Burbage Road. Southwark Council will ensure efficient removal of tree leaves from blocking gullies (e.g. in Village Way), especially in the autumn.



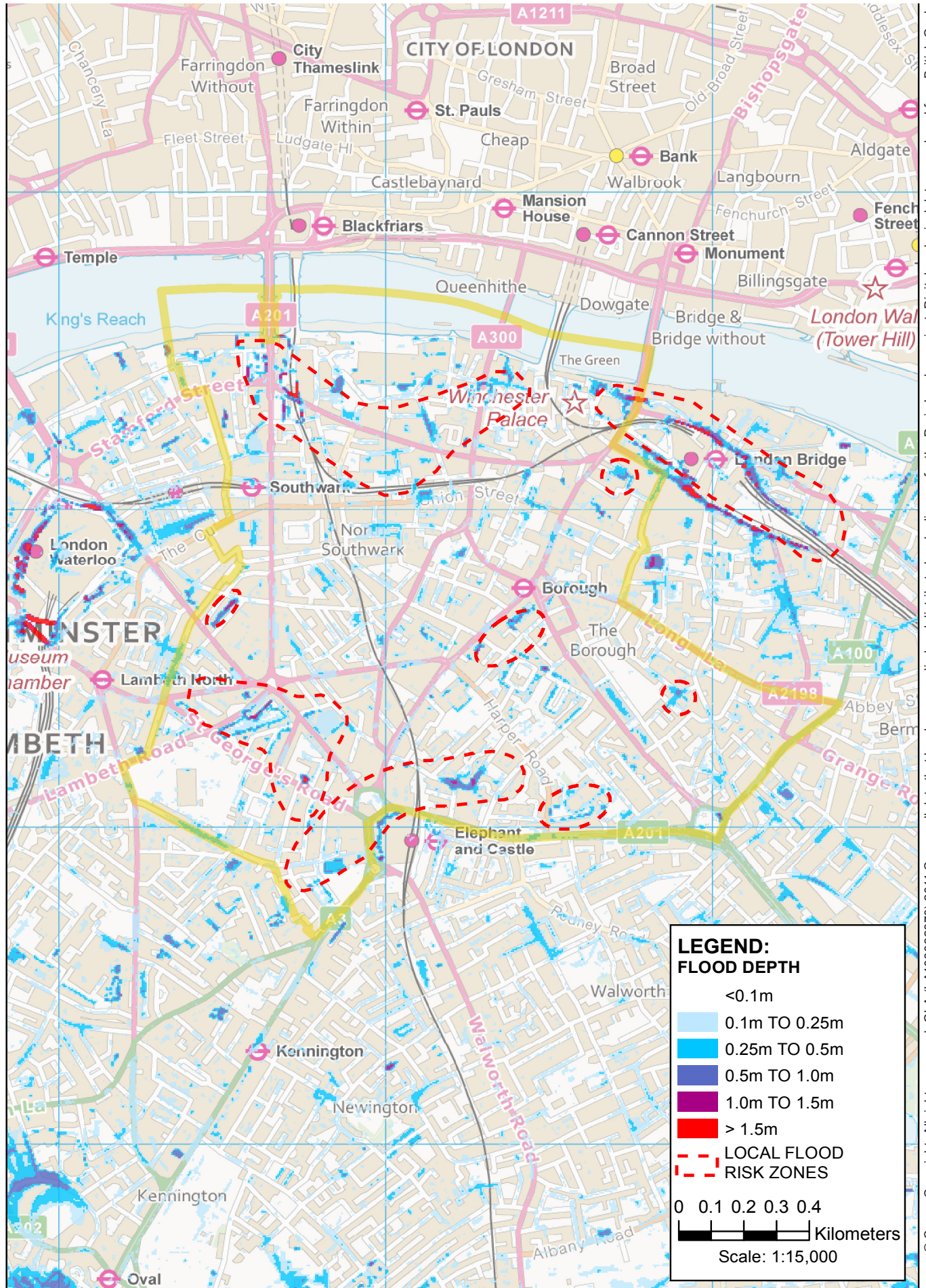
6.2 Borough, Bankside and Walworth Community Council Area

Local Flood Risk

Borough, Bankside and Walworth community council area is relatively low lying in comparison to the higher ground south of the borough and forms part of the natural floodplain of the River Thames. It is protected from tidal flood risk by the Thames flood defences. The London Bridge CDA was identified as having critical drainage issues due to the modelled areas of deep surface water flooding within it, particularly around the London Bridge rail and underground stations. There are reported incidents of surface water flooding, interspaced between the areas of Newington and Tate Modern. EA records also indicate groundwater flooding incidents in the north-western part of the community council area, which is generally overlain by permeable superficial deposits. The predominantly flat profile and spread of the area may result in accumulation of surface water runoff (ponding), but probably to a lesser depth and impact compared to other community council areas. The risk of tidal flooding in the area is considered low. Whilst an estimated total of 34,187 properties have a 0.5% chance of flooding in any year, these properties are protected by the Thames Tidal Defences (up to an event with a 0.1% chance in any year). Figure 6.3 below shows the tidal flood risk from the Thames in London Borough of Southwark

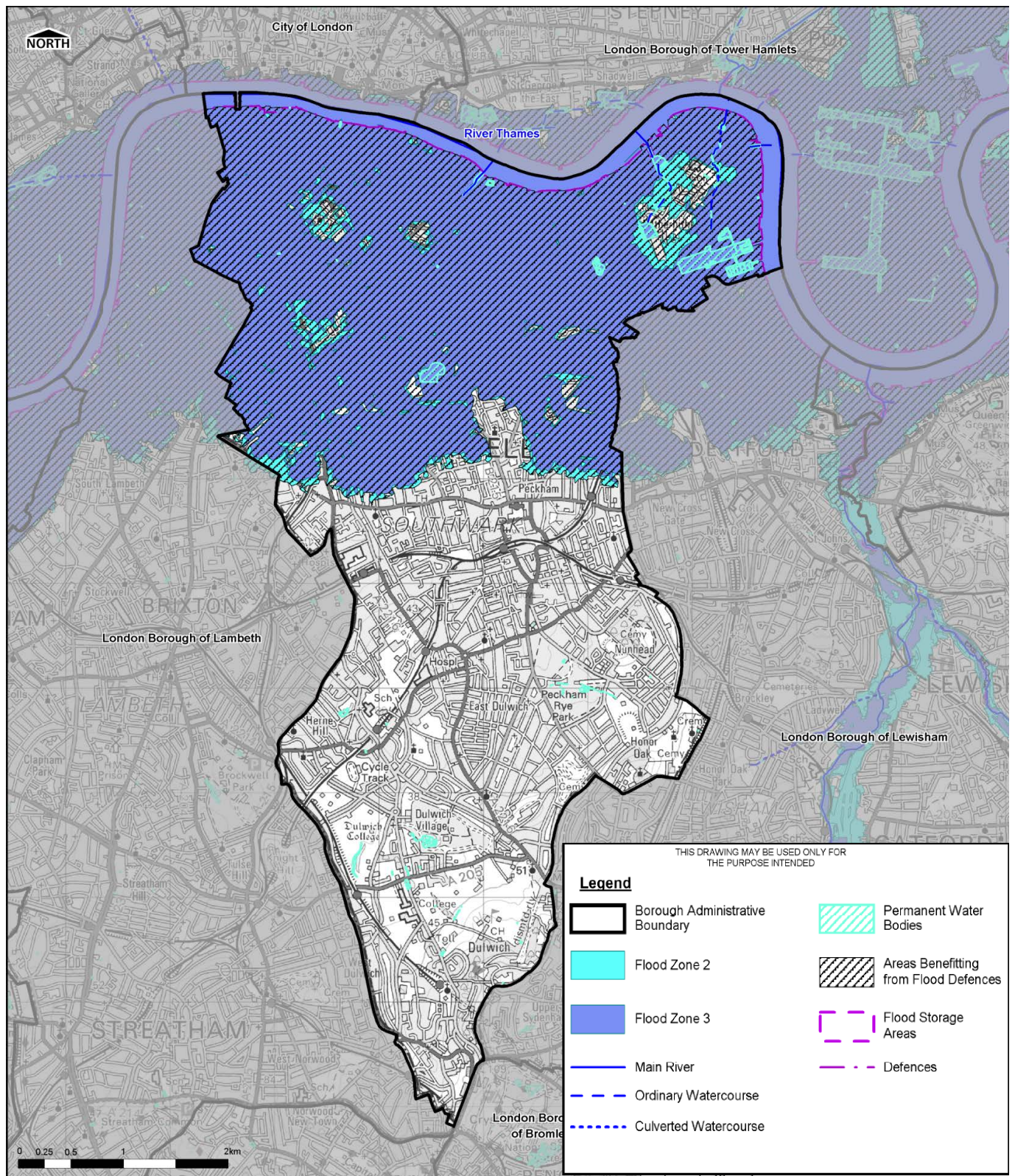
It is important to appreciate that the Thames flood defences have a limit to the protection they can provide since they are engineered structures. They may malfunction and have a finite structural life. There is therefore a residual risk of flooding within the area. In the event of a failure of the River Thames flood defence there would be a rapid inundation into the borough posing a potential risk to life and property in the path of the flood-waters. Deep, fast flowing water as well as the accumulation of standing water as a result of breaching or overtopping is a risk to life and must be considered when planning future development.

Figure 6.2: Map showing indicative local flood risk zones in Borough, Bankside and Walworth



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Figure 6.3: Map showing fluvial/tidal flood risk for the London Borough of Southwark



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Notes for Figure 6.3

1. Environment Agency Flood Zone 3: Land Assessed, ignoring the presence of flood defences as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding.
2. Environment Agency Flood Zone 2: Land Assessed, ignoring the presence of flood defences as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding.
3. Environment Agency – Areas that benefit from flood defences: Land that may benefit from the presence of major defences during a 1% fluvial or 0.5% tidal flood event. These are areas that would flood if the defence were not present, but may not flood because the defence is present. Areas benefiting from flood storage areas may be remote from the flood defence structure.
4. Environment Agency Flood Defences: The map displays the location of linear raised flood defences such as embankments and walls.
5. Environment Agency Flood Storage Area: Flood storage areas, land designated and operated to store flood water are shown as a separate polygon layer.

Borough, Bankside and Walworth Community Council Area Action Plan

i. Improve Community Awareness, Resilience and Resistance

Communication and engagement with the community of Borough, Bankside and Walworth is on-going. The focus on potential measures to protect residents and property/infrastructure in this community is on improving awareness of local flood risk, and enhancing community resilience and resistance at property level.

ii. Improve Policy Action on Spatial Development

The Borough, Bankside and Walworth community council area have the following policy areas as identified in the Council's Core Strategy:

- Part of the Borough, Bankside and London Bridge Opportunity Area.
- Elephant and Castle Opportunity Area.
- Aylesbury Action Area.

The vision set out in the Core Strategy for the Borough and Bankside Opportunity Area aims to enhance the development of new businesses, residential units and communal/youth facilities to improve living standards of the community in a way that is sensitive to resident communities. This will include introduction of more green spaces through landscaping and tree planting. The largest developments will be around Blackfriars Road and Bankside, providing new open spaces. The vision for the Elephant and Castle Opportunity Area is to encourage regeneration that provides new homes, leisure facilities and tall buildings to enhance the character of the area and encourage investment. The vision of the Aylesbury Action Area is set in the Aylesbury Area Action Plan and focuses on the phased re-development of the Aylesbury Estate (between 2009 and 2027) to provide more family housing, and safer and more accessible streets. This may involve softening up the urban landscape to introduce greener open spaces and streetscapes.

Given the vision and extent of regeneration planned for the community council area, there are opportunities for current and future redevelopments to incorporate appropriate flood risk management techniques to meet the objectives of this LFRMS. Of particular significance would be the provision of an urban design approach to the developments that uses soft engineering measures (e.g. urban greening SuDS etc.) to contain as much runoff at source as possible. The Council will ensure that future spatial development policies, including neighbourhood plans, for this area are informed by the LFRMS.

To mitigate the residual risk to tidal flooding in the highest risk areas floor levels of future developments should be raised above the predicted 0.5% (1 in 200 year) design flood level (plus climate change) calculated assuming a breach of the River. The height that the floor level is raised above flood level is referred to as the 'freeboard', and is determined as a measure of the residual risks. Areas of the London Borough of Southwark that fall within Zone 3a High Probability and/or Zone 2 Medium Probability must have a point of access that is situated above the 0.5% (1 in 200 year) plus climate change flood level. Basements within areas should progress only after a careful assessment of the level of risk. Further details on tidal flooding in Southwark are detailed in the Strategic Flood Risk Assessment (SFRA).

Borough, Bankside and Walworth Community Council Area Action Plan

iii. Provide Flood Alleviation

The northern (Borough and Bankside) and central (Elephant and Castle) parts of the community council area have limited access and availability of open spaces, offering few opportunities for attenuation storage of stormwater. The southern (Aylesbury and Walworth) area is dominated by Burgess Park and smaller open spaces, with greater potential to introduce SuDS measures to attenuate runoff. Presently, no flood alleviation scheme has been identified for the area but they will be considered as further flood risk investigations provide a confident picture of areas of susceptibility. However, there are broad prospects for providing SuDS and other urban greening measures sympathetic with Southwark's regeneration and environment enhancement aspirations (in the Core and Open Spaces Strategies) through source, pathway and receptor control measures.

The Open Spaces Strategy identifies the following improvements:

- Marlborough Playground – potential to improve access and landscaping.
- Leathermarket Gardens – potential improvements to biodiversity.
- Crossbones – potential for new open space as part of wider developments.
- Heygate Estate – potential to create new local park as part of development plans.
- Nursery Row Park – possibility of introducing new habitats.
- Carter Place – potential for new park if opportunity arises.
- Aylesbury and Walworth Estates – potential linkages (green paths) to Burgess Park and other open spaces.

It is expected that any measures proposed to reduce flooding in these areas will aim to provide multiple benefits to the community through enhancement to the environment, amenity use and aesthetic character of the area.



Rain Garden, near Potters Fields

6.3 Peckham and Nunhead Community Council Area

Local Flood Risk

The SWMP identified LFRZs and CDAs in the Peckham and Nunhead community council area. Figure 6.4 and Figure 6.5 illustrate these LFRZs which lie in the East and Central Southwark CDAs. The East Southwark CDA covers much of the eastern end of the borough, with a small section encroaching into the London Borough of Lewisham. The general flow of surface runoff is from south to north, largely following the topography of this part of the borough and along the old watercourse of the River Peck. A significant amount of ponding has been known to occur in the Brimington Park area, Commercial Way, Naylor Road, Asylum Road and Clifton Avenue.

A nearby railway embankment may worsen local flooding from surface water in the area. Pluvial flooding occurs in the Coleman Road / Newent Close area and to the south of Old Kent Road, with up to 1m flood depth predicted. The north western part of the CDA (near Brimington Park) is an area of increased potential for high groundwater levels in consolidated aquifers and contains some localised permeable superficial deposits. A few local groundwater flooding incidents have been recorded in this area.

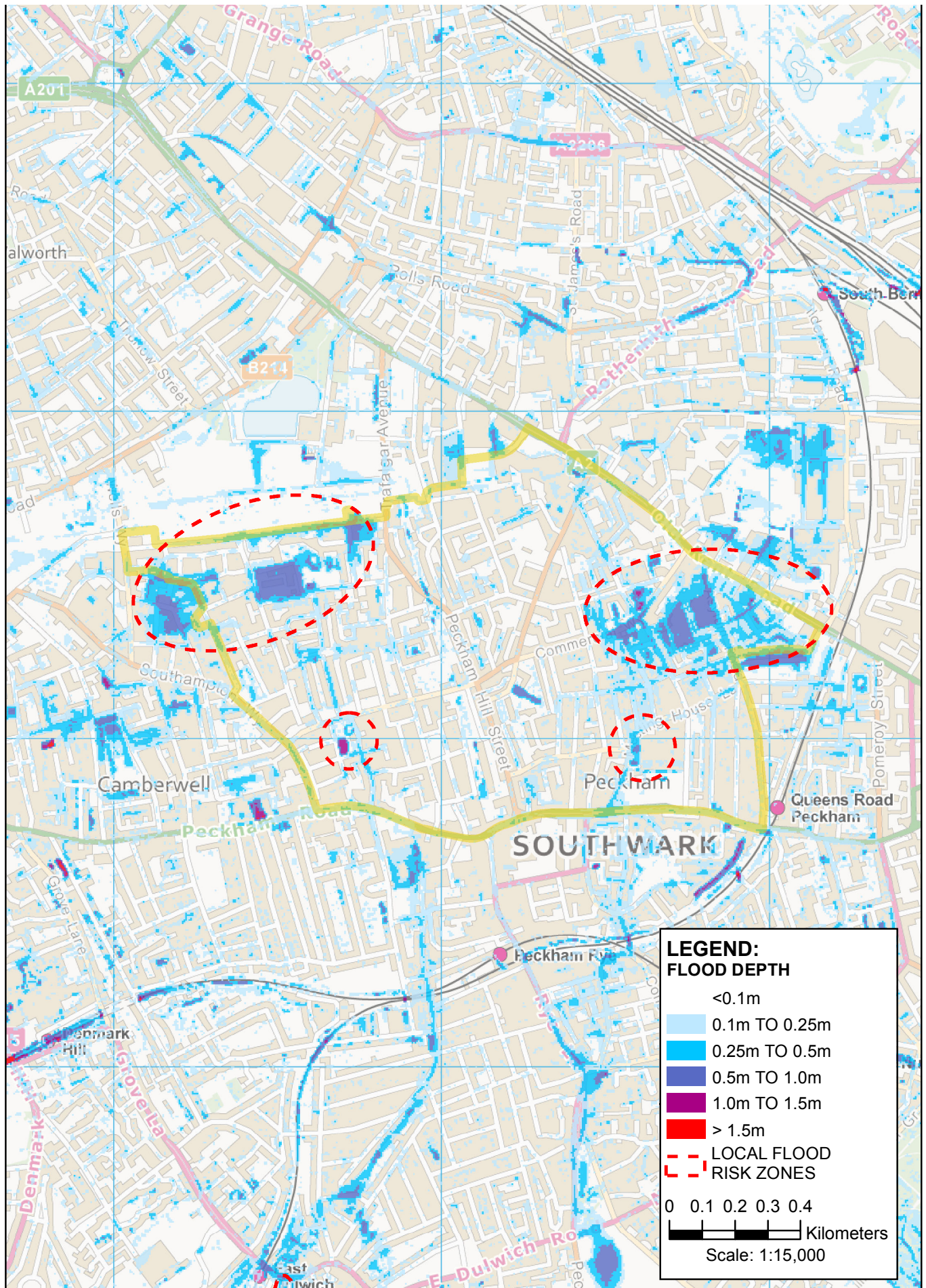
A section of Central Southwark CDA is within the community council area, bounded by East Dulwich Road, Bellenden Road, Vestry Road and Peckham High Street. There is a topographically influenced surface runoff flow path from south to north down Bellenden Road, originating from an area west of the railway line near Dulwich Hamlet Football Club and from east of the railway line near Allyn's School (both outside community council). It is thought that the flow paths follow the route of an historic watercourse.

Receptors of flood waters in the Peckham and Nunhead community council area have been predicted from modelling the impact of a 1% (1 in 100 year) rainfall event (including climate change), and include the following critical infrastructure:

- Camelot Primary School.
- Peckham Police Station (Entrance).
- Gloucester Primary School.
- The Grove Children's Centre.

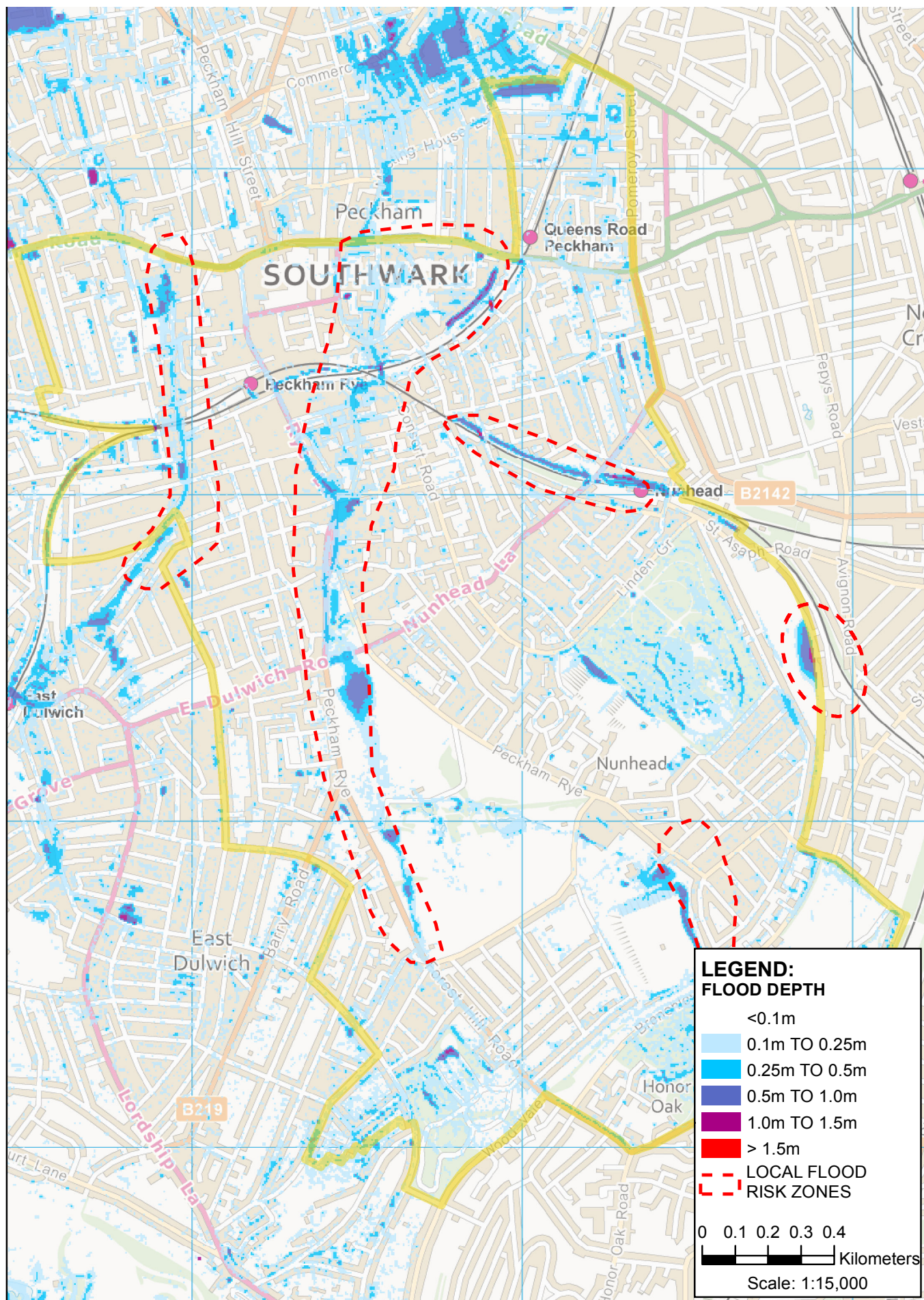
Peckham & Nunhead have an estimated 8,757 properties with a low (0.5% chance) of fluvial/tidal flooding in any year from the Thames.

Figure 6.4: Map showing indicative local flood risk zones in the Peckham area of Nunhead and Peckham Community Council



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Figure 6.5: Map showing indicative local flood risk zones in the Peckham Rye and Nunhead areas of Nunhead and Peckham Community Council



Peckham and Nunhead Community Council Area Action Plan

i. Improve Community Awareness, Resilience and Resistance

The Council has commenced a programme of raising public awareness and engagement in the Peckham and Nunhead community council area through presentations and distribution of material at public meetings hosted by the Community Council. The LFRMS recommends continued engagement with the Peckham and Nunhead community to improve publicity on flood risk, support opportunities for local initiatives on sustainable development, and develop measures to reduce its likelihood/impact through resilience and resistance.

The following measures have been identified as appropriate for improving community awareness, resilience and resistance in Peckham and Nunhead:

- **Community Engagement**

Engage residents and businesses at relatively higher risk of flooding and seek opportunities through the Peckham and Nunhead Area Action Plan to incorporate flood risk reduction measures.

- **Preparation, Response and Recovery (Community Flood Plan)**

A plan to identify specific actions required for the preparation, response and recovery from flooding will be developed with the community through public consultations and engagement at community council meetings, tenants association groups and other local associations.

- **Improving Resilience and Resistance**

A significant part of the Peckham and Nunhead Community Council area is generally flat and low lying (i.e. part of the floodplain benefiting from the Thames Defences). Although surface water flood alleviation schemes are being developed for the community council area, take up of flood resilience and resistance measures on individual basis will be encouraged in view of the residual risk.

ii. Improve Policy Action on Spatial Development

Southwark Council's Core Strategy and Open Spaces Strategy recognise that Peckham has a high population density and is subject to socio-economic deprivation. The Peckham and Nunhead Area Action Plan's vision is to develop more residential and commercial units in the area, mostly around the town centre. However, Nunhead is generally regarded as a low-density population area and the Core Strategy aims to maintain this. The vision for spatial development includes the introduction of green streets and improvements to parks (Peckham Rye Park, Peckham Rye Common and Burgess Park). Flood storage in Peckham Rye Common and Peckham Rye Park will provide an opportunity to enhance the quality and use of the area whilst reducing flood risk. There are opportunities to introduce pathway intervention of surface runoff through measures such as rain gardens and enlarged tree pits in streets, which would fit in with the aspiration to achieve greener streets. The LFRMS recommends that the objectives and multiple benefits of flood risk management should be embedded in the forthcoming Local Plan review.

Peckham and Nunhead Community Council Area Action Plan

iii. Provide Flood Alleviation

Opportunities are being sought to develop flood alleviation schemes to reduce the risk of flooding from surface water and groundwater in Peckham and Nunhead. The preferred measures that have been identified focus on LFRZs in the East Southwark CDA and the section of the Central Southwark CDA that falls within the community council area.

Source Control

The following source control measures could be developed through engagement with local residents, businesses and key stakeholders.

- **Green Roofs**

It is anticipated that housing estates would be an ideal place to retro-fit green roofs on buildings, with the potential for wider implementation in schools, private and business estates. Peckham and Nunhead community council area has several council housing estates, and consultations with internal stakeholders and the public are in progress to encourage the introduction of green roofs. In addition, with the proposed development under the Peckham and Nunhead Area Action Plan, there are opportunities for developers to be encouraged to incorporate green roofs (and green walls) as part of their proposals.

- **Rainwater Harvesting**

There are opportunities to develop and implement rainwater harvesting schemes particularly in schools and new development.

- **Water Butts**

These will be widely promoted on existing and new housing estates and will rely on voluntary uptake from local residents and businesses. Residents and tenant associations in the area will be engaged to encourage the uptake of water butts. There is scope to collaborate with Thames Water on their water conservation schemes similar to what has been done with the Wells Way Triangle Residents' Association.

- **Porous / Permeable Paving**

Given the significant share of council housing estates in Peckham and Nunhead, it is anticipated the use of porous/permeable paving in car parks and other paved areas will help alleviate surface water flooding.

- **Swales / Detention Basins**

Although there is limited space in road verges around Peckham and Nunhead, some open spaces such as Brimington Park, Peckham Rye Park and Peckham Rye Common offer opportunities to attenuate runoff generated in these areas through the use of swales and detention basins. Several housing estates in areas such as Asylum Road, Peckham Hill Street and Daniel Gardens have open spaces that can be used to develop and implement small scale detention basins in order to control runoff at source.

- **Local Greening Projects**

Local community initiatives on greening projects such as food growing appear to be active in Peckham and Nunhead. Southwark Council will be working with such groups to support a culture of greening and education/training on sustainability that benefits flood risk management.

Peckham and Nunhead Community Council Area Action Plan

Pathway Control

The following pathway interventions have been identified for Peckham and Nunhead as potential measures to attenuate and/or redirect surface runoff generated from upstream sources:

- **Swales**

Apart from attenuating surface runoff generated at source, there is the potential to use swales to intercept and slow down runoff along street verges (e.g. on Peckham Rye, Lyndhurst Way etc.) and open spaces (e.g. Warwick Gardens, Peckham Rye Common, Peckham Rye Park). Due to the highly urbanised character of Peckham and Nunhead, space for swales is limited, particularly, north of Peckham Rye.

- **New / Extended Tree Pits**

It would be more feasible to extend existing tree pits and/or provide new ones in hard-standing spaces within Council-owned housing estates and where possible along public streets. To maximise the use of tree pits in reducing runoff, it may be possible to re-profile impermeable areas to slope (and redirect runoff) towards them.

- **Geocellular Storage Tank**

Housing estate car parks and carriageways are potential areas to locate geocellular storage tanks, which would attenuate the volume and velocity of runoff flows during the peak of rainfall events. Work is ongoing to determine suitable locations for these.

Receptor Control

- **Detention Basins**

Surface water modelling indicates runoff flow paths from Dulwich into Peckham Rye. There are opportunities to capture surface runoff in Peckham Rye Park and Peckham Common by introducing low profile (landscaped) detention basins. These would store runoff diverted from surrounding streets into the northern part of the park, and would be profiled to ensure they remain sympathetic to the recreational use and character of the area. The Bog Gardens just north of the Common could be used to introduce smaller detention basin features for runoff storage, and could be linked by pipeline to the larger ones in the Common to provide a flood storage balance. These would be designed to remain dry most of the time (i.e. outside of rainy periods), ensuring there is no reduction in available amenity space from these measures. Users and friends of the park will be engaged in discussions not only to identify flood alleviation opportunities but also park and amenity enhancement opportunities. Any proposals will be sympathetic to the current character and usage of the park.

iv. Improve Maintenance of Drainage Assets

In line with Southwark Council's flood risk focus on drainage asset maintenance, the frequency of inspection and cleansing of gullies and drains has been revised to reflect the level of surface water flood risk in locations such as Crofton Road, St Georges Way etc.

6.4 Camberwell Community Council Area

Local Flood Risk

The Camberwell Community Council Area is generally flat and low lying, located within the natural floodplain of the River Thames. However, the area benefits from flood defences. It is predicted (from surface water modelling) that runoff is directed from the topographically higher ground in the south (around Champion Hill and Dulwich), where the gradient of the land gently falls towards the River Thames. The community council area is predominantly covered by the Camberwell CDA, but also takes up an area of the Central Southwark CDA around the East Dulwich area. It is important to note that the Camberwell CDA also extends into the London Borough of Lambeth, covering an area between Kings College Hospital, Milkwood Road and Denmark Hill. As a result, Southwark Council is undertaking cross-boundary collaboration with Lambeth Council in investigating flood risk and identifying potential measures to reduce/eliminate it.

Overland flow into Brunswick Park is routed there from roads to the south and west. The depth of flooding in these areas has been predicted to be about 1m from a rainfall event with a 1 in 100 likelihood of occurrence in any given year (i.e. 1% AEP rainfall event). The LFRZs in the area are summarised as follows:

- Comber Grove – flooding predicted along Comber Grove and Wyndham Road to west of the railway line. There is evidence of historical flooding (from records) along Camberwell Church Street and Camberwell New Road.
- Brunswick Park – surface water ponding is predicted to occur in and around the park.
- King's College Hospital (in Lambeth) – surface water ponding occurs around entrances to King's College Hospital, with flows from Ruskin Park. This is supported by modelling and anecdotal evidence.
- Railway Cutting West of Denmark Hill Station – the cutting is below surrounding ground levels, indicating that the section of railway is at risk from deep flooding.

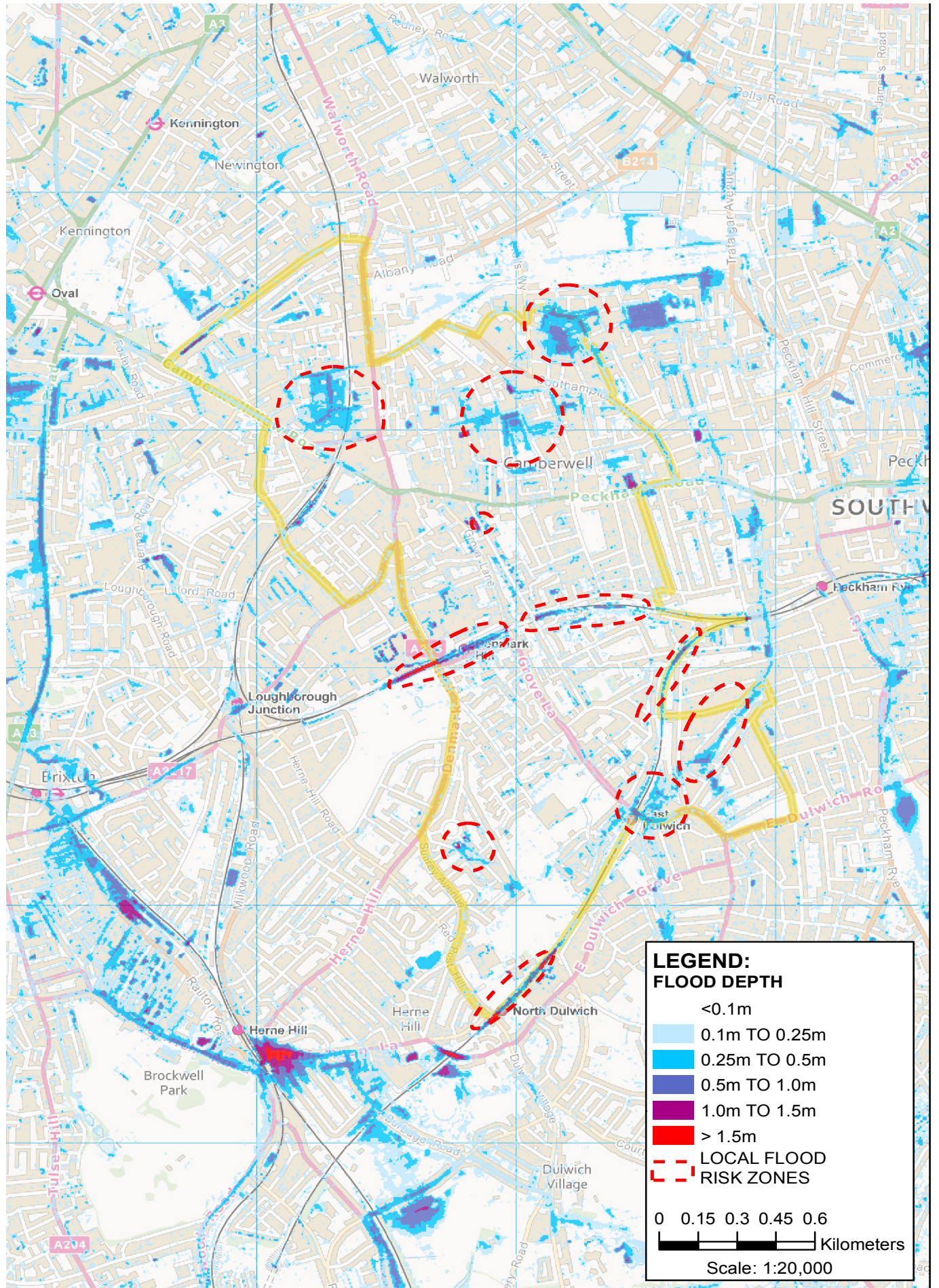
These susceptible areas are mapped in Figure 6.6.

The critical infrastructure likely to be affected by flooding from a 1% AEP rainfall event in the Community Council area includes:

- Maudsley Hospital.
- King's College Hospital (in Lambeth).
- Comber Grove Primary School.
- Railway cutting to the west of Denmark Hill Station.

Camberwell has an estimated 6,724 properties with a low (0.5% chance) of fluvial/tidal flooding in any year from the Thames.

Figure 6.6: Map showing indicative local flood risk zones in the Camberwell community council area.



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Camberwell Community Council Action Plan

i. Community Awareness, Resilience and Resistance

A programme of communication and engagement with the Camberwell community has been initiated, with public presentations at Community Council meetings and discussions already underway since early 2012. The promotion, take-up and implementation of effective resilience and resistance measures will be of great importance in this community area, due to its highly urbanised area, complex public sewer system and relative lack of larger open space for a wider range of runoff control measures.

- **Community Engagement**

Initial focus shall be on the inception, development and implementation of community-led activities to enhance resilience and resistance through tenants associations (due to the high representation of council housing estates in Camberwell), local businesses and other groups that may express interest. The engagement plan will also provide for support from Southwark Council on Community Flood Plans and other community-led initiatives that will be of benefit to flood risk management.

- **Preparation, Response and Recovery (Community Flood Plan)**

A Community Flood Plan for Camberwell will be developed through communication and engagement with residents, businesses and the Community Council. In order to develop this plan, local groups will be encouraged to volunteer their participation to champion and coordinate response and recovery activities in the event of flooding. The Southwark FDT will provide necessary support to develop the Community Flood Plan.

- **Improving Resilience and Resistance**

The uptake of resilience and resistance measures using only kitemarked products such as flood doors/barriers will be encouraged.

ii. Improve Policy Action on Spatial Development

The Camberwell Action Area (identified in the Southwark Core Strategy) focuses on improving current retail businesses rather than retail growth or new development, particularly businesses in the town centre. The vision in the Core Strategy also seeks to improve Camberwell Green and reduce traffic congestion in the area. Considering the above, the LFRMS recommends that innovative small scale measures to improve surface water management at property level be promoted at local planning level in order to reduce flood risk. Southwark Council will engage with the community in identifying and developing such measures. In addition, there are opportunities for greening the streetscape in Camberwell which fits in with the Core Strategy vision of the area. Preparation of a supplementary planning document for Camberwell is currently ongoing.

Camberwell Community Council Action Plan

iii. Provide Flood Alleviation

In general, there are limited opportunities for larger scale source and receptor control measures in Camberwell due to the lack of large open spaces. Consideration of flood alleviation measures will therefore focus on providing a combination of smaller scale source, pathway and control features that predominantly comprise of urban greening.

Source Control

- **Green roofs**
Potentially on council housing estates and possibly extending to local businesses on a voluntary take-up basis.
- **Porous / Permeable Paving**
Converting hard standing to permeable (or soft landscaped) surfacing in housing estates and car parks.
- **Rainwater Harvesting / Water Butts**
Predominantly in housing estates and schools, but will be widely promoted throughout Camberwell as part of a water conservation programme. There is scope to collaborate with Thames Water on their water efficiency schemes.
- **Rain Gardens / Tree Pits**
In green open spaces within housing estates.

Pathway Control

- **New / Extended Tree Pits and Rain Gardens**
Introducing additional infiltration areas and buildouts in footways/carriageways using rain gardens and tree pits. This complements the streetscape greening aspirations of the Area Action Plan and Open Space Strategy for Camberwell.
- **Raised Entry Treatment with Geocellular Storage**
Slowing down and draining surface runoff using speed tables at street intersections, diverting flows into below-ground geocellular storage tanks.

Receptor Control

- **Small Scale Swales and Detention Basins**
Located in areas receiving runoff from surrounding locations, small scale swales and detention basins could be introduced in Brunswick Park, Camberwell Green and open spaces within housing estates subject to consultations.
- **Raising Property Level Thresholds**
The ground levels at entry points to a property garden or building can be raised to improve its defence (resilience) against surface runoff entering and causing flooding. This would require a good level of confidence in predicted flood depths and property levels, which Southwark Council would undertake as part of the flood alleviation programme.

iv. Improve Maintenance of Drainage Assets

Maintenance of the highway drainage assets in Camberwell has been reviewed and implemented to focus on high flood risk locations, particularly in the Comber Grove and Brunswick Park area. There will also be increased focus on the cleaning of leaves and other litter to reduce the incidence of blocked gullies, especially in streets lined with trees.

6.5 Bermondsey and Rotherhithe Community Council Area

Bermondsey and Rotherhithe community council area is low lying (within the natural floodplain of the River Thames) and benefits from the Thames flood defences.

The London Bridge CDA falls within the north-western part of the community council area; defining a small area of significant flood risk in the community that covers the following LFRZs:

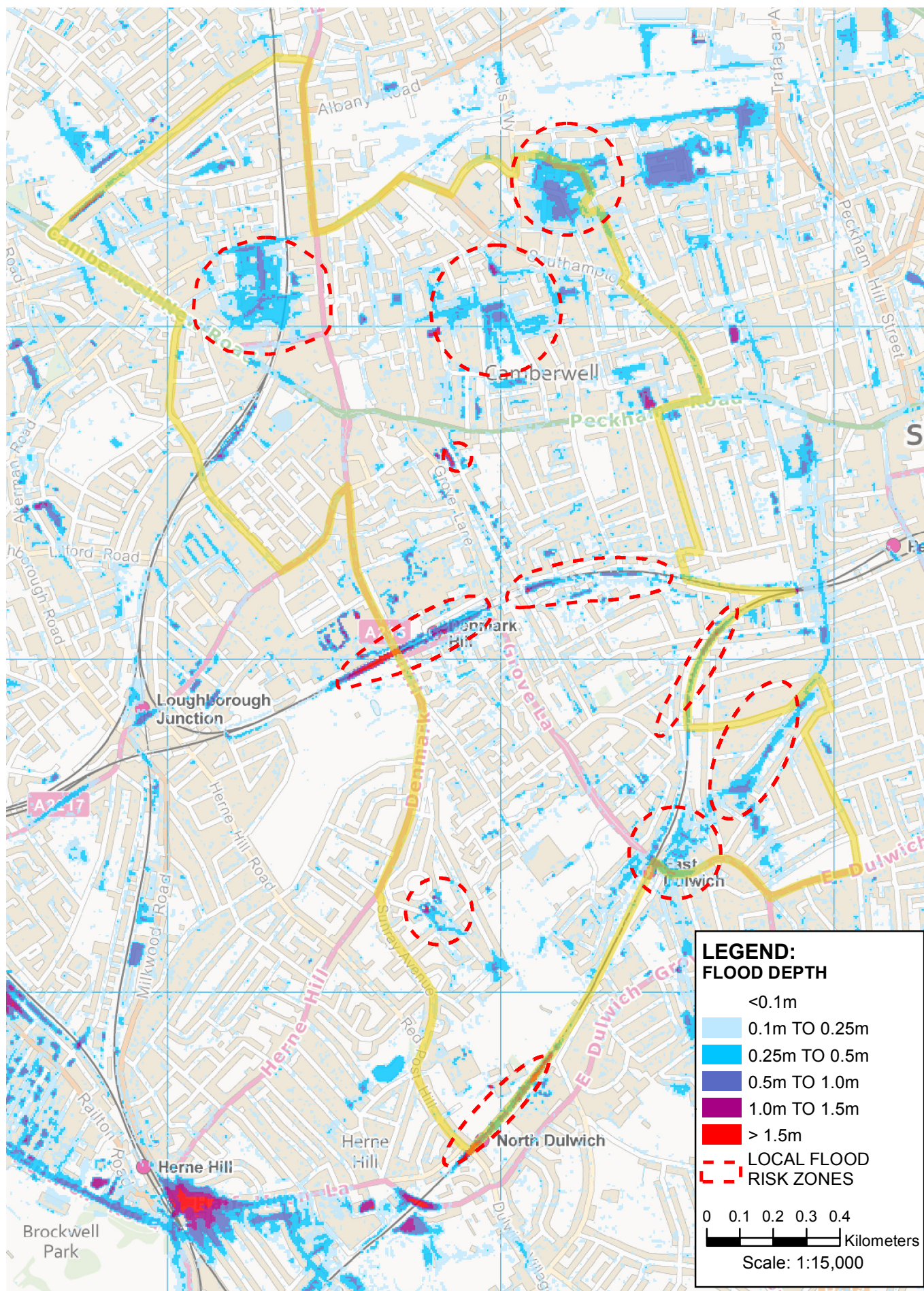
- London Bridge Station; and
- Guy's Hospital.

These two areas also define the critical infrastructure at risk of flooding from a rainfall event with a 1 in 100 chance of occurrence in any given year (1% AEP – Annual Exceedance Probability). Figure 6.7 and Figure 6.8 show indicative flood risk zones in the community.

It is predicted that surface runoff ponds around the entrance of London Bridge Station (up to 1m depth for a 1% AEP rainfall event). Surface water from the station roof and track flows southeast along Bermondsey Street and causing flooding to the immediate downstream areas. The SWMP indicates that there are some records of sewer flooding in Tooley Street, and surface water ponding at the St Thomas Street / London Bridge junction and near Bermondsey Station. However, there is no reported groundwater flooding in the area, despite indications of increased potential for high ground water levels to the east of the London Bridge CDA (within the Borough, Bankside and Walworth area). The SWMP indicates (from the surface water modelling) that in the London Bridge CDA, 410 residential and 396 non-residential properties are at risk of flooding (to a depth of greater than 3cm) from a 1% AEP rainfall episode. The same rainfall event would cause two non-residential properties to flood to a depth of more than 0.5m.

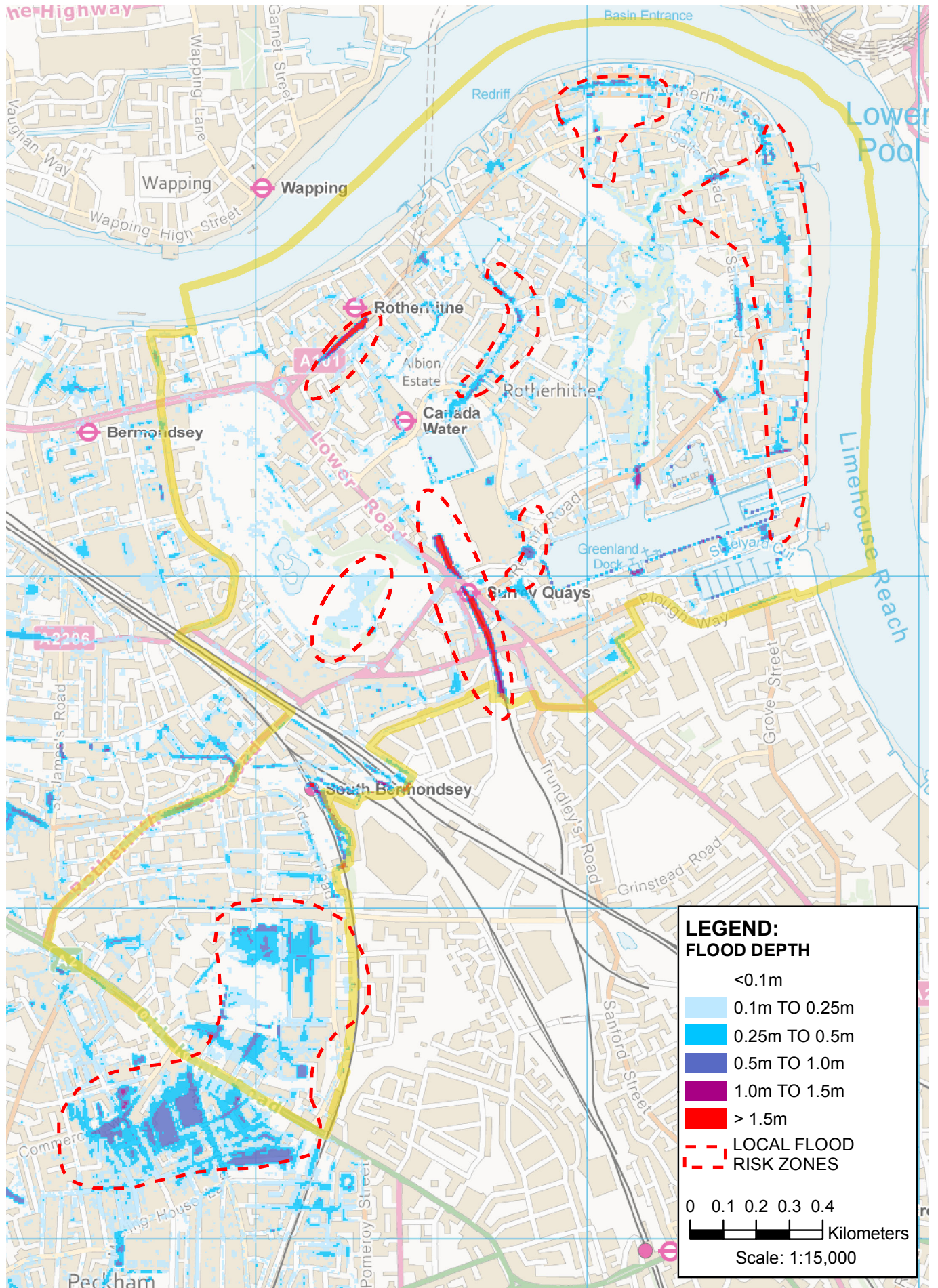
It is important to note that further investigations are being undertaken to increase the confidence and accuracy of predicted flooding in the area. It is equally important to collect as much evidence from local residents and businesses as possible in order to improve the understanding of flooding in this community. Bermondsey and Rotherhithe jointly have an estimated 36,799 properties with a low risk (0.5% chance) of tidal flooding in any year from the Thames.

Figure 6.7: Map showing indicative local flood risk zones in the Bermondsey area



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Figure 6.8: Map showing indicative local flood risk zones in the Rotherhithe area



Bermondsey and Rotherhithe Action Plan

i. Improve Community Awareness, Resilience and Resistance

A programme of communication and engagement with the community was initiated in early 2011 through a public presentation and discussion at one of the Bermondsey Community Council meetings. As this is an ongoing exercise, further communication and engagement with members of the residential and business community will be undertaken at public meetings and with local interest groups. This will raise awareness, interest and encourage local participation in flood risk management. At present, the risk of flooding is understood to predominantly result from surface water flow and ponding in relatively lower spots. As a result, the development, take-up and implementation of resilience measures will be important in mitigating flooding to properties.

ii. Improve Policy Action on Spatial Development

The Bermondsey and Rotherhithe Community Council Area have the following policy areas as identified in the Council's Core Strategy:

- Part of the Borough, Bankside and London Bridge Opportunity Area.
- Canada Water (and Rotherhithe) Action Area.
- Old Kent Road Action Area.

In London Bridge, the vision (of the Core Strategy) is to focus development around London Bridge Station and improve access and pedestrian use of streets. Urban greening of streets and pathways could be incorporated to reduce surface runoff.

The Canada Water (and Rotherhithe) Action Area's vision as set out in the Canada Water Area Action Plan, is to provide mixed use development, including more than 2,500 new homes, a secondary school (in Rotherhithe) and creating over 2,000 jobs. The creation of an open environment to link up services and facilities around the community council area is a core part of the vision, providing opportunities for the introduction of green open spaces and green streetscapes to reduce the rate and volume of surface runoff.

The Core Strategy vision for the Old Kent Road Action Area Plan focuses on provision of housing, retail and industry to complement the existing housing and business environment. The vision, development and implementation of local development policy set out in the Core Strategy must be informed by the LFRMS, to ensure that appropriate measures are taken to reduce flood risk to existing/future developments and adequate planning is in place for community-led response and recovery.

Bermondsey and Rotherhithe Action Plan

iii. Provide Flood Alleviation

The nature, extent and depth of flooding will be investigated as part of the flood alleviation work in the borough. This will focus on the London Bridge CDA where the most significant risk of flooding occurs in this community council area. Any opportunities to provide flood alleviation will be linked with development policy and current/future regeneration plans. This approach will be enabled through the continuation of ongoing collaboration among internal partners. The prospects for providing flood alleviation in the area may predominantly involve urban greening and other sustainable interventions.

Bermondsey has little open space, with the smallest open space per sub-area population head in the borough. Available open spaces consist of small parks and greens dispersed around the area. However, Canada Water and Rotherhithe are well provided for in quality and range of open spaces. The open spaces strategy identifies the following potential improvements, which may create opportunities for flood risk management measures:

- Bermondsey and Rotherhithe Green – work with local interest groups to provide additional natural greenspace and habitats.
- Dickens Square – potential to improve quality of open space.
- Providing green links between Burgess Park and Southwark Park.
- Providing allotments and other local greening projects in Canada Water and Rotherhithe.

Measures to reduce flooding will seek to provide multiple benefits to the community, including enhancement to the environment, amenity use and aesthetic character of the area.

iv. Improve Maintenance of Drainage Assets

The maintenance of highway drainage assets has been reviewed and is now implemented in line with the level of flood risk an area is exposed to.

The following benefits will be derived across all of the community council areas through the measures proposed in this strategy. For a full description of the benefits, refer to Appendix A.

- Setting out clear flood risk management plans using public awareness, understanding and participation on flood risk management
- Supporting local activities by tenants/residents associations, action groups and Community Council on the development and ownership of flood risk management actions
- Potential for developing partnership funding from likely beneficiaries of flood risk reduction and future development projects
- Using the Opportunity and Area Action Plans, and Open Space Strategy in the community area to promote sustainable measures to reduce flood risk and inform local development policy
- Encouraging proactive preparation, response and recovery from flooding through local actions
- Reduction of surface runoff released from source and into drainage system or other receptor areas
- Conservation of potable water use - through rainwater harvesting, water butts etc
- Softening of hard edges on built environment and increasing green streetscape
- Potential introduction of new open spaces and improvement of existing ones by linking flood storage / attenuation measures to open spaces and development plans
- Improved reliability of highway drainage from flood risk focused maintenance regime
- Encouraging improvement of awareness, resilience and resistance to flooding through locally developed Community Flood Plans



7 CHALLENGES ASSOCIATED WITH SuDS

7 CHALLENGES ASSOCIATED WITH SuDS

The switch to sustainable management of surface water will require some important changes to conventional approaches to the design and management of softscapes and hardscapes within public spaces. These are summarised below. Whilst this strategy proposes modifications to public spaces, it should be appreciated that seeing these through is likely to take time and that not all proposals may ultimately prove viable in view of the associated maintenance challenges.

7.1 Understanding Maintenance Requirements

In order for water quality and quantity treatment measures to operate effectively they need to be carefully maintained. Blockage by gradual sedimentation can severely reduce the performance of permeable surfaces, as can compaction of soils by pedestrian or vehicular overrun or overgrown vegetation. This will require considerable attention to avoid very costly excavation or complete reconstruction of features. Similarly, planting provided in soft landscape features would need to be well maintained to provide the desired benefit.

As SuDS are relatively new to the UK the necessary maintenance requirements and the associated financial risks including commuted sums to cover proposed features are not fully understood. This is of particular concern in the highway where poor maintenance can lead to risks and delays to road users and minor defects can quickly expand into more costly major problems due to the intensity of trafficking.

Resolving these issues is likely to require initial small scale trials and related monitoring to understand the maintenance requirement and the associated costs. It may also require some amendment to the council's existing agreements with maintenance contractors given the new approach to undertaking maintenance operations and variations to the frequency.

Assessment of SuDS schemes will take into consideration the whole life cost. The council is building up a better understanding of these costs to inform the choice of SuDS options.

7.2 Resolving Approval and Maintenance Responsibilities

Within public spaces (e.g. streets and squares) responsibility for maintenance of conventional drainage features is relatively well established, having been in place over many years. Sustainable management of surface water changes this in that alternative run-off management features to conventional collector drainage systems such as areas of amenity planting beds and swales and pervious pavement constructions is encouraged. With that, instead of surface water management being provided by separate apparatus in the street (e.g. drains and gullies) that can be maintained by a drainage team, it becomes an inherent part of other features like pavements and planting areas that have their own maintenance regimes and teams.

The Flood and Water Management Act 2010 introduces a new Sustainable Drainage Systems Approval Body (SAB). They will be responsible for approving major drainage works associated with new developments - including newly created areas of highway. This approval function is separate to others already exercised by the council in its capacities as Local Planning Authority and Highway Authority. Important further guidance under the Act that will set out the detail of these arrangements and the standards that must be accepted are still awaited. However, at present there appears to be a risk that the interests of the different Authorities could conflict for entirely appropriate reasons. For instance, the SAB may be obliged by the forthcoming guidance to accept and approve design proposals for Highways that conflict with the adoptable standards set by the Highway Authority in order to ensure that those streets are safe, accessible and maintainable. The council's internal flood risk partnership provides a forum for addressing these changes in responsibilities.

7.3 Improving Design Practice

Whether they be pervious pavement constructions, cellular reservoirs, infiltration ponds or conveyance swales, proposals for the sustainable urban management of surface water require a whole new set of skills that closely integrate drainage, pavement and softscape design either for the purposes of designing features or checking that proposals will be effective. This calls for enhanced capacity building to effectively discharge these responsibilities.

Within the highway, implementation of sustainable drainage features will be subject to proposals being supported by the adoptable standards of the Southwark Streetscape Design Manual (SSDM) (see section 8). Whilst the Highway Authority has indicated its receptiveness to better management of surface water, it has also emphasised the need for the construction and maintenance implications to be better understood and captured to facilitate the development of more innovative methods into streets and spaces. This is because of the additional safety, traffic management and maintenance risks that exist in heavily used highway environments. The process of incorporating features into adoptable standards for the highway is therefore likely to be a gradual one informed by careful implementation and monitoring of initial small scale trials.



8 ASSESSMENT OF ENVIRONMENTAL IMPACT

8 ASSESSMENT OF ENVIRONMENTAL IMPACT

As explained in section 1 of this Strategy, the SEA Directive requires a Strategic Environmental Assessment to be carried out for all plans and programmes that are subject to preparation and/or adoption by an authority at national, regional or local level, consistent with the requirements of the Act. It should prepare and integrate a wider consideration of current and future environmental effects to increase the level of protection for the environment and promote sustainable development.

Under these requirements, the LFRMS will incorporate the preparation of a Strategic Environmental Assessment, which will identify potentially significant environmental effects created as a result of the implementation of measures to manage flood risk on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic, material assets including architectural and archaeological heritage, landscape and the interrelationship between the above factors¹⁸. The SEA is an important component of the LFRMS and is included in Appendix D.

All measures proposed in this strategy will ensure water quality both underground and on the surface are not adversely affected. Where feasible opportunities will be sought to improve water quality by removing hazardous substances.

¹⁸Annex 1(f) of Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001



APPENDICES



APPENDICES

APPENDIX A – Action Plan (Measures to Reduce Flood Risk and Impacts)

Southwark Council outlines its key objectives and measures for managing flood risk as follows:

Table A.1: Summary of key objectives and measures for reducing the risks and impacts of flooding

OBJECTIVES: Minimise risk to life and properties arising from surface and ground water flooding through effective internal and external stakeholder engagement and efficient use of resources. To achieve this, the objectives described in section 1 have been summarised as follows:

1. Develop clear understanding of local flood risks;
2. Engage in local partnerships and funding to manage flood risk;
3. Establish clear and consistent risk management plans to inform local decisions;
4. Encourage innovation in the management of flood risk;
5. Promote sustainable interventions that provide multiple benefits to communities;
6. Integrate local flood risk management strategy and spatial planning;
7. Increase environmental protection and promote sustainable development;
8. Ensure effective flood warning, emergency response and recovery systems; and
9. Assist communities and individuals to recover from flooding events.

MEASURES:

1. Establish internal and external partnerships for managing flood risk;
2. Undertake detailed studies and assessments of identified critical drainage areas;
3. Raise awareness and preparedness about flood risk, consequences, response and recovery;
4. Ensure sustainable development planning and adaptation;
5. Effective management and maintenance of flood and drainage assets; and
6. Develop community flood plans.

A.1 Areas at Significant Risk of Flooding

The SWMP used direct rainfall modelling across the entire borough to identify Local Flood Risk Zones (LFRZs) where flooding could impact businesses, properties, and/or other infrastructure. Areas identified to be at significant risk have been delineated into Critical Drainage Areas (CDAs)

representing one or several LFRZs. The CDAs comprises the contributing catchment area to these LFRZs and features that influence the predicted flood extent.

A summary of the areas at significant risk of flooding identified through our PFRA and SWMP are provided below.

Table A.2: Summary of areas at significant risk of flooding

Critical Drainage Area	Areas at Significant Risk of Flooding	Critical Infrastructure at High Risk of Flooding	Evidence of Flood Risk
Herne Hill CDA (Group 7_032)	<p>Herne Hill – <i>including railway underpass and shops along Half Moon Lane, areas around Herne Hill / Norwood Road / Half Moon Lane junction.</i></p> <p>Dulwich – <i>including Turney Road and sports field to the south, Dulwich Park, Village Way and fields around Herne Hill Velodrome.</i></p>	<p>Elm Lodge Surgery</p> <p>Half Moon Dental Centre</p> <p>Locally important shops along Half Moon Lane</p>	<p>Historical Flooding:</p> <p>Flood event of 24th April 2004. High intensity rainfall inflicted flood damage on residents, homes, public services and private businesses in Dulwich, East Dulwich and Herne Hill. Another significant flooding incident of 1984 affected Herne Hill area</p> <p>Minor flooding in Dulwich, Belair and Brockwell Parks from April 2001 event. Other minor incidents in 2007 and on Christmas day in 2012. More recently Herne Hill flooded from a burst water main which once again heightened concerns among local community.</p> <p>Future Flooding:</p> <p>Model predictions in SWMP indicate LFRZs in Herne Hill and Dulwich at significant risk of flooding, with surface water depths >1.5m in worst affected locations.</p>

Critical Drainage Area	Areas at Significant Risk of Flooding	Critical Infrastructure at High Risk of Flooding	Evidence of Flood Risk
London Bridge CDA (Group 7_35)	<p>London Bridge Station – <i>periphery, including St Thomas Street.</i></p> <p>Guy's Hospital</p>	<p>London Bridge Station</p> <p>Guy's Hospital</p>	<p>Historical Flooding:</p> <p>Flood event of 14th June 2006. Localised surface water ponding along St Thomas Street near London Bridge Station. Some records of flooding in the north of the CDA.</p> <p>Future Flooding:</p> <p>SWMP model predictions indicate LFRZs along St Thomas Street, Bermondsey Street and Tooley Street, with localised water depths > 1.5m in some areas.</p>
Camberwell CDA (Group 7_36)	<p>Comber Grove – <i>including areas around Comber Grove/ Wyndham Road, Camberwell Church Street, Camberwell New Road.</i></p> <p>Brunswick Park – <i>park and surrounding areas.</i></p> <p>King's College Hospital (Lambeth)</p> <p>Railway Cutting West of Denmark Hill Station</p>	<p>Maudsley Hospital</p> <p>King's College Hospital (Lambeth)</p> <p>Comber Grove Primary School</p> <p>Railway cutting west of Denmark Hill Station</p>	<p>Historical Flooding:</p> <p>Sewer flooding incidents in south and west of CDA, and surface water ponding incidents resulting from suspected blocked gullies in 2006 and 2007. Anecdotal evidence of surface water flooding at King's College Hospital, and historical records of flooding along Camberwell Church Street and Camberwell New Road.</p> <p>Future Flooding:</p> <p>SWMP model predictions show LFRZs in Comber Grove, Brunswick Park with flood depths up to 1.0m, and rail cutting west of Denmark Hill Station with depths > 1.5m.</p>

Critical Drainage Area	Areas at Significant Risk of Flooding	Critical Infrastructure at High Risk of Flooding	Evidence of Flood Risk
Central Southwark CDA (Group 7_37)	Peckham – <i>Areas around Coleman Road / Newent Close, Gloucester Grove and St George’s Way.</i> Along Bellenden Road.	St Georges Church of England Primary School Gloucester Primary School The Grove Children’s Centre Notre Dame Roman Catholic Girls School East Dulwich Railway Station Entrance (via Grove Dale)	Historical Flooding: A number of sewer flooding incidents and one groundwater flooding incident in CDA. Future Flooding: Model predictions from SWMP show LFRZs in Peckham, South London Art Gallery and Bellenden Road.
East Southwark CDA (Group 7_38)	South Old Kent Road area – including Brimington Park, Commercial Way, Naylor Road, Asylum Road and Clifton Avenue. Peckham Rye Park	Pilgrim’s Way Primary School Camelot Primary School Peckham Police Station (Entrance)	Historical Flooding: Flood event of 24 th April 2004. Reported surface water flooding incidents southeast of CDA. Future Flooding: SWMP model predicts flooding south of Old Kent Road, Peckham Rye Park and along course of ‘lost’ River Peck.

A.2 Summary of Action Plan

List of actions to Reduce / Resist / Respond / Recover from flood risk in the borough

MEASURES CATEGORY:				
A - Resources, Structure, Governance and Capacity to fulfil LLFA requirements under the Flood and Water Management Act 2010 and Flood Risk Regulations 2009				
ACTIONS/MEASURES	TARGETED AREA	TARGET DATE	SOURCE OF FUNDS AND BENEFIT/COST ASSESSMENT	COMMENTS/UPDATES
A1. Recruitment of appropriately skilled staff to deliver flood risk and drainage management	Throughout London Borough of Southwark	Establish team by December 2011 On-going review of staff resourcing	Defra (EA) grant for LLFAs	Flood Risk Manager in place from April 2011. Flooding and Drainage Team established in November 2011/
A2. Create Internal Partnership within London Borough of Southwark: - To facilitate efficient use of internal resources, establish policies and share responsibilities for collaborative flood risk management	Throughout London Borough of Southwark	April 2011	Defra (EA) grant for LLFAs	Partnership established and has had continuous engagement through quarterly meetings. First meeting was 1st April 2011. Internal partnership chaired by the Public Realm Asset Manager/
A3. Create strategic working partnership with neighbouring boroughs including Lambeth and Lewisham: - To investigate flood risk in common catchments and deliver flood mitigation/alleviation solutions within formalised structure and terms of reference.	For collaborative work in Herne Hill and Camberwell CDAs	December 2011	Defra (EA) Drain London Tier 3 for Herne Hill & Camberwell CDAs	Partnership now established and functioning. Joint site visits to identify common flood risk issues have taken place. There is on-going collaboration with Lambeth Council and to a very limited extent, Lewisham.
A4. Create External Partnership with relevant RMAs and Stakeholders: - To facilitate wider engagement and collaborative working to deliver integrated flood risk management. Formalise governance, structure and terms of reference for partnership. Specifically collaborate with Thames Water on sewer flooding (currently Turney Road) and with the EA on ground water flooding.	Throughout London Borough of Southwark	Established in December 2011	Defra (EA)	The Central South Flood Partnership has been in place since 2011. The partnership coordinated by Southwark meets quarterly to review progress on flood risk management responsibilities. Members include Thames Water, Environment Agency, London Councils, Greater London Authority, Lambeth Council and Thames Regional Flood Coastal Committee. The partnership is chaired by the Cabinet Member for Environment, Transport and Recycling.
A5. Create central database system to keep records of investigations of flooding incidents and mechanisms: - Groundwater, surface water, ordinary watercourse including interactions with other flooding mechanisms (e.g. sewer flooding, main river flooding)	Throughout London Borough of Southwark.	April 2012	Defra (EA)	On-going implementation.
A6. Develop and maintain Flood Risk Asset Register and Records: - To ensure assets that have significant impact on flood risk are identified and properly maintained.	Throughout London Borough of Southwark, prioritising areas at high risk of flooding	On-going	Defra (EA)	London-wide approach being promoted by the Drain London Forum.
A7. Prepare Local Flood Risk Management Strategy: - As required by section 9 of the Act.	Throughout London Borough of Southwark; and as LLFA in collaboration with London Borough of Lambeth on Herne Hill CDA	By close of 2014/15 financial year	Defra (EA)	Use document as high level document for managing flood risk in the borough and to inform spatial planning.

MEASURES CATEGORY:

B - Communication, Partnerships and Community Engagement

ACTIONS/MEASURES	TARGETED AREA	TIMESCALES	SOURCE OF FUNDS AND BENEFIT/COST ASSESSMENT	COMMENTS/UPDATES
<p>B1. Work with EA to incorporate SWMP outputs in fluvial/pluvial modelling and strategic policies: -</p> <p>To enable SWMP recommendations to be used to oblige new developments / redevelopments to demonstrate sustainable drainage solutions to meet National Planning Policy Framework (NPPF), national and local SuDS standards.</p>	<p>Throughout London Borough of Southwark, especially areas identified under London Borough of Southwark's Core Strategy for Future Development</p>	<p>On-going</p>	<p>Defra (EA) Southwark Council</p>	<p>A subject of discussion among internal partners</p>
<p>B2. Actively engage with the public and key stakeholders on formulation of Local Flood Risk Management Strategy: -</p> <p>Using stakeholder engagement plan that identifies key interest groups / stakeholders (internal and external) and consider how they will be informed and involved in developing local flood risk strategy, flood risk awareness, flood response and recovery.</p> <p>Objectives include maximising communication and improving community resilience.</p> <p>Engagement that fulfils statutory requirement to consult on development of local flood risk strategy.</p> <p>Raise awareness of flood risk in the borough, gain access to additional local knowledge on flooding, build trust and increase acceptance of options/proposals for future flood alleviation works.</p>	<p>Throughout London Borough of Southwark</p>	<p>On-going</p>	<p>Defra (EA) Southwark Council</p>	<p>Awareness raising presentations done at community council meetings and local knowledge obtained from residents.</p> <p>Key stakeholders are engaged in flood alleviation schemes development.</p>
<p>B3. Develop a Communication and Engagement Plan to increase awareness on flood risk, consequences, improvement works and future resilience: -</p> <p>Develop Community Flood Plans (through engagement with local communities) to improve resilience to flooding:-</p> <p>Plan that manages public expectations regarding effectiveness of flood alleviation measures on future resilience.</p> <p>Local community to be informed and prepared to minimise the impact of flood incidences should they occur. The community to take a leading role in producing community flood plans.</p> <p>Plan to cater for actions in preparing for flood incidents, avoiding human/economic loss during a flood and assisting communities and businesses to deal with consequences of flooding.</p>	<p>Herne Hill and Camberwell CDAs within London Borough of Southwark</p> <p>Throughout London Borough of Southwark</p>	<p>On-going</p>	<p>Defra (EA) Southwark Council GLA</p>	<p>Two communities engaged in developing community flood plans with the intention of rolling out to other communities at a relatively higher risk of flooding.</p>

MEASURES CATEGORY:

C - Emergency Response and Recovery

ACTIONS/MEASURES	TARGETED AREA	TIMESCALES	SOURCE OF FUNDS AND BENEFIT/COST ASSESSMENT	COMMENTS/UPDATES
<p>C1. Emergency Response Plan: -</p> <p>Update the Multi-Agency Flood Plan (MAFP) to take account of the new information on flood risks.</p> <p>Improve weather warning through systematic linkages in use of Extreme Weather Alert, predicted flooding mechanisms, local flood knowledge and high flood risk locations to provide timely and appropriate response and recovery.</p> <p>Use Community Flood Plans as effective tool to coordinate response and recovery activities at a local scale.</p> <p>Ensure that the plan fulfils obligations of local authority under the Civil Contingencies Act 2004, including contingency planning and risk assessments.</p> <p>Provide adequate resourcing to implement MAFP responsibilities during flooding emergency.</p>	<p>Throughout London Borough of Southwark</p> <p>Specific Community Flood Plans for each 'at risk' community.</p>	On-going	<p>Defra (EA)</p> <p>Southwark Council</p>	Working collaboratively with relevant parties both internal and external to Southwark.

MEASURES CATEGORY:

D - Community and Infrastructure Resilience

ACTIONS/MEASURES	TARGETED AREA	TIMESCALES	SOURCE OF FUNDS AND BENEFIT/COST ASSESSMENT	COMMENTS/UPDATES
<p>D1. Identify opportunities to improve property resilience through implementation of small scale measures by the public: -</p> <p>These would include promoting use of permeable paving, raising property threshold levels, water conservation (rainwater harvesting, grey water re-use etc), gardening projects (local food growing) and other small scale SuDS.</p> <p>The Community Flood Plan will give guidance on community and property level measures to reduce flood risk, with recommendations on costs, benefits and preferred suppliers.</p>	Throughout London Borough of Southwark	On-going	<p>Defra (EA)</p> <p>Southwark Council</p> <p>GLA</p>	On-going engagement with communities at a higher risk of flooding to provide guidance
<p>D2. Identify opportunities to improve resilience of critical infrastructure: -</p> <p>Support the London Borough of Lambeth in feasibility studies and developing solutions to provide source control measures in Ruskin Park to mitigate surface water flooding to the railway line to the west of Denmark Hill Station and King's College Hospital.</p> <p>Identify other critical infrastructure at high risk of flooding, develop and implement solutions to improve resilience.</p>	Throughout London Borough of Southwark , with focus on Camberwell CDA (Group 7_036)	On-going	<p>Defra (EA)</p> <p>Southwark Council</p> <p>GLA</p>	On - going collaboration with Lambeth and other relevant partners.

MEASURES CATEGORY:

E - Planning and Development Policies

ACTIONS/MEASURES	TARGETED AREA	TIMESCALES	SOURCE OF FUNDS AND BENEFIT/COST ASSESSMENT	COMMENTS/UPDATES
<p>E1. Ensure development management policies in the forthcoming Local Plan incorporate use of permeable paving and SuDS for local residents: -</p> <p>Explore education opportunities to increase awareness among developers and 'best practice' on use of SuDS to mitigate surface water flooding. This includes water conservation (rainwater harvesting), infiltration, conveyance and detention SuDS.</p> <p>Developers to be encouraged to incorporate flood risk mitigation measures in planning policy and provide appropriate lead on local planning guidance to reduce flood risk.</p>	<p>Throughout London Borough of Southwark</p>	<p>On-going</p>	<p>Defra (EA) Southwark Council</p>	<p>Development in CDAs to contribute to measures to reduce surface water flood risk in the CDA through Section 106 agreements or Community Infrastructure Levy.</p>
<p>E2. Ensure planning policies require developers to incorporate Surface Water Flood Risk considerations when submitting planning applications : -</p> <p>Continue to use policies in the Sustainable Design and Construction SPD which seeks to reduce surface water flooding through the use of SuDS, by requiring surface water run off attenuation of at least 50% with a preference to achieve green field levels.</p> <p>Ensuring SWMP mapped outputs in LFRZs are used to require developers to comply with the National Planning Policy Framework (NPPF), supported by detailed modelling where required.</p>	<p>Throughout London Borough of Southwark</p>	<p>On-going</p>	<p>Defra (EA) Southwark Council</p>	<p>On-going discussions among internal flood partners in view of the expected implementation of the Sustainable Drainage Approval Body (SAB).</p>

MEASURES CATEGORY:

F - Flood Alleviation Feasibility, Investigations and Design

ACTIONS/MEASURES	TARGETED AREA	TIMESCALES	SOURCE OF FUNDS AND BENEFIT/COST ASSESSMENT	COMMENTS/UPDATES
<p>F1. Validate outputs of SWMP model: -</p> <p>Validate SWMP modelling outputs and drainage capacity assumptions through engagement with the public and key stakeholders (including Thames Water, Network Rail, Transport for London and London Underground</p>	<p>All LFRZs / CDAs in London Borough of Southwark.</p> <p>Areas in particular include:</p> <ul style="list-style-type: none"> • Public space/roads • Railway infrastructure at Rotherhithe Tunnel approach, East London Line rail cutting near Surrey Quays Station, railway line to the west of Denmark Hill Station, London Bridge Station • TfL Red Routes 	<p>Complete for Herne Hill, Central Southwark and East Southwark CDAs by December 2014</p> <p>Other CDAs will be addressed subsequently</p>	<p>Defra (EA)</p> <p>Southwark Council</p> <p>GLA</p>	<p>Validation taking place as part of the on-going scheme development efforts.</p>
<p>F2. Undertake surface water Drainage Capacity Study in Critical Drainage Areas:-</p> <p>To determine drainage capacity of rail infrastructure (around Denmark Hill Station) and public sewer network, including future improvements</p>	<p>Herne Hill, Brixton and Camberwell CDAs in consultation with London Borough of Lambeth, Network Rail and Thames Water</p>	<p>On-going</p>	<p>Defra (EA)</p> <p>Southwark Council</p> <p>GLA</p>	<p>This will include an advanced assessment of potential measures for flood alleviation including potential upgrades to sewer network, storage/source-control SuDS, detailed modelling, value management (benefit: cost analysis) and solution development.</p>
<p>F3. Investigate resilience of Critical Infrastructure and Services: -</p> <p>Detailed review of existing drainage information and resilience to surface water flooding at underground stations, utility services stations, hospitals, schools etc.. Produce detailed models to form basis for flood alleviation solution development</p>	<p>Throughout London Borough of Southwark</p>	<p>On-going</p>	<p>Defra (EA)</p> <p>Southwark Council</p> <p>GLA</p>	<p>This will be achieved through effective collaboration with the emergency planning and resilience team.</p>
<p>F4. Undertake Feasibility Study, Investigations and Solution Design for providing Source Control using localised 'Urban Greening' measures: -</p> <p>Mitigation including soft landscaping of hard-standing public areas below property thresholds, re-landscaping existing green areas, swales in raised grassed areas.</p> <p>Feedback from partnership consultations will inform feasibility assessment of scheme options, scheme development and implementation.</p>	<p>Camberwell CDA; area Peckham and Nunhead Community Area</p> <p>Other CDAs</p>	<p>By December 2015</p>	<p>Defra (EA)</p> <p>Southwark Council</p> <p>GLA</p>	<p>Investigate feasibility of 'Urban Greening' in Camberwell (Wells Way, Brunswick Park and Comber Grove areas), develop detailed scheme designs for preferred solution and demonstrate how these measures can be applied to other parts of the borough.</p>

MEASURES CATEGORY:

F - Flood Alleviation Feasibility, Investigations and Design (continued)

ACTIONS/MEASURES	TARGETED AREA	TIMESCALES	SOURCE OF FUNDS AND BENEFIT/COST ASSESSMENT	COMMENTS/UPDATES
<p>F5. Undertake Feasibility Study, Investigations and Solution Design for providing Source Control using localised 'Flow Diversion', 'Flood Storage' and SuDS measures: -</p> <p>Mitigation using large scale flood storage (detention basin) and small scale attenuation SuDS in upper part of catchment, including opportunities to re-route surface water run-off.</p> <p>Feedback from partnership consultations will inform assessment of scheme options, scheme development and implementation.</p>	<p>East Southwark CDA (Group 7_038) in Peckham Rye, Brimington Park, Caroline Gardens and car parks along Old Kent Road</p>	<p>April 2015</p>	<p>Defra (EA) Southwark Council GLA</p>	<p>Investigate feasibility of flood storage (detention basin) in Peckham Rye Common to attenuate flows in upper part of catchment, and small scale attenuation SuDS in Caroline Gardens, Brimington Park and car parks along Old Kent Road in consultation with key stakeholders.</p>
<p>F6. Identify "Quick Win" flood mitigation schemes and fast-track design as pilot : -</p> <p>"Quick win" feasibility investigations and design of preferred schemes as a pilot project that compliment reduction of flooding in high risk areas. Ensure schemes provide multiple benefits to local communities.</p> <p>Leverage multi benefits from scheme proposals to source alternative funding from local businesses, local/central government initiatives and other interest groups.</p>	<p>Throughout London Borough of Southwark; focussing on LFRZs in CDAs</p>	<p>By April 2015</p>	<p>Defra (EA) Southwark Council GLA</p>	<p>Collaborative working with internal and external partners.</p>

MEASURES CATEGORY:

G - Flood Alleviation Scheme Implementation

ACTIONS/MEASURES	TARGETED AREA	TIMESCALES	SOURCE OF FUNDS AND BENEFIT/COST ASSESSMENT	COMMENTS/UPDATES
<p>G1. "Quick Win" flood alleviation schemes: - Typical schemes including urban greening, soft landscaping, rainwater harvesting etc.</p>	<p>Throughout London Borough of Southwark; focussing on LFRZs in CDAs</p>	<p>By April 2015</p>	<p>Defra (EA) Southwark Council GLA</p>	<p>Collaborative working with internal and external partnerships</p>
<p>G2. Source control using localised 'Flow Diversion', 'Flood Storage' and SuDS measures: - Appoint and commission specialist contractors to implement selected schemes. Alleviation schemes to include flood storage ponds (upstream attenuation), small scale attenuation SuDS.</p>	<p>Herne Hill CDA (Group 7_32) in Sports Club near Turney Road, Belair Park, Dulwich Sports Grounds, Dulwich Park East Southwark CDA (Group 7_038) in Peckham Rye Common, Caroline Gardens, Brimington Park and car parks along Old Kent Road</p>	<p>By December 2015</p>	<p>Southwark Council Defra (EA) Thames Water Local Businesses CIL RFCC Herne Hill BCR – 3.3 East Southwark BCR – 1.5* * (Benefit cost ratio is estimated and under review could change at the next stage of the design process)</p>	<p>Collaborative working with internal and external partnerships as well as key stakeholders.</p>
<p>G3. Source Control using localised 'Urban Greening' measures: - Appoint and commission specialist contractors to implement selected schemes. Alleviate flooding through green roofs, green open spaces with improved amenity, soft-landscaping of hard standing public areas, small scale SuDS etc.</p>	<p>Camberwell CDA (Group 7_036); in Comber Grove area Central Southwark CDA (Group 7_37) in northern areas</p>	<p>December 2015</p>	<p>Defra (EA) Southwark Council Local Businesses CIL RFCC Thames Water Average BCR – 0.5 * (Benefit cost ratio under review could change at the next stage of the design process)</p>	<p>Collaborative working with internal and external partnerships as well as other key stakeholders. Other sources of funding being explored to enhance the BCR.</p>

MEASURES CATEGORY:

H – Drainage Asset Operation and Maintenance

ACTIONS/MEASURES	TARGETED AREA	TIMESCALES	SOURCE OF FUNDS AND BENEFIT/COST/ASSESSMENT	COMMENTS/UPDATES
<p>H1. Operation and Maintenance of New and Adopted Drainage Assets : -</p> <p>Develop plan to achieve efficient and sustainable operation and maintenance of assets. Operate plan effectively, engaging local partnerships and specialist contractors where required.</p>	<p>Throughout London Borough of Southwark</p>	<p>Lifespan of asset</p>	<p>Southwark Council</p>	<p>On-going programme to ensure gullies are in optimum condition.</p>
<p>H2. Improve maintenance of surface water drainage network: -</p> <p>Adopt a risk based approach with improved and targeted maintenance of surface water drainage assets in LFRZs. Increased frequency of cleaning in areas at relatively higher risk of flooding and with high incidence of blockages.</p> <p>Embark on a gulley repair programme to ensure all gullies are fully functional</p>	<p>Throughout London Borough of Southwark, and as LLFA in collaboration with London Borough of Lambeth on Herne Hill CDA (Group 7_032)</p>	<p>On-going annual inspection (at a minimum), and as per maintenance schedule</p>	<p>Southwark Council</p>	<p>Continuous review of maintenance KPIs.</p>
<p>H3. New maintenance approach: -</p> <p>Develop and refine new approaches to the maintenance of SuDS in collaboration with relevant internal flood risk partners</p>	<p>Throughout London Borough of Southwark</p>	<p>On-going</p>	<p>Southwark Council Defra</p>	<p>Advance through discussions at the partnership meetings.</p>
<p>H4. Post-Project Reviews: -</p> <p>Use learning outcomes to inform future scheme development and implementation.</p>	<p>Throughout London Borough of Southwark</p>	<p>On-going</p>	<p>Southwark Council</p>	<p>All stakeholders to be engaged in the continuous learning process.</p>

A.3 General Approaches to Flood Alleviation

Source Control

Involves reducing the volume and velocity of runoff released from areas receiving rainfall using SuDS at source. New developments should be encouraged to promote the use of source control as part of their sustainable drainage approach to surface water management. Source control measures require the engagement of local residents and businesses.

Green Roofs

A system that uses living plants (usually in beds) over roof tops to act as a natural filter for rainwater (through plants absorbing water) and thus reduce the amount of rainwater lost to drainage. The plants can also provide the added advantage of excellent insulation to a building. Residential/commercial property owners and public property administrators should be encouraged to retrofit green roofs. As public sewers are prone to being overwhelmed by storm water during heavy rainfall, reducing discharge of rainwater from roofs would provide some much needed relief to the sewers. However, it must be appreciated that other measures would be needed to supplement the reduction of surface runoff. It is anticipated that community council areas with a greater proportion of council housing estates may offer the best opportunities to pilot retro-fitting of green roof schemes through public consultations and collaborative working.

Rainwater Harvesting

Intercepting rainwater from roof downpipes and associated drains, and redirecting flow to underground storage where this water can be sourced for re-use. This system can be implemented in residential and commercial properties, and provides a means to reduce discharge of rainwater to public drainage systems. The cumulative effect of many properties undertaking such a scheme is that there will be some relief in the capacity of the public drainage system during rainfall events.

Water Butts

Another way of collecting rainwater directly from roof downpipes; it uses drums (commonly of polyethylene material) to collect and store water from property roofs which can be used for watering gardens at a later time. It is commonly used at individual property level and can be retrofitted to most types of domestic downpipes. The take up and implementation of water butts will rely on voluntary interest from residential and commercial property owners, with local community groups providing an opportunity to sell such ideas to residents/businesses.

Porous / Permeable Paving

Porous paving allows the infiltration of rainwater through porous paving material and into the underlying soil (or sub-base construction), thereby attenuating the flow of surface runoff from a site. Permeable paving provides a similar function, enabling infiltration of rainwater through spaces between paving slabs and into the underlying soil/sub-base. With many applications available on the market, porous or permeable paving can be used in existing and new residential and commercial spaces. The use of such paving will provide some reduction of surface runoff discharged from residential/commercial land into public carriageways and subsequently conveyed towards lower lying, flood risk areas such as Herne Hill.

Communication and engagement with the public through the Community Council and other local interest groups started in late 2011 and is on-going. The aim is to encourage more porous/permeable paving areas to be introduced in residential and commercial spaces and reduce hard standing areas. Southwark Council, through the Internal Flood Risk Partnership, will also take up opportunities to introduce such paving as part of linked schemes such as urban greening schemes, highway resurfacing among others. The widespread use of porous paving on public highways will however be subject to successful piloting and development of solutions that meets the adoptable highways standards.

Local Greening Projects

Local communities have been taking the initiative to create sustainable projects that promote greening of the urban landscape whilst providing useful benefits such as organic food growth, softening of hard urban design, beautification of public space and enhanced functionality of community spaces. These projects can provide a beneficial reduction in surface runoff generated at source through infiltration, storage and/or reduction of volume/speed of runoff. They present an opportunity to promote community-led design and management of simple but effective source control features. Added benefits are increased social cohesion, awareness/understanding of flood risk management and education/training initiatives for local people. Founders and project leads of such schemes include local action groups, charities (e.g. Trees for Cities), tenants/residents associations, Community Councils, other Council Officers (e.g. the Cleaner Greener Safer Team) and the Greater London Authority. The Council is working alongside residents/tenants associations and local action groups to support local greening schemes with the aim to promote greater benefit on the reduction of surface runoff.

Pathway Control – Intercepting surface runoff along known pathways in order to attenuate runoff volumes and velocities. This has the benefit of incrementally reducing the likelihood (or impact) of flooding resulting from peak flows reaching Local Flood Risk Zones.

Swales

Low profile (broad, shallow) channels covered by grass and other suitable vegetation, which convey and/or infiltrate surface runoff into the ground (where conditions allow). Swales can also provide the benefit of treating surface runoff through filtration, especially for small and more frequent rainfall events. They can be used to intercept runoff from adjacent and upstream sources (such as footways, roads and other paving) and conveyed to detention ponds or other sustainable stormwater storage systems. Open spaces such as parks and road verges would be ideal locations for introducing swales in the borough.

Geocellular Storage Tank

This is a modular plastic cellular system with a high void ratio and can be used to create an underground storage tank for surface runoff from surrounding areas. It is ideal for paved open spaces and could be used to detain runoff from carriageways, footways, hard-surfaced sports fields and car parks in the borough.

Carriageway Raised Entry (Speed Table) Treatment

Is an ideal way of slowing down and intercepting surface runoff in roads. It consists of a raised carriageway table feature incorporated into the end of a road, with connected underground geocellular storage within the adjacent footway areas. Roads form the majority of hard-standing pathways for surface runoff, and the raised tables enable some of this runoff to be removed and stored before being slowly released back into the drainage system. Attenuating these runoff volumes will reduce the speed and amount of water that reaches vulnerable low lying areas. These measures will be useful in less trafficked roads and will need to meet adoptable highway standards.

Rain Gardens

These are plant beds (commonly formed as linear depressions with free draining soil) that receive rainwater to mimic natural drainage processes, and can be retrofitted to existing developments. There are opportunities to introduce rain gardens in the public domain as build-outs into carriageways, or simply kept within footways and verges. In addition, the rain gardens will be used to enhance the aesthetic appeal of built up areas in the borough, providing a social benefit to local residents and road users. An ongoing opportunity assessment is underway as part of the flood alleviation investigations and scheme development, which will identify a comprehensive group of public roads where rain garden build-outs can be introduced.

Capacity Improvement of Sewers

The public sewer network in the borough is owned and maintained by Thames Water. Southwark Council is working closely with Thames Water (through the External Flood Risk Partnership) to identify common ground for the development of flood alleviation schemes, particularly where sewer flooding of properties is predicted. It is widely acknowledged that the existing sewer network can become overwhelmed in heavy rainfall events. This is acknowledged to be a particular issue as the sewers would be expected to accommodate up to a 1 in 30 probability of occurrence rainfall event (e.g. rainfall events with a 1 in 75 likelihood of occurrence would have greater magnitude and overwhelm the sewers). Thames Water are undertaking a programme of capacity improvements to their sewer network, and working in collaboration with Southwark Council to identify common schemes where sewer upgrades would reduce surface runoff reaching properties at risk of flooding.

Carriageway Permeable Parking Bays

Where possible, permeable parking areas can be introduced to reduce the discharge of surface runoff from existing and proposed developments. Ideal areas in Dulwich include local sports clubs and schools.

Receptor Control

Detention Basins

Small permanent basins in public open spaces, acting to detain surface runoff collected from the surrounding catchment and slowly releasing the water back to the drainage system after the peak of a rainfall event. These basins are normally dry, and may provide amenity use as well as environmental enhancement when not providing temporary storage of storm water. An example may be the landscaping of low profile detention basin in public parks with planting to introduce or extend habitat in the area. As a result of their potential multiple function, detention basins would be ideal for providing flood storage in parks and other suitable open spaces receiving runoff from upstream sources. The viability and scale of introducing such basins is being investigated for the Dulwich, and Peckham and Nunhead Community Council areas as part of flood alleviation projects.

Existing Ponds

These are generally considered to be wet ponds that have a permanent pool of water, but could provide additional storage for storm water above the normal water level. The use of existing ponds to provide flood storage may require extension of the normal holding capacity, with the potential of landscaping a floodplain around the ponds where possible. An allowable discharge from the pond into the public drainage system would enable water levels to revert to normal once the rainfall has receded. In order to protect the biodiversity of an existing pond, surface runoff coming into the water body would be treated using pollution interceptors and flows attenuated using geocellular storage tanks (to reduce high runoff velocities that would have an adverse effect on the pond's ecology).

A number of parks with existing ponds have been identified in Dulwich as potential locations flood storage. Southwark Council is investigating the feasibility of such schemes concurrent with preliminary communication and engagement on these ideas with local communities and interest groups (e.g. friends of parks).

APPENDIX B - Links with Other Plans and Strategies

B.1 Southwark Council's Vision

The London Borough of Southwark is a dynamic and diverse community, and continues to grow in that trajectory. In recognition of the challenges this brings, Southwark Council's aspirations identify the vision to create a fairer future and enhance benefits and opportunities to people and the environment by;

Being more transparent;

Creating a fairer borough;

Making Southwark a place to be proud of;

Realising potential;

Spending public funds with prudence; and

Transforming public services.

Greater Transparency

The council will be accountable to residents and businesses on how services are delivered, and ensure that their views will be considered in the decision making process. The strategy proposes engagement with local communities as a fundamental aspect of promoting awareness on flood risk, enhancing local resilience, encouraging local participation and ownership in decision making. Through engagement with local communities, the development of the strategy will be transparent, participative and more responsive to local needs and aspirations.

A Fairer Borough

The council aims to create an environment that provides opportunities to all residents, businesses and organisations to engage fully in the community. This includes listening to individuals and community concerns, treating each fairly regarding access to services and protecting the most vulnerable members of society. Through communicating, engaging and creating partnerships with local communities in developing local resilience measures, the strategy provides opportunities to empower individuals and communities to contribute and participate in identifying specific plans and measures most suited to their needs.

A Place to be Proud of

The council recognises that some of its housing estates, schools, leisure centres and local amenities are not in a condition to be proud of. As a result, the council will create regeneration for local

people and make it work for the longer term through its 30-year housing investment programme. The council will also act as responsible custodians of the public realm, protecting and enhancing the environment through sustainable development. The Strategy proposes opportunities to reduce flood risk through sustainable drainage in new developments and through retrofitting sustainable drainage on existing developments. It also prioritises the development of flood alleviation solutions that provide multiple benefits to communities. These include enhancing open public spaces by introducing green areas (e.g. rain gardens) through which some surface runoff can be 'lost' into the ground.

Realising Potential

The council will work with residents and partners to make the borough a safe place in which families and individuals have the opportunity to achieve their educational, lifestyle, and economic potential. The detailed investigation of flooding mechanisms, detailed design, implementation of measures to alleviate flooding and developing community flood plans in higher risk areas will provide local communities the opportunity to pursue their aspirations and achieve their potential in safety.

Prudent Spending

The Strategy will identify measures that can be successfully implemented to manage flood risk in the borough, and will seek partnership funding with its stakeholders (and beneficiaries) to invest in the interventions. To ensure efficient use of resources, the intervention measures will be focused on areas most at risk of flooding and only cost beneficial solutions will be implemented.

Transforming Public Services

Southwark Council aspires to deliver more for less, providing services to a high standard. This involves transforming service delivery through sharing knowledge and resources with other departments, councils or organisations; taking broader approaches to resolving complex issues affecting individuals or families; and empowering communities to deliver where they are best placed to. The management of flood risk in the borough is being delivered through a collaborative approach with relevant internal and external partners and stakeholders through shared services and resources. Overall, the LFRMS will identify opportunities to manage flood risk in a manner that seeks to deliver on Southwark Council's vision for the borough, placing emphasis on provision of multiple benefits.

B.2 Strategic Flood Risk Assessment

Southwark Council's SFRA was produced in 2008 as required under Planning Policy Statement 25. The SFRA places emphasis on flooding from the sea and River Thames (i.e. assuming the absence of the Thames flood defence walls and tidal barrier), but is relatively weak in assessing local flooding from surface water, groundwater and ordinary watercourses. It provides an important tool to inform the revision of flooding policies, including spatial planning and land use, and in supporting/informing the council's response to emergency planning. The LFRMS will improve upon the SFRA's understanding of flood risk, and will use information from further assessments to outline measures that shall be implemented to reduce flood risk. The SFRA is currently being reviewed

The SFRA is available to view at:
http://www.southwark.gov.uk/downloads/download/1753/strategic_flood_risk_assessment

B.3 Preliminary Flood Risk Assessment (PFRA)

The PFRA was required as part of the Flood Risk Regulations 2009, to provide a high level assessment of flood risk, based on existing and readily derivable information on both historical floods and future flood risk from surface water runoff, groundwater and ordinary watercourses and any interaction these may have with main rivers and the sea. The PFRA also considers the potential consequences of flood risk on human health, economic activity, cultural heritage and the environment. Southwark's PFRA provides information on areas at risk of flooding, highlighting those at significant risk (with projected flood depths) and producing flood hazard maps. It also collates information on historical flooding events and incidents in the borough. The PFRA provides an essential baseline on flood risk, for further investigation and development of mitigation actions. The PFRA also provides the evidence base for the development of the LFRMS.

The PFRA is available to view at:
<http://modern.gov.southwark.gov.uk/documents/s20243/Appendix%201%20Flood%20Risk%20Assessment.pdf>

B.4 Surface Water Management Plan (SWMP)

Developed through the Drain London Project, the Southwark's SWMP (2011) provides an improved prediction of flooding (using probabilistic, 2-dimensional modelling) on national data made available by the Environment Agency. The SWMP also discusses opportunities (e.g. partnerships, synergies in policies/strategies on spatial planning etc) and options to mitigate flooding in the borough, and develops them into an action plan of measures for further investigation and/or implementation. The LFRMS will be guided by the SWMP to provide an account of local flood risk and measures to be implemented to manage flooding in specific areas within the borough.

The SWMP is available to view at:
http://www.southwark.gov.uk/downloads/200448/flood_risk_management

B.5 Thames Catchment Flood Management Plan (2009)

The Thames Catchment Flood Management Plan (Thames CFMP) sets out sustainable flood risk management policies, through a broad consultation and appraisal process, for the whole Thames catchment over the long term (i.e. 50 – 100 years) taking climate change into consideration. The CFMP focuses on river flooding. As of the time of the plan preparation there was limited data available on other sources of flooding. At the time of publication of the CFMP, the last major flooding event in the Thames catchment region occurred in July 2007, when heavy rainfall caused surface water flooding which was followed by river flooding in the upper part of the catchment. With over 5,000 flooded properties reported (to the EA) in which 2,000 of them were attributed to surface water flooding, the impact was felt across many communities including Oxfordshire, Gloucester, Berkshire and London.

In the Thames CFMP area, there are approximately 135,000 properties at a 1% chance (1 in 100) of flooding from rivers. In London, it is estimated that approximately 300,000 are at risk from tidal flooding. However, the Thames Defence Walls and Tidal Barrier provide a high standard of protection against a 1 in 1000 (0.1%) chance of tidal flooding in any given year. London and the Lower Thames region also represent the largest number of people and property at risk, approximately 60% of the total at risk in the Thames CFMP area.

The Thames CFMP seeks to address the challenge of adapting the management of flood risk in urban areas (including London catchments) by identifying actions to reduce the consequences of flooding. Some large scale developments are planned to take place in high flood risk areas, most notably in London. While the tidal flood risk area in the London Borough of Southwark benefits from tidal defences, it is important to consider the developments as opportunities to provide designs and layouts that consider current and future flood risk.

B.6 Thames Estuary 2100 Plan

The Thames Estuary 2100 (TE2100) project was established by the Environment Agency in 2002, with the aim to produce a strategic flood risk management plan for London and the Thames estuary through to the year 2100. One of its key drivers is to consider how changes in sea level, storm surge height/frequency and river flows as a result of uncertain climate change would affect flood risk in the future, and how adaptation to these changes can be developed and implemented. The TE2100 Plan went through consultation in 2009, with the final version submitted to Defra in March 2012 for consideration. Defra have now given the go-ahead for an implementation plan and business case to be presented to the Treasury.

The plan uses the best available climate change projections (e.g. from the National Oceanography Centre, Centre for Ecology and Hydrology, UK Met Office etc) and is adaptable to future amendments on projections. It sets out recommendations on actions that the EA and its strategic partners will need to take in the short (next 25 years), medium (the following 15 years) and long term (to the end of the century).

Some of the key findings of the TE2100 Plan are¹⁹;

- Many of the Thames' defences were built following the 1953 floods and will reach the end of their design lives during the next 50 years. The system includes the Thames Barrier, over 300 km of fixed defences and numerous smaller structures.
- The Thames Barrier is expected to hold fast and continue to provide London and the Estuary communities with a higher standard of protection than anywhere else in the country. When it was built, engineers planned for 8 mm

per year sea-level rise, while sea-levels are currently rising by 6 mm per year.

- However, the Thames Barrier must continue to be maintained to ensure its reliability and to reduce major costs in the future.
- Upstream plans also need adapting — to handle increased water runoff from the torrential winter rains expected as our climate continues to change.

The London Borough of Southwark falls under the Wandsworth to Deptford Policy Unit of the TE2100 Plan, and is within the Thames CFMP area. The general policy for Wandsworth to Deptford is to take further action to reduce flood risk, through recommended actions to be implemented by the EA and its partners including Southwark Council.

Recommended actions from plan include:

- TE2100 Plan to inform the development and revision of local authority SFRAs and flood plans.
- Agree a programme to provide local flood protection, resilience and emergency plans for vulnerable key sites.
- Agree partnership arrangements and principles to ensure that new developments in the central London tidal risk area is safe over the short, medium and long term.
- To maintain, enhance or replace, the river defence walls and active structures through central London over the short, medium and long term.
- Agree a programme of managing flooding from other sources in the defended tidal floodplain.
- Review and maintain, in the medium and long term, the partnership arrangements and principles for development and flood risk management established in the first 25 years of our Plan.

While the EA has the ownership for the operations, and replacement of the Thames defences, Southwark Council maintains river walls and will continue to work in partnership with the EA to take further actions to support recommendations on improving flood risk management. The proposed measures of the LFRMS included in Appendix A to complement the recommended actions above.

The TE2100 Plan is available to view at; <http://www.environment-agency.gov.uk/research/library/consultations/106100.aspx>.

¹⁹Summary report on the TE2100 Project by the Met Office, available at http://www.metoffice.gov.uk/media/pdf/b/j/MO_PUP_insert_ADAPT.web.pdf

B.7 National Flood and Coastal Erosion Risk Management Strategy

The National Flood and Coastal Erosion Risk Management Strategy (2011) sets out a framework for managing risk of flooding (and coastal erosion), and enables Risk Management Authorities and local communities to understand their roles/responsibilities, particularly for Lead Local Flood Authorities (LLFAs). While the National Strategy is aimed at Risk Management Authorities, it significantly supports the greater role that communities can take in making local flood risk management decisions and is relevant to individuals/businesses that suffer from flooding as well as the general public. The LFRMS will be consistent with the National Strategy, complementing and building upon the national framework that sets to achieve an inclusive approach to managing flooding in the borough.

The National Strategy is available to view at; <http://www.environment-agency.gov.uk/research/policy/130073.aspx>.

B.8 Southwark Core Strategy (2011)

The Core Strategy is a planning document that sets out Southwark Council's long term vision, spatial strategy and strategic policies to deliver sustainable development within an implementation plan up until 2026. It is the core document that guides development in the borough. The Core Strategy sets out a vision for growth in Southwark and outlines policies that will inform planning decisions within the borough. The policies of the Core Strategy were tested through a Sustainability Appraisal to ensure they have positive social, environmental and economic impacts. Measures proposed in this strategy will complement the Core Strategy's vision and objectives, taking cognisance of unique opportunities across the borough to reduce flood risk across the borough.

The Core Strategy document is available to view at www.southwark.gov.uk/corestrategy.

B.9 Open Space Strategy (2013)

The Council's vision for the open space strategy is:

“to encourage a diverse network of sustainable open space of high quality which meets the needs of those living and working within the borough and encourages the development of more inclusive communities, safeguards natural resources and

cultural heritage, improves access to natural greenspace, provides recreational and educational opportunities and helps to promote sustainable development.”

The objectives for the open space strategy include:

- Enhancing provision of open spaces to meet the needs of an increasing and changing population.
- Providing opportunities for health and wellbeing through open spaces.
- Using regeneration to provide open spaces and improve quality of life.
- Promoting biodiversity by retaining areas of natural habitat.
- Providing community cohesion through provision and use.
- Tackling inequality in provision and access to open spaces.
- Promoting the use of open spaces for education and culture.
- Protect and improve the heritage value and design of open spaces.
- Promote the use of open spaces to help mitigate the impacts of climate change.

The council will identify opportunities to introduce new green spaces into the built environment and enhance existing open spaces to provide multiple benefits while implementing flood risk management measures within the public realm.

Southwark's Open Space Strategy is available to view at: http://www.southwark.gov.uk/downloads/download/2948/open_space_strategy_2012.

B.10 Multi Agency Flood Plan (MAFP)

The emergency planning and resilience team has developed the Multi-Agency Flood Plan for Southwark in consultation with key partner agencies including the emergency services, transport and utility providers, health partners and the EA. The MAFP aims to provide a coordinated multi-agency response to a major flooding event in the borough regardless of the source of flooding.

Its key objectives are to:

- Provide a framework for response activities.
- Manage the wider impact of flooding in the borough and reduce disruption to communities, infrastructure and the environment.
- Manage precautionary actions to preserve life for the highest impact flood risks.
- Identifying, prioritising and implementing appropriate responses to protect the vulnerable

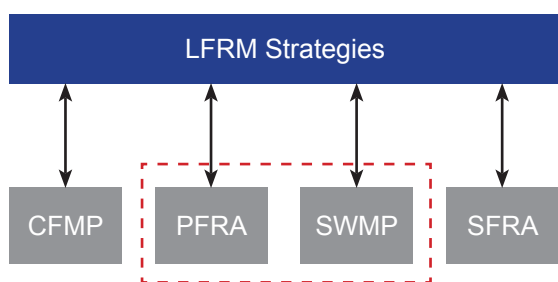
in communities.

- Support the EA in the provision of flood warnings to communities at risk.
- Provide accurate and timely information to the public and local businesses on flood response.
- Provide advice and information to prepare key parts of the community susceptible to flooding.
- Provide a framework for activities to support the recovery of communities and businesses.

The MAFP will be triggered if there is a severe flood warning from the EA; there is an indication of flooding about to occur; there is a significant risk to life, property and/or infrastructure; responding organisations are failing to cope with incidents; or there is a declaration of a major incident by the Emergency Services as a result of flooding.

The above documents have provided a useful evidence base for this strategy, particularly, the PFRA and the SWMP as depicted in Table B.1 below.

Table B.1: Schematic Diagram of Development of LFRM Strategies (adopted from the SWMP, 2011)



B.11 Corporate Risk Management Strategy

Southwark Council has in place corporate risk management strategy which describes the approach for identifying, evaluating, and managing risks including flood risk. The primary objectives for the strategy are to:

- Continue to support the strategic aims and operational objectives of the council.
- Ensure that risk management is embedded into all key council activities.
- Build on the programme and project management risk management standards, and extend risk management procedures to include key partnerships.
- Ensure that there is an escalation and communication process through the council on risk management that ensures that there is a transparent and prompt flow of information to key decision makers.
- Consider opportunities or positive risks that may help improve the chances of succeeding in achieving those aims and objectives.

- Achieve standards in risk management which are best practice in both the public and private sector, exceeding regulatory requirements.

Southwark’s Corporate Risk Management Strategy is available to view at http://www.southwark.gov.uk/downloads/download/2081/risk_management_strategy.

B.12 Southwark Streetscape Design Manual

The Streetscape Design Manual (SSDM) is the council’s overarching strategy and technical standards document for the design of streets and spaces. All works to existing or proposed public streets and spaces are required to meet with its procedures and design requirements.

Rather than being a single document, the SSDM is composed of a portfolio of individual documents. The highest level of these is the Framework Plan. This includes a series of high-level Strategic Design Policies and Strategic Design Objectives that inform the content of the individual technical design requirement documents. A number of these support the use of sustainable surface water management techniques and increased street greening (specifically from the canopies of large street trees) for broader climate change mitigation, (See in particular SDP xxviii, SDP xix and SDP xx). However, the document recognises the importance of ensuring that the highways are maintainable and that associated maintenance costs are understood and captured.

At present the individual technical design standards within the SSDM do not support the widespread use of pervious pavement and other SuDS construction techniques. This is due to various complex design and maintenance risks that will require careful live testing.

However:

- The document does note that the Highway Authority is keen to pilot some limited pervious pavement constructions with a view to better understanding these issues to facilitate potentially permitting future incorporation of pervious pavement designs into adoptable standards. It should be appreciated that the significant number of constraints in existing streets and spaces mean that application is likely to be largely restricted to new areas and very low trafficked streets.
- The document does support the introduction of certain types of under-pavement surface water

- reservoirs – providing water can be conveyed to them by more conventional collector drainage systems that will limit maintenance activities (like the removal of sediment and oil that will be washed into them) to easily accessible features.
- Use of planting beds (including particularly those containing street trees) for water quality and quantity management is strongly supported due to: the circular environmental benefits this can provide by helping improve conditions for trees; the associated amenity benefits for residents and business; and the reduced maintenance complexity compared to previous pavement constructions. However, introduction of other amenity planting within such beds (e.g. plants, grasses or shrubs) is likely to be subject to resolution of maintenance issues given existing limited funds.

Southwark's Streetscape Design Manual is available to view at http://www.southwark.gov.uk/info/200456/southwark_streetscape_design_manual_ssdm

B.13 EU Water Framework Directive (Directive 2000/60/EC)

In order for the LFRMS to meet some of its wider environmental obligations, considerations will be made for the prevention of deterioration of aquatic ecological systems.

The EU Water Framework Directive (Directive 2000/60/EC) requires EU member states to manage the effects of changes to the physical characteristics of water bodies on the ecological quality of water bodies (including inland surface waters, transitional waters, coastal waters and groundwater). It provides a timeframe for all aquatic ecosystems and associated wetlands to achieve ecological good status by 2027. Its purpose is underpinned by the following objectives²⁰:

- *prevent further deterioration and protect/enhance the status of aquatic ecosystems* and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
- promote *sustainable water use* based on a long-term protection of available water resources;
- enhance *protection and improvement of the aquatic environment*, amongst other things, through specific measures for the progressive reduction of discharges, emissions and losses of

- priority hazardous substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
- ensure the *prevention and progressive reduction of pollution of groundwater*; and
- contribute to *mitigating the effects of flooding (and drought)* on the aquatic environment, and thereby contributing to meeting the above objectives.

The Strategy must promote sustainable management of the water environment to minimise the effects of measures implemented to reduce flooding, while giving due consideration to future climate change. It must also promote the enhancement of the environment, especially ecological status, where possible, of aquatic environments affected by flood risk related measures. The Strategy will be consistent with the principle of preventative action, and that environmental damage must be a priority and rectified at source.

B.14 European Strategic Environmental Assessment Directive (Directive 2001/42/EC1)

The European Directive 2001/42/EC1 (otherwise known as the SEA Directive) was adopted in June 2001 with a view to increase the level of protection for the environment, integrate environmental considerations into the preparation and adoption of plans and programmes and to promote sustainable development. It was transposed into English legislation by the Environmental Assessment of Plans and Programmes Regulations 2004 (the SEA Regulations).

The SEA Directive requires a Strategic Environmental Assessment to be carried out to identify, describe and evaluate the likely significant effects on the environment of implementing a plan or programme that is subject to adoption by an authority at national/regional/local level, and reasonable alternatives taking into account the objectives and geographical scope of the plan or programme²¹.

²⁰Article 1 of the Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000

²¹ A Practical Guide to the Strategic Environmental Assessment Directive, September 2005 (Office of the Deputy Prime Minister)

APPENDIX C - Background Information

C.1 Sources and Consequences of Flooding

Flooding is a natural process that occurs when water overflows onto land that is normally dry, resulting in the submergence of that area. It can occur at any time, and in a number of forms presenting a range of different risks to affected areas. The prediction of flooding is a challenging process as the probability, velocity, magnitude and duration of rainfall (or other precipitation) varies greatly and is becoming increasingly influenced by climate change. It is difficult to accurately define the limits of flood risk areas as diverse permutations in flooding sources, rainfall patterns, topography and urban/rural development can result from similar rainfall probabilities. For example, rainfall events with a probability of occurring once in every 100 years may have different magnitude/intensity/duration and hence a dissimilar potential impact on a catchment. The consequences of flooding will also depend on land occupation and use.

Sources of flooding include the sea, rivers, direct rainfall, elevated groundwater levels and overloaded drainage with varied impact on populations, property and the environment. As an example, the overtopping or breach of a flood defence wall in a densely populated area could have serious consequences including loss of human life and/or damaging impact on health, businesses and property. However, a similar event in a less populated rural setting would have less impact on people and property and would be considered to be a lower risk. Last but not least, the potential impact of rainfall runoff on the environment must be given due consideration, due to the potential contamination of runoff from agricultural areas, industrial sites and other hard-standing areas containing hydrocarbons and other pollutants.

LLFAs have been required by the Act and the Regulations to prepare Preliminary Flood Risk Assessments (PFRA) aimed at identifying areas susceptible to flooding and developing Surface Water Management Plans (SWMP) and Local Flood Risk Management Strategies (LFRMS) that identify action plans to eliminate/reduce the risk of flooding to human life, property and the environment.

C.1.1 Pluvial Flooding (Direct Rainfall)

Pluvial flooding occurs when rainfall that is typically conveyed overland as runoff is not adequately removed from the surface through drainage and/or infiltration. This is commonly associated with short duration rainstorms (up to 3 hours), but can also occur in low intensity rainfall (about 10 mm/hr) over longer durations, particularly if the ground is impermeable, waterlogged or frozen. Rain water remains on impermeable surfaces and runs off into topographic depressions where it collects as temporary ponds. This type of flooding is generally not well understood by the general public; it often occurs with little warning and can cause considerable damage. With climate change predicted to result in more extreme rainfall events and changes in weather patterns in the near future, the severity of pluvial flooding is set to get worse, especially in urban areas where there are significant areas covered by impermeable surfaces. It is also likely to cause a significantly greater threat to human life and property/infrastructure due to high population densities in urban areas.

In spite of pluvial flooding gaining more attention from policy makers lately, there is still a lack of understanding of its nature, likelihood and impact, particularly the impact and extent of climate change on rainfall patterns, flood distribution and ability to accurately forecast local flooding and issue warnings. The Flood Forecasting Centre, a partnership between the Environment Agency and the Met Office, currently provides 5-day flood forecasts each day. The forecasts consider all types of flooding and cover the general flood risk level by county, enabling a broader assessment to be made. The Met Office is currently working on improving the accuracy of its weather modelling. It is anticipated that an improved resolution of the flood forecast spread would improve the prediction of the likelihood and impact of pluvial flooding at the local scale. The Council is responsible for managing pluvial flood risk and has undertaken pluvial flood modelling to identify areas in the borough at a relatively higher flood risk.

C.1.2 Groundwater Flooding

Groundwater flooding occurs as a result of water levels in the ground rising above the surface from water bearing geological features such as fissures and fractures in non-porous rocks. It usually occurs in low lying areas underlain by aquifers where the water table is at shallow depth below ground or from abnormal springs. Groundwater flooding often arises sporadically and lasts longer than pluvial,

fluvial or sewer flooding. While this type of flooding has been associated with principal aquifers in the past, it is also now increasingly being associated with localised floodplain sands and gravels. Groundwater flooding may take weeks or even months to dissipate as groundwater flow is considerably slower than surface runoff and thus water table levels would fall at a slow rate.

In general, groundwater levels tend to rise during wet winter months and fall in the summer as it flows out to recharge rivers and streams. In some very wet winters, high groundwater levels may result in flooding of land that would normally be dry and may also induce flow in bournes¹⁹. Some geological formations can have large seasonal variations in groundwater levels. The Chalk formation is one such type, and is the most extensive source of groundwater flooding. The risk from groundwater flooding may lead to damage of basement properties, tunnels, cuttings, buried utility services and other related structures. It may also lead to reduced flow capacity in sewers (e.g. due to infiltration). High groundwater levels may reduce the capacity of the ground to allow rainfall to infiltrate, exacerbating pluvial flooding from increased rainfall runoff. These high levels may also lead to an increased risk of sewer flooding, as a result of sewer/groundwater interactions (i.e. infiltration of groundwater into sewer systems).

C.1.3 Fluvial Flooding (Rivers)

The flooding of rivers occurs when the amount of water entering them exceeds the flow capacity of the river channels. The majority of rivers and watercourses have floodplains into which water spills from the channels during flooding. The rise and fall of water levels in river channels and floodplains will be influenced by the grade of the river and the speed of recharge of the channel by surface runoff and tributaries. It is important to consider floodplains as part of the natural river system, as they act as regulators of river flow (i.e. as detention basins) in times of flooding. For that reason, there is a need for current and future development to make allowance for natural space for flood waters, discourage development in floodplains. Southwark does not have any significant watercourses besides the Thames.

C.1.4 Tidal Flooding

Usually flooding from the sea is very rapid, giving very little time for warnings and/or temporary emergency defences to be put in place. Severity of flooding from the sea is influenced by the combination of weather patterns, tidal heights and wave conditions. High tides and surges of storms from the sea and estuaries can cause flooding of low lying areas, especially where tidal defences do not exist. The London Borough of Southwark is situated in the lower reaches of the River Thames, where tides from the sea can reach the river channel along its stretch through London and create high water levels. This can be exacerbated by the high tides coinciding with high fluvial flows due to heavy rainfall. It can also be exacerbated by a surge in water levels in the river channel resulting from a propagation of a 'wedge' of water pushed through the channel by gale force winds from the North Sea in the upper reaches. Should a tidal surge occur (i.e. a surge coinciding with high tide), the natural River Thames basin upon which most of central London is built would experience flooding.

The Thames Tidal Barrier was built specifically to prevent tidal surge propagating upstream into built up areas of London, including the Borough of Southwark. Combined with the rest of the Thames Tidal Defence (i.e. the raised flood defence walls along the River Thames plus other associated barriers and flood gates), it provides protection against flooding from unusually high water levels in the river and also ensures that there is capacity to accommodate fluvial flood waters coming from upper reaches of the River Thames. These defences provide protection for northern area of Southwark against a 1 in 1000 chance of tidal flooding in any given year (i.e. 0.1% Annual Exceedance Probability). However, overtopping or accidental breach of the defence structures during extreme storms can result in flooding and extensive damage to protected areas that are populated. The failure of these hard defences is often random and very difficult to predict, and may also result from poor design, construction defects, scour, poor maintenance, unforeseen accidents, structural deterioration, vandalism or sabotage. The Environment Agency is responsible for managing tidal flood risk.

¹⁹A 'bourne' (or winterbourne) is a stream or river that is dry during the summer period when the water table falls below the level of the stream/river's bed.

C.1.5 Sewer Flooding

Sewer flooding occurs when the sewerage network becomes overcharged with wastewater as a result of receiving inflows above its normal operational capacity. This could be due to inundation of a catchment with heavy rainfall or blockage of the sewer network. In urban areas, rainfall runoff is commonly drained into combined sewers²⁰ or surface water sewers. When flooding occurs from a combined sewer system, there is a significant risk of pollution of property, land and water bodies/courses from raw sewage contamination.

The sewer systems are generally managed by utility companies, and in the case of the London Borough of Southwark, Thames Water is the water and sewerage company responsible for the public sewer network. It is important to appreciate that the surface water and combined sewer systems may have been built to provide a hydraulic capacity for a rainfall event not exceeding a 1 in 30 chance of occurring in any given year (i.e. a 3.3% Annual Exceedance Probability). Such a capacity provides a lower standard of flood protection than that typically provided for measures managing flooding from rivers, the sea or pluvial sources in Southwark. Sewers in parts of Southwark lack capacity and present sewer flooding risk. Sewer flood risk in the borough is managed by Thames Water.

C.1.6 Flooding from Reservoirs, Canals and Other Artificial Sources

Artificial sources of flooding may include water reservoirs, lakes, canals and water retention features above natural ground levels. They may include industrial operations such as quarrying, mining and aggregate extraction which may introduce un-natural conduits/spaces that increase floodwater depths and velocities in nearby areas. Flooding from a reservoir or canal may result from the overwhelming of that facility and/or a bank/dam failure. Such flooding may happen rapidly with little warning; and considering the volume of water stored, may result in very serious threats to human life, the environment, property and infrastructure. Southwark has two reservoirs at Honor Oak and Nunhead which are both managed by Thames Water.

C.2 Built Environment

Southwark plays an important role in facilitating movement of traffic across London through strategic road and rail networks controlled by the Mayor of London via Transport for London (TfL). These strategic road networks comprise of thirteen 'red routes' (including A205, A202, A2, A200, A3200, A201 and A100) classed as major routes by TfL.

Several main railway lines traverse the borough to towns and cities in the South and Southeast of England. There are nine London Underground stations connecting to the Jubilee, Northern and Bakerloo lines, and linking with London Bridge overland railway station (the fourth busiest rail terminal in London). The Station serves over 54 million passengers a year with a comprehensive bus network. Other important infrastructure of note includes the railway cutting west of Denmark Hill Station, Guy's Hospital near London Bridge, Maudsley Hospital and King's College Hospital (just across the administrative border with Lambeth Council).

²⁰A 'Combined Sewer' is a type of sewer system that collects domestic/ industrial wastewater and rainwater in a single pipe system.

Figure C.1: London Borough of Southwark (Source: Southwark Open Space Study, 2012)

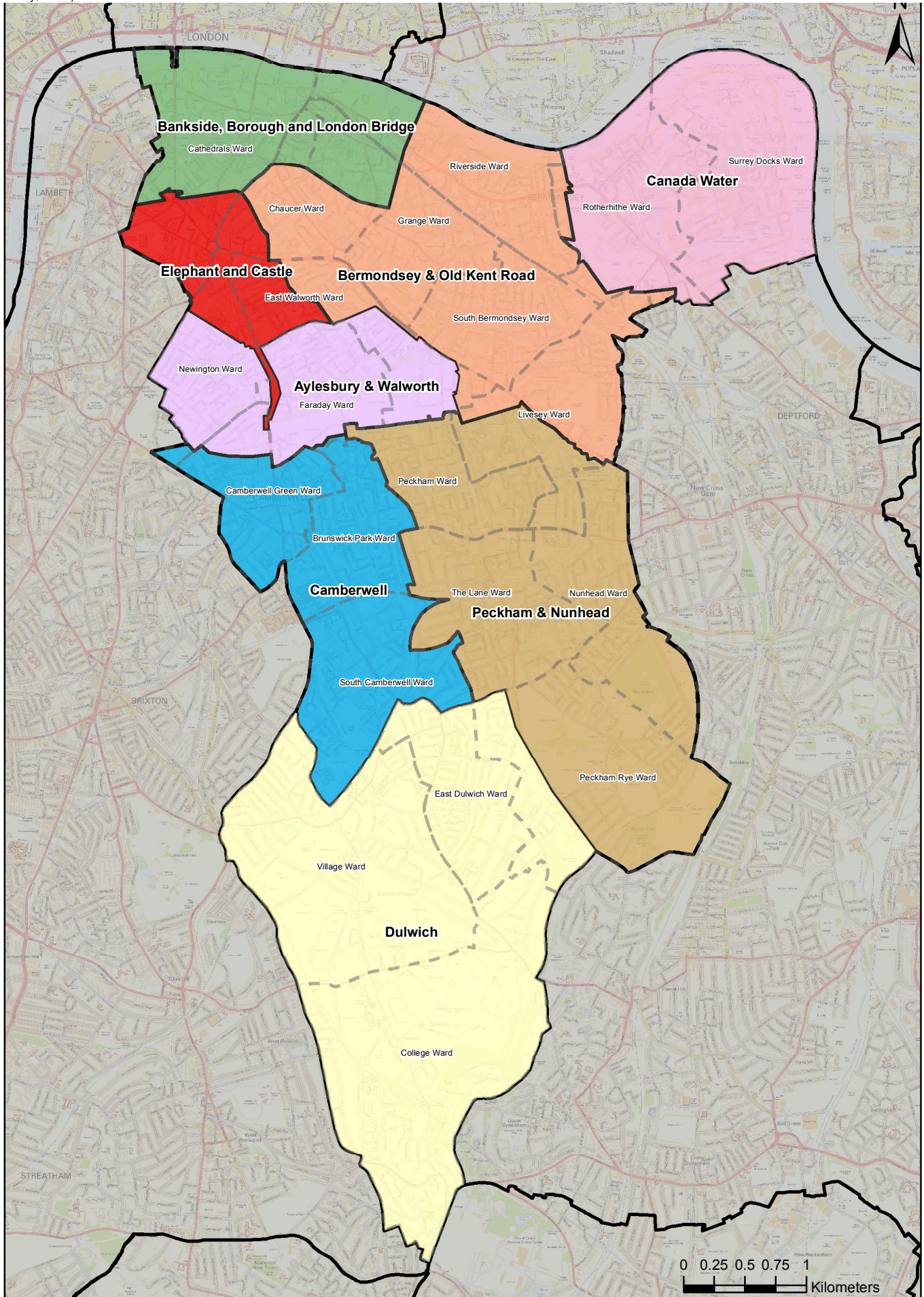


Table C.1: Identified Members' Roles for the Southwark Internal Flood Risk Partnership

Department	Possible Role / Impact
Public Realm Asset Management	<ul style="list-style-type: none"> • Undertake the duties of the LLFA as outlined in the Act and the Regulations. • Maintain and update inventory of drainage assets. • Stewardship of the drainage infrastructure including Thames River Walls. • Lead on Flood Risk Management in Southwark. • Develop, test and evaluate robust maintenance and management techniques for SuDS measures to support efforts to incorporate them into adoptable standards for Highways. • Coordinate approach to maintenance of hard and soft SuDS structures including potential commuted sum requirements.
Public Realm Capital Projects	<ul style="list-style-type: none"> • Undertake innovative projects that could reduce surface water runoff. • Consider incorporation of SuDS techniques into adoptable standards for highway design. • Explore potential to make more widespread use of pervious pavements (subject to findings and incorporation into adoptable standards). • Publicise within adoptable standards commuted sum requirements from scheme developers.
Public Realm Parks and Open Spaces	<ul style="list-style-type: none"> • Explore opportunities to have ponds in the parks to store water instead of draining into the sewer network whilst ensuring the safety of users. • Provide opportunities to introduce/improve surface water attenuation in parks and open spaces through partnerships on regeneration schemes. • Progressively ensure run off from parks are kept within the park • Promote and maintain increased tree canopy coverage from larger trees within the highways. • Contribute towards the development of an approach to maintenance of hard and soft SuDS structures – including potential commuted sum requirements.
Emergency Planning and Resilience	<ul style="list-style-type: none"> • Develop and maintain Southwark's Multi-Agency Flood Plan (MAFP) in line with Defra guidance for the response and recovery from a flooding incident in consultation with the emergency services partners and other relevant organisations. • Help raise awareness, warn and prepare high risk communities to minimise the impact of risk should it occur. • Support communities at higher risk of flooding to develop community flood plans.
Development Management Planning Policy	<ul style="list-style-type: none"> • Adopt policies to manage development in high risk areas in order not to increase flood risk. • Protect land earmarked for flood management (such as flood storage, defences, conveyance) from undergoing development. • Make the most of opportunities offered by new developments to reduce the risk and impact of flooding; promoting green infrastructure for attenuation, SuDS, conveyance and flood routing to designated floodplains • Ensure spatial planning policies link with flood risk management and support the Local Flood Risk Management Strategy.

Department	Possible Role / Impact
Sustainable Services – Southwark Hygiene Services	<ul style="list-style-type: none"> • Collaborate with public realm to develop, test and evaluate robust maintenance and management techniques for soft SuDS features with the view of incorporating them into adoptable standards for highways. • Explore and resolve issues related to impact of daily street cleansing regimes on SuDS structures (e.g. sweeping of footways on pervious block surfaces). • Contribute towards the development of an approach to maintenance of hard and soft SuDS structures – including potential commuted sum requirements.
GIS/Data Management	<ul style="list-style-type: none"> • Help to prepare the register/record of assets that could have significant effect on local flood risk. • Storage of all flood incident investigations data. • Storage of flood maps.
Communication	<ul style="list-style-type: none"> • Support efforts to raise awareness among residents through Southwark Life and other existing channels. • Support public consultation and engagement efforts.
Corporate Risk	<ul style="list-style-type: none"> • Awareness and management of potential claims against the Council should there be a flooding event.
Legal	<ul style="list-style-type: none"> • Provide legal advice and ensure the Council meets its obligations under the Act, the Regulations, EU Water Framework Directive, European SEA Directive and any other relevant Regulations, Acts and related Directives.
Regeneration	<ul style="list-style-type: none"> • Promote innovative schemes that reduce surface water run-off. • Actively seek opportunities to promote SuDS.
Housing	<ul style="list-style-type: none"> • Seek opportunities to provide soft landscaping and urban greening measures on some Council Estates to reduce surface run-off. • Adopt proactive approach to the maintenance of gullies in housing estates.
Sustainability and Climate Change	<ul style="list-style-type: none"> • Promote sustainability and ensure climate change impacts are considered in new scheme developments.

APPENDIX D – Strategic Environmental Assessment

