

Local Flood Risk Management Strategy: 2023-2028

London Borough of Croydon

Draft Version 2

September 2022

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Foreword *to be written by Croydon Council*

1 – Understanding Flood Risk

1.1 Introduction

There are an estimated 5.2 million homes and businesses in England which are at risk of flooding, this directly effects communities, businesses, and infrastructure situated within the borough of Croydon. With the effects of climate change due to exacerbate flood risk within the UK, Croydon LLFA is committed to meeting the challenge posed by increased flood risk and is taking actions to make its community more resilient to future flood risk.

In 2020, during the UK's wettest winter on record, Environment Agency flood schemes managed to protect 129,600 properties despite water levels being higher than the summer floods of 2007 where 55,000 properties flooded. The Environment Agency's 2020 [National Flood and Coastal Erosion Risk Management Strategy](#) (FCERM) for England has three core ambitions regarding future risk and investment needs. These focus on climate resilience, sustainable investment decisions and developing local peoples understanding of flood risk to create a nation ready to respond and adapt to flooding change (Environment Agency, 2020). This Local Flood Risk Management Strategy (LFRMS) will provide a key tool to managing flood risk in Croydon whilst aligning with the new national strategy.

1.2 Flood Risk Management Requirements

As a Lead Local Flood Authority (LLFA), Croydon Council have a legal duty under The Flood and Water Management Act 2010 to develop, maintain, act, apply and monitor a LFRMS. The Act aims to reduce flood risk associated with increasingly extreme weather and climate change via local authority action. Furthermore, The Act requires flood Risk Management Authorities (RMAs) to contribute towards the achievement of sustainable development when exercising their flood risk management functions.

Table 1 below outlines these requirements and indicates where these are addressed in this Strategy.

The strategy must specify from The Flood and Water Management Act 2010 section 9 (4)	Covered in this strategy
(a)the RMAs in the authority's area,	Appendix B
(b)the flood and coastal erosion risk management functions that may be exercised by those authorities in relation to the area,	Appendix B
(c)the objectives for managing local flood risk (including any objectives included in the authority's flood risk management plan prepared in accordance with the Flood Risk Regulations 2009),	Section 2 - Objectives
(d)the measures proposed to achieve those objectives,	Section 2 - Objectives

The strategy must specify from The Flood and Water Management Act 2010 section 9 (4)	Covered in this strategy
(e)how and when the measures are expected to be implemented,	Section 2 and Appendix C
(f)the costs and benefits of those measures, and how they are to be paid for	Objective 1
(g)the assessment of local flood risk for the purpose of the strategy,	Section 1.4
(h)how and when the strategy is to be reviewed, and	Section 3
(i)how the strategy contributes to the achievement of wider environmental objectives.	Objective 5

Table 1 Requirements of the strategy

1.3 Roles and responsibilities for flood risk management

The Act recognises the following authorities as RMAs:

- LLFA i.e. Croydon Council
- The Environment Agency
- Water Companies i.e. Thames Water Utilities & Sutton and East Surrey Water (SES Water)
- Highways Authority i.e. Transport for London (TfL)

These RMAs have a duty to co-operate with each other when carrying out their flood risk management responsibilities.

The main RMAs within Croydon are Croydon Council as the LLFA, the Environment Agency which has a national and regional responsibility in coordinating flood risk management, SES Water and Thames Water as the water company and sewerage undertaker, and TfL as the Highways Authority. Developers and riparian owners also have a role to play in flood risk management. Riparian owners are responsible for the management and maintenance of main rivers and ordinary watercourses as they own the adjacent land and are therefore deemed to own the land up to the centre of the watercourse.

Appendix B shows the duties and powers upon specific RMAs and other authorities which are relevant to local flood risk management.

1.4 Assessment of flood risk

Signpost to Section 9 (4) requirements of The Act, this section deals with:

(g) the assessment of local flood risk for the purpose of strategy

This section sets out the assessment of local flood risk from main rivers, ordinary watercourses, surface water, groundwater and sewers and reservoirs as well as assessing risks associated with climate change.

Within the London borough of Croydon, there is no risk from tidal flooding, therefore this strategy will only focus on the sources of flooding listed above. Croydon's 2021 Strategic Flood Risk Assessment (SFRA) used modelling and analysis to predict the area's flood risk. The 2021 [SFRA](#) has been used to identify high risk areas, incorporating climate change and urbanisation. It also provides information on flood depths and velocities to assess the likely impact. SFRA's and LFRMS of neighbouring boroughs of Merton, Bromley, Sutton, Lambeth, Reigate and Banstead and Tandridge provide additional evidence of nearby risks which may affect Croydon. This information can be found on their respective council websites. The most up to date flood risk maps for Croydon can be found on the council website [here](#), these are also shown in Appendix E.

Section 19 reports, developed under the Flood and Water Management Act 2010, are the summary of investigations based on a specific flood event which outlines the details of the event, source(s) of the flooding and RMA responsibilities for its future management. Evidence gathered from Section 19 reports has been used throughout this section to highlight specific examples of historic flood events throughout Croydon.

Fluvial flood risk

Fluvial flooding occurs when river levels rise due to high quantities of or intense rainfall, resulting in rivers overflowing and bursting their banks. The Environment Agency define Main Rivers on their Main River Map and Croydon contains four of these main rivers; Wandle, Norbury Brook, Caterham Bourne and Chaffinch Brook. The Environment Agency is the risk management authority for main rivers. The Caterham Bourne main river led to significant flood events from January to March 2014 and throughout the winter of 2000-2001. During these events, high groundwater levels resulted in floodwaters receding exceptionally slowly. There are also records of several similar flood events throughout the 20th century when the Bourne was in flow. There are numerous incidents associated with the Norbury Brook from flood records dating back to the 1960s. These events were caused by overtopping in open sections and the surcharging of manholes and culverts in its culverted sections.

In 2021, the Environment Agency updated an existing dataset called the Risk of Flooding from Rivers and the Sea, which bands the risks into Low, Medium, and High categories. This dataset is readily available to the public to enable them to understand their own flood risk. This strategy uses the Environment Agency's Flood Map for Planning (Rivers and Sea) to determine future flood risk from rivers. This is used by Croydon Council as the Local Planning Authority (LPA), to make planning

decisions in line with national legislation. The Environment Agency's most up to date Flood Map for Planning can be found on the [Environment Agency website here](#).

The 2021 Croydon [SFRA](#) shows that 97.8% of its area is identified as Flood Zone 1 (Low probability of flooding from rivers) with 1.7% defined as Flood Zone 2 (Medium probability), and less than 0.5% of the area defined as Flood Zone 3a (High probability) and 3b (Functional Floodplain) (Croydon, 2021). According to the Environment Agency around 3% of all properties in Croydon are at risk of fluvial flooding, although 96% of these properties are in Flood Zone 1 where likelihood of flooding is low. In some cases, properties are protected by nearby flood defences as well as geological and topographic features (NEF, 2021) (Croydon Resilience Team, 2020). These flood defences within Croydon can be seen in **Error! Reference source not found**. Appendix E.

Flood Event Case Study

In August 2015, extremely high levels of rainfall (2.6% AEP (Annual Exceedance Probability)) caused significant flooding in the catchment of the River Wandle. In addition to surface water and sewer flooding, fluvial flooding played a large role in the source of this flood event (Croydon, 2016).

The River Wandle is a main river which runs through Wandle Park before entering a culvert and flowing into the neighbouring borough Sutton. During this event the River Wandle was reported to have burst its banks at multiple locations downstream, in Sutton. Despite not being within the area of Croydon, this indicates that the River Wandle was flowing at high levels and that this watercourse is capable of bursting its banks. Further details are outlined in the 24th August 2015 Section 19 Flood Investigation Report.



Figure 1 Purley Cross underpass (Croydon, 2015)

Ordinary Watercourses flood risk

Ordinary watercourses are watercourses managed by the LLFA, these include all rivers, streams, ditches, drains, cuts, dykes, sewer (other than public sewer) and passages through which water flows, above ground or below ground or culverted. Whilst the Environment Agency are responsible for the management of main rivers, Croydon Council, as the LLFA, are responsible for the management of ordinary watercourses. **Error! Reference source not found**. Appendix E, shows the location of main rivers and ordinary watercourses within Croydon. Environment Agency records indicate that the mapped ordinary watercourses within Croydon, include the upstream section of Norbury Brook and the tip of the Beck, which flows into the neighbouring borough of Bromley. There are also several other ordinary watercourses which only flow when groundwater is high (Croydon, 2021).

Throughout Croydon, significant lengths of ordinary watercourse are culverted. These culverts have the potential to become blocked by debris and trash during periods of intense rainfall. This can restrict the flow of water through these watercourses, increasing the likelihood of localised flooding (Croydon, 2021). To reduce the likelihood of blockages, some culverts have trash screens at the inlet.

Flood Event Case Study

The Merstham Bourne, an ordinary watercourse near Coulsdon South Station, caused flooding to nearby residents' gardens in the winter of 2014. In January and February 2014, there was an increase of around 300% and 270% of the normal average rainfall for those months respectively. This event also caused disruptions to the nearby railway and nearby residents reported that lack of ditch and culvert maintenance led to the wider flooding of the area (Croydon, 2015). Specific details are outlined in the Merstham Bourne Flood Investigation Section 19 report.

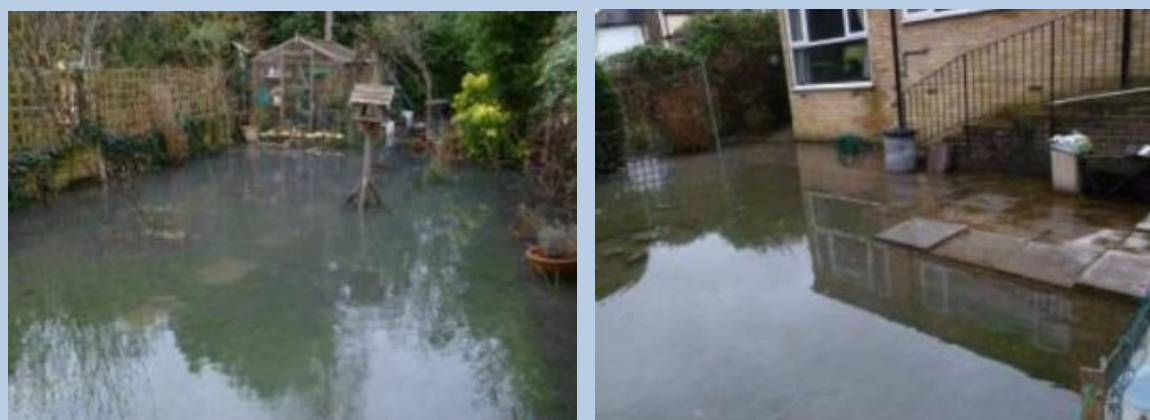


Figure 2 Flooded gardens during 2014 event (Croydon, 2015)

Further asset information gathering and actions to address flooding from ordinary watercourses have been included in the action plan for this strategy to aid future management. These include actions focussed on clarifying riparian responsibility and mapping ordinary watercourses to better manage the associated risks.

Surface water and sewer flood risk

Surface water flooding is caused when intense rainfall creates surface runoff which flows over the ground and pools in low areas. This flooding occurs when the runoff exceeds the capacity of the existing drainage system. There are several areas which are particularly susceptible to surface water flooding. These include, Brighton Road up to Central Croydon via Purley and the A22 Godstone Road. **Error! Reference source not found.** Appendix E, shows these risks defined by the following risk levels:

- High Risk – Higher than 3.3% AEP
- Medium Risk – Between 1% and 3.3% AEP
- Low Risk – Between 0.1% and 1% AEP

Exceptionally high rainfall in August 2015 caused significant surface water flooding throughout Croydon. Short and intense periods of rain led to surface water runoff accumulating in low lying areas. The high intensity rainfall exceeded drainage capacity of road gullies and drain gratings. The rain gauge at Purley Cross recorded 56mm on the 24th August which almost exceeds the August monthly average rainfall for the area of 58.6mm (Croydon,2016). This event was determined to have a 2.63% AEP.

Surface water flooding can be managed by the use of Sustainable Urban Drainage Systems (SuDS) and landscaping to absorb and retain surface water, therefore minimising strain on the drainage system and sewers.

Sewer flooding is caused by the combined sewer and drainage network capacity being exceeded resulting in overflow from manholes. This may occur if the rainfall event overloads the capacity of the sewer and drainage system or if the network becomes obstructed by debris and sediment. Sewer flooding often results in localised short-term flooding. Historic sewer flood events can be seen in **Error! Reference source not found.** Appendix E.

Flood Event Case Study

In June 2016, a significant rainfall event caused surface water flooding in several locations in the River Wandle Catchment, predominantly in the south of Croydon and beyond. The flooding located at Caterham Drive was due to surface water and sewer flood sources. During the 7th June event, just under 1.5 times of the monthly average rainfall fell within 2 hours (Croydon, 2017).



Figure 4 Surface water flowing onto Sites Hill Road



Figure 3 Surcharging manhole on Caterham Drive

The sewer network in Caterham Drive is a separated sewer for foul water only. Surface water drains via a separate network of gullies and soakaways within the highway. A survey conducted by Thames Water following this event found that there was spare capacity within the foul network in this area, however, surface water entered the foul system resulting in overcapacity. The surface water may have entered the sewer network for a variety of reasons including direct surface water ingress into the foul water network and/or accumulated permitted and non-permitted connections over the years (Croydon, 2017).

The surface water drainage network also reached capacity during this event causing surcharged highways drains and manholes. This suggests a network capacity issue, likely exacerbated by increasing demand and development throughout Croydon. For the last 65 years there has been a separated sewer system, however, the effectiveness of this system has been compromised due to misconnections. This makes it increasingly difficult for authorities to determine the capacity of the

network. Furthermore, impermeable surfaces in the area have increased in recent years. This increases the surface water runoff to low-lying areas like Caterham Drive and therefore increases pressure on the drainage network.

As the sewerage undertaker, Thames Water are responsible for the management of sewer flooding although it is usually difficult to distinguish from surface water flooding. Croydon LLFA is working with Thames Water to identify flooding hotspots and system capacity issues. The risk from sewer flooding in Croydon remains relatively low as Croydon is mainly served by separate foul and surface water sewers instead of a combined system. However, due to an increase in rainfall intensity and development, we may see a rise in sewer flood events in the future. The new Thames Water [Drainage and Wastewater Management Plan](#) sets out how wastewater systems and drainage networks will be improved and extended to ensure resilience against future pressures for the next 25 years.

Groundwater flood risk

Groundwater flooding often occurs after long periods of sustained high rainfall as a result of water rising up from underlying aquifers or springs. Groundwater flood events have been reported in Croydon, with regular hotspots primarily appearing on the land along the Caterham Bourne, Brighton Road and up to Norbury Brook (Croydon,2021). These events are often highly localised, usually affecting basements and gardens. In the south of the borough, the chalk geology increases groundwater flooding vulnerability on a larger scale through valley routes through Kenley, Purley and Coulsdon. Susceptibility to groundwater flooding throughout Croydon can be seen in **Error! Reference source not found.** Appendix E.

Groundwater flooding is difficult to predict as it may occur several days or weeks after heavy rainfall events and when river levels have receded. Existing groundwater monitoring takes place in boreholes which are placed in areas known to be at risk. This system can give notice days or weeks in advance of flood events. This early warning can be used to alert authorities, therefore allowing them to plan their response to potential groundwater flooding. There are measures that can be implemented to stop or minimise groundwater flooding but have varying degrees of effectiveness.

The Croydon Surface Water Management Plan (SWMP) used a dataset derived from British Geological Survey, Environment Agency, and Defra groundwater datasets to create **Error! Reference source not found.** Appendix E. This map identifies areas where there is increased potential for groundwater to rise within 2m of ground level after periods of above average recharge.

Other sources of flood risk

Artificial flood risk sources and water bodies are not covered within the above categories, this typically includes reservoirs, canals and lakes. Croydon contains South Norwood Lake, an open reservoir located next to Bromley, and Russel Hill, which is a covered reservoir managed by Thames Water in the West of the borough. To date, there has been no recorded incidents of reservoir flooding within Croydon and the last recorded fatality linked to reservoir flooding in the whole of the UK was in 1925.

In 2021, the Environment Agency updated their reservoir flood maps which can be found [here](#). This tool can be used to show where water is likely to go in the event of a dam or reservoir failure. An extract from this tool has been included in **Error! Reference source not found.** Appendix E to show the flood risk from South Norwood Lake and Russel Hill Reservoir. **Error! Reference source not found.** Appendix E, shows that if the Russel Hill Reservoir were to fail it would impact areas of West Croydon

and Waddon veering west to follow the course of the River Wandle. The failure of South Norwood Lake would lead to flooding primarily in the London borough of Bromley, affecting areas of Penge, Elmers End and Beckenham.

Under the Reservoirs Act 1975, all large reservoirs must be inspected annually, supervised by a reservoir panel engineer. Croydon LLFA own and manage South Norwood Lake and are therefore responsible for ensuring that inspections are carried out by a qualified panel engineer and that necessary safety work is completed to reduce the likelihood of a failure.

2 - Objectives

Signpost to Section 9 (4) requirements of The Act, this section deals with:

(c) the objectives for managing local flood risk (including any objectives included in the authority's flood risk management plan prepared in accordance with the Flood Risk Regulations 2009)

(d) the measures proposed to achieve the objectives

The sources of flooding that carry the most significant risk within Croydon are considered to be surface water and groundwater flooding. High profile instances of groundwater flooding have been associated with the Caterham Bourne in the south of the borough. The area's most susceptible to surface water flooding are Brighton Road and Purley. These events threaten a significant number of homes, businesses and transport infrastructure as well as exacerbating other sources of flooding. The following objectives for managing flood risk aim to reduce the risk and impact of flooding within Croydon (Croydon,2021).

These objectives have been developed in line with the National FCERM Strategy for England. Each objective in this section will be achieved via its accompanying measures and actions which have been developed in line with the recent 2021 SFRA findings outlined in section one of this strategy.

The National Strategy is centred around 3 long-term ambitions which are based on future risk and investment needs to ensure resilience to the year 2100. These 3 core principles are:

- **Climate resilient places:** working with partners to bolster resilience to flooding and coastal change across the nation, both now and in the face of climate change.
- **Today's growth and infrastructure resilient in tomorrow's climate:** making the right investment and planning decisions to secure sustainable growth and environmental improvements, as well as infrastructure resilient to flooding and coastal change.
- **A nation ready to respond and adapt to flooding and coastal change:** ensuring local people understand their risk to flooding and coastal change, and know their responsibilities and how to take action.

These core principles have been carried through each of the following 7 objectives within this strategy.

Objective 1

Identify investment and funding opportunities to develop and deliver a programme of flood alleviation schemes which will take forward innovative actions that help to bolster resilience to flooding and climate change.

Local flood risk management requires funding and resources from many different sources. To date, the primary funding sources have been provided through the central government. With pressures building on government funding in today's economic climate, there is a greater need for LLFAs to finance local flood risk management activities and schemes from their own funding or to find

alternative sources. Effective flood risk management requires new ways of working and funding based on collaboration across partner organisations to maximise investment return.

There are many ways in which central government funding can contribute towards local flood risk management, these are summarised in Figure 5 below.

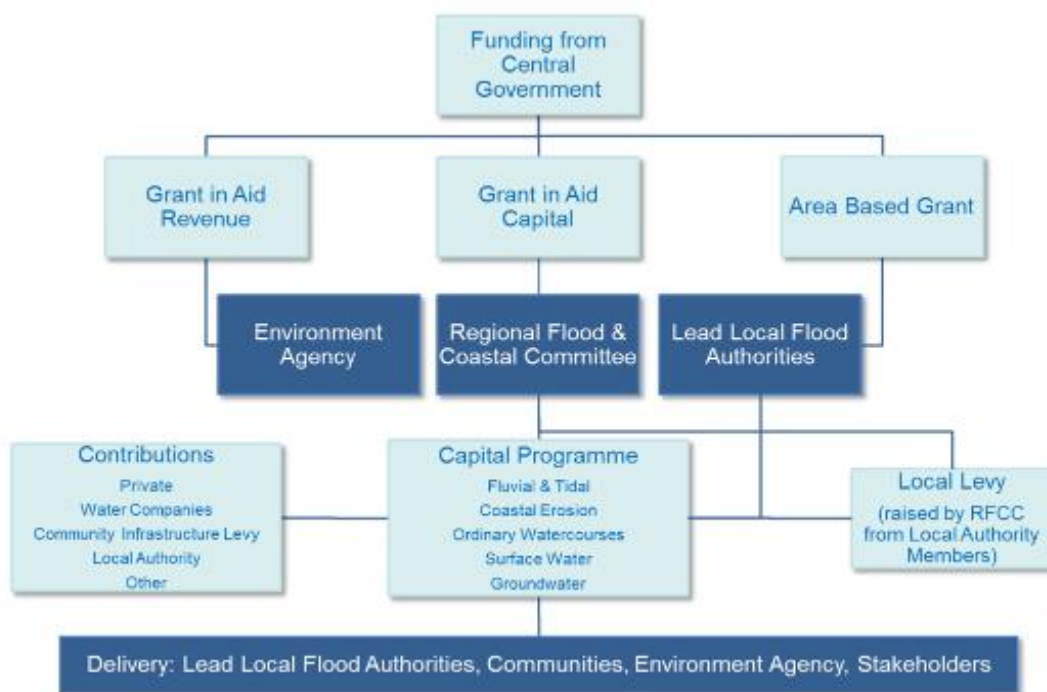


Figure 5 Summary of LLFA Funding streams

Details of the allocation of Government funding to Croydon LLFA can be seen in Table 2.

Financial Year	Approximate Grant Allocation
2016/17	£217.5K
2017/18	£230K
2018/19	£235K
2019/20	£249K
2020/21	£267.5K
2021/22	£565K*
2022/23	£435K*

Table 2 Defra funding allocation for LLFA duties to Croydon Council (*partially funded by Defra: combination of grant and LBC capital funding)

It may be possible to fund some schemes using government funding alone, however, most projects will require multiple sources of funding to reach the required sum. Flood risk management projects are primarily funded by the following funding sources:

- National Government Funding – FCERM Grant in Aid (GiA)
- Regional funding – Local levy
- Local, Partnership and other funding (Organisations, Businesses, Borough & Parish Councils, residents)

FCERM GiA funding is the central government funding which is specifically for flood defence projects throughout England and it is administered by the Environment Agency on behalf of Defra. If the FCERM GiA funding doesn't cover the entire cost of the project, extra money can be raised through Partnership Funding. Partners can be anyone who benefit from an FCERM project such as; local businesses, residents and developers. The Environment Agency released the updated [Partnership Funding Calculator](#) tool in 2021 to help to estimate how much FCERM GiA funding a project is eligible for.

As the LLFA, Croydon Council are responsible for coordinating with other RMAs to address local flood risk. For example, Croydon LLFA engage with Thames Water who are responsible for upgrading the sewerage network to account for the effects of climate change and to prevent sewer flooding whilst also helping manage surface water flooding. Coordination with utility companies and property owners is also essential for local flood risk alleviation and resilience. If property owners and businesses benefit from a flood risk management project, they will be encouraged to provide a contribution. Furthermore, developers are responsible for managing flood risks in their building and landscaping design.

Croydon LLFA will capitalise on what has been achieved so far and will continue to learn lessons as highlighted in the case studies below. They will continue to improve the borough-wide understanding of current and future flood risk and use this to inform and prioritise a programme of flood alleviation schemes.

Croydon LLFA will look at innovative solutions that help to bolster resilience to flooding and climate change, identifying opportunities to achieve environmental net gain through de-culverting, natural catchment management and other measures. This will be done whilst exploring options to reduce the carbon footprint and environmental impact during the design, build and maintenance of flood alleviation schemes.

Croydon LLFA will explore opportunities to support the Infrastructure Delivery Plan by providing progress on various schemes that involve S106 and Community Infrastructure Levy (CIL).

This objective pays particular attention to the [National Strategy](#) target of 'making the right investment to secure sustainable growth and environmental improvements, as well as infrastructure resilient to flooding' (Environment Agency, 2020).

Funding Case Studies

GiA and Local Levy - Kenley Flood Alleviation Scheme – In April 2013, the Thames RFCC approved the first stage of a funding application (through FCRM GiA) to address long-standing localised surface water flooding problems in the Welcomes Road / Kenley Lane area of Kenley. A consultant was procured to carry out the first stage of refined modelling of the area alongside stakeholder engagement with local residents to develop an evidence base for detailed design of flood alleviation options in the area. Small scale drainage interventions which had the potential to reduce the frequency and impact of flooding at Kenley Lane without increasing risk to properties in Station Road were identified and these are programmed to be implemented by March 2023.

DEFRA Funding - Surface Water Modelling & Mapping – In November 2019, Croydon LLFA secured DEFRA funding to undertake detailed and up-to-date surface water modelling for two Critical Drainage

Areas (i.e. Caterham Drive and Purley Cross to River Wandle), for the purpose of updating the Environment Agency Risk of flooding from Surface Water (RoFSW) Mapping as part of the Boosting Action for Surface Water Programme. A consultant was procured to deliver the project and developed a detailed and integrated 1D-2D hydraulic model of the catchment to provide the necessary resolution and confidence in the prediction of flood depths and extent, commensurate with the requirements for the Environment Agency RoFSW. The project was completed and the outputs delivered to the Environment Agency in July 2020.

Council Funding - Flood Hotspot Alleviation Schemes – This is an ongoing programme which involves investigating the flooding mechanism in known flood hotspots within the borough and identifying viable small-scale interventions that could be implemented to alleviate the flooding or better manage the risks of flooding. These are flooding incidents that would not normally comply with the requirements of the FCERM GiA or Local Levy funding and are therefore funded from the capital budget provided by the Council for flood and water management activities. In 2022, flood alleviation works were completed in Lower Barn Road, Palace Green, Upper Shirley Road, Calley Down Crescent, Wolsey Crescent, with works programmed to be completed in Kenley Lane/Welcomes Road, King Henrys Drive, Norbury Crescent, Asmar Close and many more sites.

Measures

Measure 1: Continue to improve the borough-wide understanding of current and future flood risk, including the likelihood and consequences, and inform the prioritisation of flood alleviation schemes.

We will review and update the Surface Water Management Plan and Strategic Flood Risk Assessment using the newest available data. Furthermore, we will continue to undertake flood alleviation studies and prioritise alleviation schemes based on these and our understanding of current and future flood risk.

Measure 2: Develop a funding strategy which identifies investment and funding opportunities to develop and deliver a programme of flood alleviation schemes.

Croydon will monitor and update funding streams for flood alleviation measures to prioritise opportunities. We will also submit a business case for capital funding to implement small interventions and support the Infrastructure Delivery Plan by providing progress on schemes which involve S106 and CIL money.

Measure 3: Identify opportunities to achieve environmental net gain through de-culverting, natural catchment management and other measures.

Croydon will generate a list of potential locations for de-culverting as well as assessing and identifying the multiple benefits of de-culverting in these locations.

Measure 4: Explore options to reduce carbon footprint and environmental impact in the design, building and maintenance of flood alleviation schemes.

Council teams will be encouraged to attend the Environment Agency carbon calculator and reporting training to gain an understanding of our current footprint. Using this, we will be able to consider the

carbon footprint and environmental impact during all stages of a scheme and be able to realise the council's aspirations with regards to carbon reduction.

Measure 5: Identify innovative solutions that help to bolster resilience to flooding and climate change.

To achieve this, we will investigate and form a list of innovative solutions which will help to increase resilience to flooding and climate change within Croydon.

Measure 6: Investigate benefits and costs of different resilience actions and property level protections that could be effective in Croydon.

Croydon will collate a list of resilience actions and property level protection that could be effective in Croydon and perform cost benefit analysis on these actions. Following this, we will raise awareness of the different resilience actions and the outcome of our analysis.

Objective 2

New developments and regulated activities will contribute to making places more resilient to flooding using Nature Based Solutions where possible and achieving environmental net gain, today and in the future.

As well as managing existing flood risks, Croydon LLFA has a responsibility to ensure that new developments do not contribute to further flood risk. Since the Croydon 2015 LFRMS, work has been done both locally and nationally to tackle flood risk through planning. For example Policy DM25: Sustainable Drainage Systems and Reducing Flood Risk, has been introduced as part of the Croydon [Local Plan](#) adopted in February 2018. The Local Plan states that developments should not increase the risk of flooding and that sustainable drainage systems should be prioritised (Croydon, 2021).

[The London Plan](#) also aligns with the idea of using Nature Based Solutions and achieving Environmental Net Gain within new developments. London Plan Policy 13 on Sustainable Infrastructure, states that development proposals should prioritise sustainable drainage and that this drainage should be designed to promote multiple benefits such as enhancing biodiversity and urban greening (Greater London Authority, 2021).

The [National Planning Policy Framework](#) (NPPF), provides Government guidance on Planning. The primary focus of this framework is to take full account of flood risk and to avoid developments increasing flood risk elsewhere and in the future. Importantly, this guidance highlights making use of natural flood management as an approach to flood risk management, safeguarding land that is or may be required for flood risk management and encouraging policies which consider cumulative flooding impacts in a more holistic approach (Department for Levelling Up, Housing and Communities, 2021).

The NPPF also encourages Planning Authorities to incorporate sustainable drainage systems to ensure future resilience. The Local Plan is now under review and changes to the NPPF will be reflected in the revised policies. This offers an opportunity to maintain focus on using Nature Based Solution, such as SuDS, to make Croydon more resilient to flooding now and in the future, and to implement the national guidance and the objectives stated in this LFRMS.

This objective will contribute to the [National Strategy](#) long term ambition to ensure that ‘today’s growth and infrastructure is resilient to tomorrow’s climate’ (Environment Agency, 2020). As the local effects of climate change are uncertain, localised research is needed to greater understand the impacts of climate change (See section on **Climate Change**). Sustainable development and drainage must be prioritised throughout the planning process in order to adapt to the effects of climate change and manage the increasing future flood risks.

Since the 2015 LFRMS, Croydon LLFA have identified additional resources to process SuDS applications as part of planning applications, reviewed workforce to meet SuDS obligations and created stronger ties between neighbouring boroughs by sharing their processes with the Southwest London Flood Group.

Sustainable Drainage Systems

Sustainable drainage systems (SuDS) provide a more natural approach to water management. They increase the resilience of drainage systems by controlling the rate and quantity of surface water runoff, therefore decreasing the impact of storm events on existing infrastructure. SuDS also have additional benefits such as improving water quality, providing green spaces and increased biodiversity. The higher levels of surface water runoff which are generated by new development and the associated increase of impermeable areas can be reduced by providing SuDS. This ensures that new development does not increase the flood risk of the surrounding area. Some examples of SuDs include soakaways, swales, green roofs, permeable paving, rainwater harvesting and detention basins.

Strategic Policy 6.4 in the Local Plan requires all developments, including refurbishments and conversions, to utilise SuDs to reduce surface run-off and to provide water treatment on site (Croydon, 2021). Croydon LLFA will work with partners and developers through the development management process to work towards provision of SuDS to fulfil the requirements of the Act.

Guidance for designing SuDS can be found within the [CIRIA SuDS Manual](#) and Defra’s [non-statutory technical standards for sustainable drainage systems](#). Croydon LLFA promotes its own SuDS guidance via its 2018 [Sustainable Drainage Design and Evaluation Guide](#). This guide is intended for developers and SuDS designers.

As an LPA, Croydon LLFA is expected to ensure that planning policies and decisions include SuDS for the management of run off, unless demonstrated to be inappropriate. As the LPA and LLFA, Croydon LLFA must also ensure that SuDS are operated to appropriate standards and that they are maintained throughout the lifetime of the development.

Developers who implement SuDS must provide evidence that their drainage systems do not increase groundwater levels and subsequent flood risk on or off site. This is particularly important for developments working within areas prone to groundwater flooding, as shown in **Error! Reference source not found.** Appendix E.

Measures

Measure 1: Ensure appropriate guidance for developers is available to make places more resilient, use Nature Based Solutions, achieve environmental net gain and promoting retrofitting SuDS.

We will review and update planning advice for major and minor developments to incorporate a list of appropriate nature-based solutions that will be effective to use in Croydon. In addition, we will develop specific SuDS related cost guidance and increase the awareness of these sustainable practice's borough wide.

Measure 2: Continue to monitor the risk of individual and cumulative flood risk to and from developments and review ways to facilitate more sustainable design and post-construction changes.

We will identify ways to increase awareness of flood risk to owners of developments and improve our understanding of flood risk to and from developments, in order to inform required changes to planning policy and guidance documents.

Measure 3: Ensure the technical review of SuDS applications including the use of Nature Based Solutions as part of the LLFA Statutory Consultee Role for planning applications.

We will quantify the resources needed to assess drainage strategies and flood risk assessments submitted as part of planning applications and provide the training needed to do so.

Measure 4: Monitor and record planning application against SuDS Hierarchy to ensure that nature-based solutions are prioritised.

We will develop a tracking system to monitor the number of applications for major and minor developments.

Measure 5: Continuous working with the Environment Agency, other partners, and other bodies (such as Association of Directors of Environment Economy Planning & Transport, Town and Country Planning Association and the Royal Town Planning Institute) to develop the planning skills and capabilities.

We will collaborate with our partners to develop and share good practice and knowledge including utilising national sources of information and guidance.

Measure 6: Identify and promote development-related funding mechanisms to support the delivery of flood alleviation schemes.

We will collate a list of potential developments to seek funding and explore how S106 agreement funding can be utilised to deliver flood alleviation schemes. The Infrastructure Delivery Plan will be updated annually with the progress on various schemes that involve S106 and CIL money.

Objective 3

Develop and implement best practice for recording, inspecting, and managing flood assets, considering the changing environment.

This objective focusses on the [National Strategy](#) Objective A to have the flood data and information available and accessible so assets can be managed effectively and efficiently and to help inform decisions made by RMAs (Environment Agency, 2020).

Data collection and the effective sharing of information is essential to the management of flood risk. Data should be collected and input to a common data environment which is stored and maintained properly. This data can then be easily analysed and manipulated within the corporate GIS system. Within Croydon, data is gathered in many ways for example, inspections, studies, and Section 19 reports when investigating flood incidents. Using robust data management, Croydon will be able to better manage assets and share knowledge both within Croydon and with its neighbouring boroughs.

In addition to the better management of existing assets, data management supports flood risk management by informing guidance such as the installation and maintenance of innovative flood management techniques. In 2019, Croydon collated all asset information into one system and with a target to use more sustainable drainage methods going forwards, a list of suitable SuDS systems will also be included. Highways drainage assets are also due to be added to the system.

Managing Highways Drainage assets

Highways drainage assets within Croydon are maintained via three methods; cleansing, repairing and pumping.

CLEANSING

- There is a cyclical gully cleansing programme in place where all road gullies are inspected/cleaned once a year (or 4 times a year in areas susceptible to flooding). Recently, we have included all linear drainage systems and footpath gullies to the programme. Gullies and linear drainage systems are also inspected/cleaned on an ad-hoc basis should they become blocked before they are due to be inspected/cleaned on the cyclical programme.
- There is a soakaway cleansing programme in place where all soakaways are cleaned/jetted once every 5 years (or more frequently in areas susceptible to flooding). Soakaways are also cleaned/jetted on an ad-hoc basis if there is a need to do so (i.e. after a flooding event).
- All other drainage assets (i.e. trash screen, ditch, culvert etc) are inspected/cleaned on an ad-hoc basis, mainly when a severe weather warning is issued by the Met Office.

REPAIRING

- Drainage assets that are identified as defective during the cleansing programmes are placed onto a repair programme where the defect is investigated, and repair works carried out as necessary.

PUMPING

- There is an inspection programme in place where general mechanical/electrical inspections and testing of all pumping stations owned by the Council are undertaken 4 times a year.

As a LLFA, Croydon Council have a duty to respond to and investigate significant flood events. For flood resilience to be maximised, local residents and communities must be informed and engaged in flood awareness and riparian owner responsibility. During a severe flood event, Croydon LLFA works with RMAs, the EA, emergency services and local flood action groups to coordinate a response. Appendix E – Croydon flood risk maps contains maps which indicate flood risk in Croydon from the latest SFRA.

As an Open Data organisation, the Environment Agency makes its data readily available and free of charge. Environment Agency open data resources such as the [Flood Map for Planning](#) are incredibly valuable tools for Croydon to use and we aim to create similar open data sources for our neighbouring boroughs to use. Surface water and groundwater flood maps of Croydon are also published on the Council website and can be found [here](#). Since the 2015 LFRMS, Croydon LLFA has improved its external collaboration by attending quarterly South West London Flood Group meetings and reporting progress to the RFCC representatives.

Flood investigation

Signpost to Section 19 of The Act: As a Lead Local Flood Authority Croydon Council have a responsibility to investigate certain flood incidents.

Local authorities: investigations

(1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate—

(a) which risk management authorities have relevant flood risk management functions, and

(b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

(2) Where an authority carries out an investigation under subsection (1) it must—

(a) publish the results of its investigation, and

(b) notify any relevant risk management authorities.

As outlined in the [London Borough of Croydon Flood Investigation Protocol](#), investigations of flood events under Section 19 of the Act will be considered by Croydon LLFA for events which meet the criteria below:

Formal investigation:

- Fatality or serious injury as a direct result of flooding
- 3 or more residential properties flooded

Formal investigation likely:

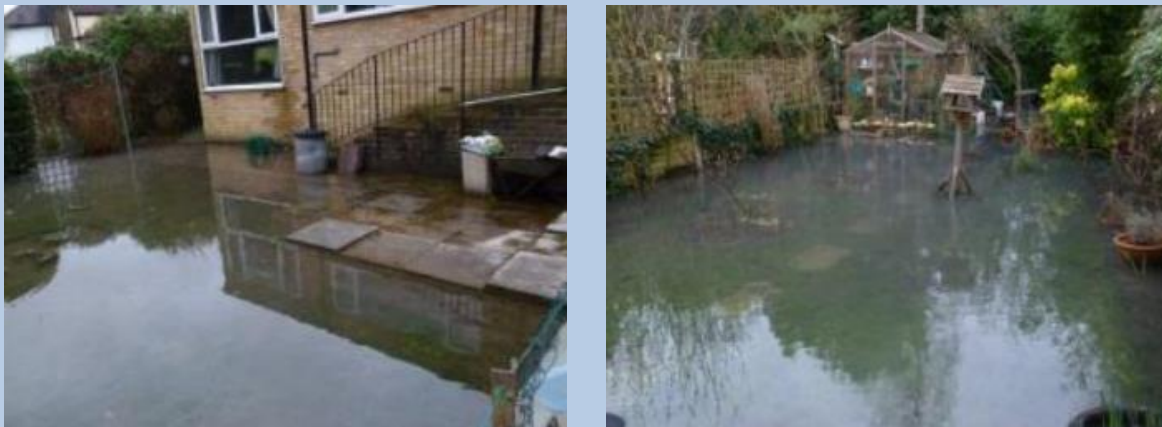
- Depth greater than 0.10m over ground floor
- Critical infrastructure affected for more than 2 hours

- Internal flooding at a facility supporting vulnerable communities
- 3 or more commercial properties flooded
- Lasting effect on local environment and/or biodiversity
- Recurring incident (occurred at least 3 times in last 6 months)
- Requests for formal investigation from the public

Case study

In January 2014, high levels of rainfall caused groundwater levels in the Merstham Bourne area to rise rapidly. Whilst there were other contributing flood types such as surface and sewer flooding, groundwater was the predominant source of flooding during this event.

The groundwater in the underlying chalk geology rose to exceptionally high levels as a direct result of prolonged rainfall throughout the month. This led to the emergence of springs in the area, causing bournes to flow in Croydon. Furthermore, high groundwater levels led to the exacerbation of other flood types. For instance, surface water flooding was made worse by the lack of infiltration due to saturated soil from high groundwater levels. Fluvial flooding was also worsened as Merstham Bourne only flows at times of high groundwater level. The Section 19 report documented this flood event in detail and Croydon are able to use this to better manage flood risks in the future. The report investigated the effectiveness of the relevant RMAs and provided future recommendations as well as lessons learnt. In 2019, Croydon LLFA collated all asset information into one system to develop a comprehensive picture of their assets and associated flood risk.



*Figure 6 Flooded Gardens from Merstham Bourne
(Croydon 2015)*

The early 2014 flood events and the consequent emergency response led to successful internal collaboration between Croydon LLFA and various authorities as reported in the [Caterham Bourne Flood Investigation](#) (Croydon Council, 2014). The flood event saw the formation of the Caterham Bourne Project Board which consisted of officers from Croydon, Surrey, Tandridge, Environment Agency, Thames Water and SES Water, who collectively were responsible for overseeing delivery of the Caterham Bourne Flood Alleviation Study. The Croydon Resilience Forum (CRF) are a group of multi-agency responders who provide a forum for an integrated and coordinated approach to

emergencies and potential risks throughout the borough. In 2020, the CRF created the [Multi-Agency Flood Response Guidance](#) which highlights the importance of data collection for example when a property or business is flooded to assist with flood warning work and defence operation.

Measures

Measure 1: Invest in developing and improving in-house information management to enable knowledge sharing between the different teams and externally

To achieve this, Croydon will collate all assets onto a single system and map all flood assets including ordinary watercourses on the corporate GIS system. We will also ensure that up to date flood maps and data are available and accessible to all users. In addition to this, we will improve inter-team collaboration for communicating flood issues in the borough with residents.

Measure 2: Raise profile and understanding of groundwater as a flood risk.

Croydon will develop a strategy for groundwater management within the borough and improve groundwater information on the council website in addition to developing an information leaflet for residents and businesses to raise awareness. This proactive response will be furthered by exploring the possibility of installing and monitoring boreholes in areas which are susceptible to groundwater flooding.

Measure 3: Collate and develop guidance on costs of installing and maintaining different SuDS types.

Croydon will raise awareness of the existing SuDS Design and Evaluation Guide as well as compiling a list of suitable SuDS systems and promoting their use on council schemes.

Measure 4: Develop a programme to assess the effectiveness and working conditions of all the Council's existing drainage infrastructure and put in place a robust maintenance/renewal programme that will ensure that the risk of flooding is reduced.

Croydon will review and improve existing gully cleansing programme to target the most silted areas. Croydon will also develop a maintenance programme for the footpath gullies and linear drainage assets within the borough as well as exploring the possibility of installing silt/water level monitoring sensors in hotspot areas.

Measure 5: Investigate flood events to understand their source and impacts and apply the learning to inform the Council's and other RMAs' flood management procedures.

Through carrying out many successful Section 19 reports, Croydon have been able to generate a better understanding of flood risk within the area. Croydon will continue carrying out Section 19 reports where appropriate and updating the flood incident register with new information. Croydon will also review and update the existing flood investigation protocol.

Objective 4

We will communicate effectively with infrastructure owners, businesses, and the community to ensure they understand the potential impact of flooding on their lives and livelihoods. They will therefore be better prepared to respond to flooding and will take action to make their properties more resilient to flooding and climate change.

This objective aligns with the [National Strategy](#) ambition to create a nation ready to respond and adapt to flooding through effective communication so that the Council, its partners, and the community can be better prepared and can increase resilience. Strategic objective 3.1 in the [National Strategy](#) focusses on effectively communicating the risks and consequences of flooding to communities and businesses (Environment Agency, 2020). In recent years, Croydon has been building strong relationships both internally between council departments, externally with its partners (Environment Agency, LLFA, Thames Water, TfL) and with the wider community.

Case study

In June 2022, the Mayor of London launched a flood awareness leaflet which was produced with inputs from local authorities. The leaflet was designed to help London residents with basement properties prepare for flash floods. The leaflet can be viewed by visiting [London.gov.uk/flash-flooding](https://london.gov.uk/flash-flooding).

Other documents such as the [LBC Riparian Owner Leaflet](#) provide the local community with information surrounding riparian responsibility to act as a flood risk management guide. This document summarises the roles and responsibilities for riparian owners in a way which is easily understandable (Croydon,2017). Furthermore, since 2015, Croydon has continued to encourage residents to sign up to the flood alert service through the flood responsibility [webpage](#) to ensure residents safety and encourage flood risk initiative within the community.

Croydon will ensure that all infrastructure and properties are more resilient to flooding and climate change, through fostering collaboration, effective communication and knowledge sharing.

To do so, Croydon will work with the other RMAs to:

- Identify areas within the borough which are at significant risk of flooding from combined sources.
- Understand how the assets are managed and maintained and identify common actions which could reduce the risk of flooding.
- Review asset records and agree ownership.

Croydon LLFA will work with Emergency planning to:

- Review existing emergency procedures and identify actions to take forward.
- Support the Emergency Resilience Team in developing flood plans.
- Undertake regular reviews of the flood plans to ensure they are fit for purpose, including undertaking regular drills to test them and update as necessary.

As part of the wider community engagement Croydon will:

- Support flood action groups and residents' association meetings.
- Expand the information available on the council website and available advice and guidance.
- Encourage residents and businesses to sign up to the Environment Agency flood warning service.
- Compile a list of flood alleviation initiatives that residents/businesses could implement privately or with wider support.

- Undertake regular surveys of watercourses to identify riparian owners, providing them adequate information about riparian owner responsibilities on the website and during flood action group/residents association meeting, and ensuring they understand their maintenance responsibilities.

Flood Response

Croydon LLFA will implement appropriate measures to mitigate any devastation caused by the event and to manage risk. These may include but are not limited to:

- Establishing temporary shelters and housing for evacuated persons
- Flood barrier construction and sandbagging
- Establish transport diversion plan to keep motorists away from flood waters
- Establish effective communication networks (website, Facebook, Twitter)
- Regular rainfall, river, groundwater and soil moisture monitoring
- Enabling over pumping to maintain water and sewer services
- Work with utility companies to prioritise protection of key infrastructure

After the flood event, Croydon LLFA will work with its partners to ensure normality is restored and that people, services and businesses that were affected by the event are able to recover as soon as possible. Croydon LLFA will investigate the causes of the flooding, lessons learned and form a proposal for potential changes such as:

- Altering flood plans
- Improving riparian owners' awareness of responsibility
- Improving communication with public surrounding property level resilience
- Identifying ways to reduce future flood risk
- Increasing maintenance operations
- Communicating risks with other RMAs

Measures

Measure 1: Review effectiveness of emergency procedures and ensure our capabilities are known throughout the council and our commissioned services.

To achieve this, Croydon will review existing emergency procedures and identify actions to take forward as well as circulating the emergency procedures with relevant teams.

Measure 2: Regularly liaise with Network Rail, Thames Water and other infrastructure owners to discuss areas where their infrastructure falls in Croydon's flood hotspots.

Croydon will engage with Network Rail, TfL and Thames Water to find solutions to the problems identified in the action plan. Furthermore, Croydon will identify and collate other problem areas within the borough relating to Network Rail and Thames Water assets and invite their representatives to the internal flood group meetings for further discussions.

Measure 3: Engaging with the public and improving digital communication to encourage resident led initiatives and provide an efficient warning system.

Croydon will expand the information available on the council website and make it more accessible and user friendly. Residents and businesses will be encouraged to sign up to the Environment Agency warning service and advice will be provided on how they could implement flood alleviation initiatives privately or community wide.

Measure 4: Identify riparian owners and raise awareness of their responsibilities.

Croydon will engage with owners of properties near watercourses to ensure they understand their maintenance responsibilities. Riparian owner responsibilities will also be promoted at flood action group and resident association meetings. Regular inspections will be undertaken to ensure adequate maintenance of channels and trash screens has been carried out.

Measure 5: Develop flood plans that better coordinate preparing and responding to incidents.

Croydon LLFA will liaise with the Emergency Resilience Team to develop flood plans and undertake regular reviews to ensure they are fit for purpose. Regular drills will also be undertaken to test the effectiveness of the plans and necessary adjustments will be made.

Objective 5

Enable sustainable growth by taking account of social, economic, environmental and flood risk opportunities and challenges.

Signpost to Section 9 (4) requirements of The Act, this section deals with:

- (i) *how the strategy contributes to the achievement of wider environmental objectives.*

Sustainable growth is essential for the longevity and prosperity of the borough. This includes many elements such as new homes, jobs, infrastructure, education, and health. With an increasing population, there is a current need for over 41,580 new homes alone in Croydon by 2039 (Croydon, 2021). The 2021 Local Plan Strategic Policy 1.0D states that Croydon Council will support developments which can achieve sustainable growth while protecting and enhancing the borough's natural environment and built heritage. This strongly aligns with the [National Strategy](#) objectives of enabling sustainable growth in the right places, contributing to job creation, attract funding and providing resilient and sustainable infrastructure.

Since the previous strategy, Croydon LLFA adopted the Drainage Hierarchy as defined in the 2021 [London Plan](#). This has also been incorporated into the Croydon SFRA and [new developers guidance](#). A submission criteria document for developers submitting planning applications was finalised and published in 2019. This [Advice to Planning Applicants](#) document contains the requirements of the Drainage Strategy which should be submitted to support all major planning applications. Sustainable drainage systems are now required in all development and should meet the following requirements (Croydon, 2021):

- Ensure surface run-off is managed as close to the source as possible;
- Accord with the London Plan Sustainable Drainage Hierarchy;
- Achieve better than greenfield runoff rates;

- Be designed to be multifunctional and incorporate sustainable drainage into landscaping and public realm to provide opportunities to improve amenity and biodiversity;
- Achieve improvements in water quality through a sustainable drainage system management train; and
- Be designed with consideration of future maintenance.

The [Level 2 SFRA](#) provides an assessment of specific development sites and recommends measures involving SuDS to mitigate any identified flood risk in these sites.

Sustainability Assessment (SA)

The SA evaluates the impact that the Local Plan will have on wider sustainability objectives. SA is the process which identifies and evaluates social, environmental, and economic objectives for the area in order to fulfil the requirements prescribed by the Environmental Assessment of Plans and Programmes Regulations which transpose EU Strategic Environmental Assessment into national law. The SA was used during the preparation of this strategy to evaluate options for achieving the flood risk objectives against wider sustainability objectives.

The following topics included in the [2022 SA](#) have influenced this strategy:

- | | | |
|------------------------------------|-----------------------------|-----------------|
| -Air Quality | -Health | -Water |
| -Biodiversity | -Heritage | -Transport |
| -Climate Adaptation and Mitigation | -Housing | -Land and Soils |
| -Economy and employment | -Population and communities | - Landscape |

The SA shows that Croydon Council's Plan is expected to have a positive impact on the environment in both the short and long term as it actively reduces and manages flood risk within Croydon. The Strategy objectives support the objectives outlined in the SA both directly and indirectly as they aim to improve knowledge and understanding surrounding sustainable growth as well as focussing on the high-level management on local flood risk (Croydon, 2022).

Strategic Environmental Assessment (SEA)

The [SEA](#) is the process which identifies and evaluates social, environmental and economic objectives for the area in order to fulfil the requirements of the SEA (2001/42/EC) (SEA Directive). The SEA was used during the preparation of the Croydon 2015 strategy to evaluate options for achieving the flood risk objectives against wider sustainability objectives, and remains applicable for this strategy.

The sustainability objectives relevant to this strategy and determined by the SEA are listed below:

1. Protect and enhance human health and wellbeing
2. Raise awareness and understanding of local flooding and its dangers
3. Conserve and enhance biodiversity, wildlife corridors and habitats
4. Protect and enhance the water quality and hydromorphology of watercourses, WFD (Water Framework Directive) waterbodies and groundwater
5. Minimise the risk of flooding on existing and future key assets, infrastructure, homes and businesses

6. Manage and mitigate the future effects of climate change in new and existing development
7. Conserve and enhance the historic environment, heritage assets and their settings
8. Protect, conserve and enhance the quality, character and availability of open spaces and natural resources

The key findings of the SEA process are set out in the Environmental report for the previous Strategy. This outlines how the sustainability objectives and the identified measures are predicted to affect different environmental receptors. The SEA shows that Croydon Council's Strategy is expected to have a positive impact on the environment in both the short and long term as it actively reduces and manages flood risk within Croydon. The Strategy objectives successfully support the objectives outlined in the SEA both directly and indirectly as they aim to improve knowledge and understanding as well as focussing on the high-level management on local flood risk.

Measures

Measure 1: Establish the impact of planned growth on flooding hotspots/Critical Drainage Areas (CDA)

Croydon will update the existing or develop a new Surface Water Management Plan and review planning policies to establish the impact on planned growth. The LLFA will provide inputs to the planning application process to ensure that developments are steered away from areas identified as at high risk of flooding.

Measure 2: Identify how investments in flood resilience can minimise the local economic impacts of flooding, improve investor confidence and enable sustainable growth

A list of effective measures will be developed to identify alleviation methods in flooding hotspots and CDAs. This list will undergo a cost benefit analysis to produce a final list of alleviation methods which minimise the local economic impacts of flooding. A business case will be produced in order to raise the necessary funding.

Measure 3: Integrate long-term adaptive approaches into the spatial plans and growth strategies

To achieve this, Croydon will develop a list of long-term adaptive approaches whilst regularly reviewing spatial plans and growth strategies to ensure these approaches are included.

Measure 4: Delivering wider environmental objectives

Croydon will coordinate and monitor the actions included in objectives 1, 2 and 3 such as using Nature Based Solutions, identifying opportunities to achieve environmental net gain, and exploring options to reduce carbon footprint and environmental impact. This will ensure consistency and maximise the positive impact on the wider environment.

Objective 6

Be at the forefront of understanding current and future flood risk in Croydon, contributing to and applying UK research and innovation on better understanding and managing flood risk.

To remain resilient to the increasing flood risk exacerbated by the effects of climate change, we must push forward our research and innovation to create a better understanding of flood risk management. As an outcome of the previous strategy, resources have been used to improve SuDS awareness across the council and to roll out technical guidance based on this research. Ongoing training sessions also took place between 2016 and 2018 which was provided to council officers who also attended internal SuDS workshops.

This strategy aims to further develop our understanding of flood risk for the benefit of our residents, neighbouring boroughs and to help create a nation which are ready to respond and adapt to flooding change. With a developed understanding, Croydon can better support communities and businesses to be resilient and if affected by flood events, to get back on their feet swiftly. In line with the new [National Strategy](#), we want to take wider innovative actions that improve resilience to flooding such as those adopted by other local authorities throughout the UK.

Case study

In 2018, the London borough of Enfield funded a research project on evaluating the strategic long term financial benefit of retrofitting SuDS in London. The method used large-scale hydraulic modelling to provide evidence on the value of flood risk mitigation, therefore demonstrating the return-on investment across multiple beneficiaries such as residents and businesses. This project ultimately resulted in £750k of SuDS retrofit funding being secured, as well as demonstrating the feasibility of sustainable growth and innovation across London and the UK (Simon Ainley, 2018).

In 2017, Croydon LLFA conducted the Caterham Bourn Flood Alleviation Study which used computer modelling to develop flood alleviation options. They explored innovative ideas to integrate the groundwater model into the base model to maximise the accuracy of the results and a newsletter was produced to inform residents and businesses on the study's findings (Croydon, 2017). Initiatives such as these play a vital role in the effort to provide our residents and businesses with protection from flood risk whilst also protecting the environment.

Climate Change

Each year, climate change increases the likelihood of all types of flood risk. Our changing climate causes more intense and unpredictable weather patterns which put us at greater risk of flooding. The [UK Climate Projections 2018](#) predicts that by 2080, winter rainfall could increase by as much as 20%. This greater intensity of rainfall events increases the risks of all forms of flooding mentioned throughout this report as well as flash flooding (Met Office, 2018). This means there is a great need to discover and implement new sustainable solutions through research and innovation.

According to recent figures from the Environment Agency's [Climate Change Allowances Tool](#), Croydon LLFA should plan for an increase in peak rainfall amounts of 20% or greater and peak river flow increases of a minimum of 7% (Environment Agency, 2022).

Changes in climate can affect flood risk in many ways depending on the local conditions, topography and vulnerability. Increased rainfall will cause more surface runoff, therefore increasing localised flooding and erosion. As a result, there will be greater pressure on drainage and combined sewer systems.

Rising sea and river levels will increase flood risk due to the consequential increase in the water level of drains, sewers, and other connected watercourses. There is also an increased risk of groundwater flooding from limestone and chalk aquifers due to increased recharge during wetter winters.

Current emission rates means that climate change is inevitable to some degree. It is therefore essential that we plan ahead with the effects of climate change in mind. To adapt we must understand our current and future levels of vulnerability to flooding to ensure that resources are appropriately distributed. Regular updates, improvements and adherence to these plans is crucial to achieving long term sustainable flood resilience.

The [SFRA Good Practice Guide](#) provides information on how to ensure that developments are resilient to climate change whilst minimising the impact on its surroundings. To minimise flood risk, developments should be located in areas of low flood risk from all sources. Furthermore, the value of land which helps to manage flood risk should be respected, meaning, land, natural assets and infrastructure which contributes to flood risk management should be protected from development (Environment Agency, 2021). As outlined in [Local Plan](#) Policy DM25, developments that cannot be steered away from areas of high flood risk, developers must demonstrate the measures taken to mitigate the flood risk. The accompanying table in the [Local Plan](#) shows the various requirements to be completed for developments proposed in flood-risk areas (Croydon, 2021).

The National Planning Policy Framework states that developments should also support the transition to a low carbon future by reusing resources, converting existing buildings and encouraging renewables. Importantly, this guidance highlights the benefits of mixed-use developments, creating land for multiple uses such as recreation, habitat creation and carbon storage as well as flood risk mitigation. Section 10 of the NPPF states 'Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change, taking full account of flood risk, coastal change and water supply and demand' (Department for Levelling Up, Housing and Communities, 2021).

Measures

Measure 1: Upskilling and training for staff on new innovations surrounding flood risk management.

Croydon will identify training opportunities which promote innovation and ensure teams across the council are made aware. Teams will also be encouraged to share knowledge. Regular online research will be undertaken to identify new innovative ideas surrounding flood risk management.

Measure 2: Monitor future updates and guidance on flood risk about UK Climate Change projections, planning and development design and flood risk management good practice, communicate these across the Council's teams and ensure policies and practices take account of them.

Policies and practices will be regularly reviewed to ensure they are up to date and any updates will be discussed at the internal flood group meetings with a focus on innovation and sustainable growth. `

Objective 7

Collaborate with Risk Management Authorities in and around Croydon to jointly manage flood risk.

Signpost to Section 9 (4) requirements of The Act, this section deals with:

- a)) The risk management authorities in the authority's area and
- b) The flood and coastal erosion risk management functions that may be exercised by those authorities in relation to the area,

As mentioned in section 1.3, RMAs are responsible for cooperating and providing a coordinated operation to jointly manage flood risk. Appendix B shows the different RMAs operating within Croydon, their function, and their responsibilities.

RMAs are responsible for carrying the common themes featured throughout this report such as biodiversity gain and sustainable growth. [National Strategy](#) objective 1.4 states that RMAs will use nature-based solutions and improve the environment through their investments in flood resilience. Through collaboration, RMAs will work with catchment partnerships in adjacent boroughs to coordinate a catchment wide approach.

Working collaboratively helps to deliver practical and innovative solutions as well as improving resilience to floods and droughts. In addition, catchments can span over more councils and a catchment-based approach can promote a healthy blue green environment which benefits residents and wildlife.

Case study

Partnership Approach - Caterham Bourne Flood Alleviation Scheme – In April 2014, the Thames RFCC approved funding for a catchment wide investigation and flood alleviation scheme for the Caterham Bourne. The application was led by Croydon LLFA in partnership with Surrey County Council and Tandridge District Council. In September 2014, a consultant was procured to carry out the first stage catchment modelling and feasibility which will investigate surface water and groundwater mechanisms in the catchment. The catchment study informed the most appropriate forms of flood management in both Tandridge and Croydon for maximum benefit to local residents. Due to the complex nature of the Caterham Bourne and a requirement of the consultant to be innovative in its approach, the study had taken longer than anticipated but in March 2020, Stages 1 & 2 of the study were completed and options that could be taken forward to the Outline Business Case (OBC) are being considered in Stage 3. The study is programmed for completion in March 2023.

Croydon will further this collaborative approach by pursuing work with the London Drainage Engineers Group (LoDEG). LoDEG promote best practice across flood risk matters whilst nurturing effective working relationships between RMAs within the 33 London Councils.

Measures

Measure 1: Work with multi-agency partners to enhance local arrangements for flood planning and response.

Croydon LLFA will identify the RMAs in and around the borough and determine the roles and responsibilities of these RMAs. Collaborations will be pursued through LoDEG to develop ways of anticipating and managing flooding.

Measure 2: Continue to meet regularly and work with the other five South West London Boroughs.

To achieve this, Croydon will ensure any issues are resolved within the South-West London Partnership meetings. Opportunities for jointly addressing cross border flood management, technical knowledge sharing and jointly procuring services will be identified.

3 – Strategy Monitoring and Review

Signpost to Section 9 (4) requirements of The Act, this section deals with:

(h) how and when the strategy is to be reviewed,

The Act requires Croydon Council as the LLFA to specify how and when the Strategy will be reviewed. Croydon LLFA will monitor their progress against the action plan quarterly at the internal flood group meetings. The action plan is provided in Appendix C – Action Plan . This will include the Council team responsible for each action, funding allocation, priority, status and comments.

This Strategy provides a key tool to managing flood risk in Croydon over the next 5 years. The strategy is therefore due to be reviewed in 2028 as a minimum requirement under the Flood Risk Regulations 2009.

References

- [Caterham Bourne Flood Alleviation Study Update](#) (Croydon, 2017)
- [Caterham Bourne Flood Investigation](#) (Croydon Council, 2014)
- [Caterham Drive Flood Investigation Report](#) – 7th June 2016 (Croydon, 2017)
- [Croydon Climate Crisis Commission Report](#) (NEF, 2021)
- [Croydon Flood Investigation Report – 24th August 2015](#) (Croydon, 2016)
- [Flood risk assessments: climate change allowances](#) (Environment Agency, 2022)
- [Flood Risk Information V1.0 October 2020](#) (Croydon Resilience Team, 2020)
- [Level 1 Strategic Flood Risk Assessment](#) (Croydon, 2021)
- [Level 2 Strategic Flood Risk Assessment](#) (Croydon, 2021)
- [London Borough of Croydon Riparian Owner Leaflet](#) (Croydon, 2017)
- [London Borough of Croydon Flood Investigation Protocol](#) (Croydon, 2013)
- [Local Plan](#) (Croydon, 2021)
- [London Plan](#) (Greater London Authority, 2021)
- London Strategic SuDS Pilot Project (Simon Ainley, 2018)
- [Merstham Bourne Flood Investigation S19](#) (Croydon, 2015)
- [National Planning Policy Framework](#) (Department for Levelling Up, Housing and Communities, 2021)
- [National Flood and Coastal Erosion Risk Management Strategy](#) (Environment Agency, 2020)
- [Sustainability Appraisal](#) (Croydon, 2022)
- [Strategic Environmental Appraisal](#) (Croydon, 2014)
- [Strategic Flood Risk Assessments Good Practice Guide](#) (Environment Agency, 2021)
- [UK Climate Projections \(UKCP\) - Met Office](#) (Met Office, 2018)

Appendix A – Legislative Context

Flood and Water Management Act 2010 – received Royal Assent on 8th April 2010. It gives local authorities responsibilities as Lead Local Flood Authorities (LLFA):

Part 1 of the act requires all Lead Local Flood Authorities in England to:

- Develop, maintain, apply, and monitor the application of, a strategy for local flood risk from surface run off, groundwater and ordinary watercourses, in their area. The strategy must at least set out who the risk management authorities are in the area and their relevant functions, the authority's objectives for managing flood risk, as well as proposed measures to deliver the objectives, and timescales for implementation of the measures; how those measures are to be paid for as well as their costs and benefits, how and when the strategy will be reviewed, and how the strategy contributes to the achievement of wider environmental objectives. The Lead Local Flood Authority must consult affected risk management authorities and the public about its strategy and provide guidance on the application of the strategy.
- Investigate flooding incidents in its area and report on its findings.
- Establish and maintain a register of structures or features which may significantly affect flood risk in their area including information regarding ownership and state of repair.
- Contribute to sustainable development in the discharge of its flood risk duties.
- Assume the power to designate features with respect to flood risk and subsequently to act as responsible authority for such features.

Part 2 of the act gives local authorities new duties as “approving bodies” with regard to drainage including:

- Approving rainwater drainage systems before commencement of any construction works which have drainage implications
- Adopting and maintaining approved systems which affect more than one property
- Approval of surface water drainage systems prior to connection to public sewers. (Automatic right of connection to public sewers is removed by this Act).

Part 3 of the act provides legislative powers for:

- Consolidation of legislation relating to flood risk including Water Industry Act 1991, the Water Resources Act 1991, the Land Drainage Act 1991, the Reservoirs Act 1975, the Highways Act 1980 (so far as relevant to water), the Environment Act 1995 (so far as relevant to water), the Public Health Act 1936 (so far as relevant to water) and the Coast Protection Act 1949.
- Provision of funding by Parliament to pay for expenditure under the Act

As Lead Local Flood Authority, the City Corporation is responsible for preparing and implementing a Local Flood Risk Management Strategy for the City. The Requirements of the Flood and Water Management Act with respect to this Local Flood Risk Management Strategy are set out in Table 1.

Local flood risk management strategies: England

- (1) 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 (a "local flood risk management strategy").
- (2) In subsection (1) "local flood risk" means flood risk from—
 - (a) surface runoff,
 - (b) groundwater, and
 - (c) ordinary watercourses.
- (3) In subsection (2)(c) the reference to an ordinary watercourse includes a reference to a lake, pond or other area of water which flows into an ordinary watercourse.
- (4) The strategy must specify—
 - (a) the risk management authorities in the authority's 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 authority's flood risk management plan prepared in accordance with the Flood Risk Regulations 2009),
 - (d) the measures proposed to achieve those 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.
- (5) The strategy must be consistent with the national flood and coastal erosion risk management strategy for England under section 7.
- (6) A lead local flood authority must consult the following about its local flood risk management strategy—
 - (a) risk management authorities that may be affected by the strategy (including risk management authorities in Wales), and
 - (b) the public.
- (7) A lead local flood authority must publish a summary of its local flood risk management strategy (including guidance about the availability of relevant information).
- (8) A lead local flood authority may issue guidance about the application of the local flood risk management strategy in its area.
- (9) A lead local flood authority must have regard to any guidance issued by the Secretary of State about—
 - (a) the local flood risk management strategy, and
 - (b) guidance under subsection (8).

Figure 7: Requirements of the Flood and Water Management Act 2010 Section 9 Local flood risk management strategies: England

Appendix B – Responsibilities of RMAs and other organisations under The Act

Authority	Function	Responsibilities
Croydon Council	LLFA	<ul style="list-style-type: none"> • Strategic role in managing local flood risk sources (Surface water runoff, groundwater flooding and ordinary watercourses). • Maintain a register of flood defence structures and features which are likely to have significant effect on flood risk. • Investigate incidents of flooding and publish flood incident reports.
Croydon Council	Category 1 Responder	<ul style="list-style-type: none"> • Croydon Council is a Category 1 Responder under the Civil Contingencies Act 2004. • Responsible for ensuring that systems and processes are in place to provide emergency response to flooding. • The complex nature of flooding emergencies requires a widespread and prolonged response from multiple organisations; therefore, Croydon Council has created a Multi-Agency Flood Response Guidance document to allow all responding parties to collaborate on an effective coordinated response to severe flooding.
Croydon Council	Local Planning Authority	<ul style="list-style-type: none"> • Croydon Council has a responsibility to consider flood risk within strategic land use planning and the development of the Local Plan. • As the decision maker for flood risk for planning applications for development, Croydon Council must consider technical advice from other RMA's as consultees.
Croydon Council	Regulator of Ordinary Watercourses	<ul style="list-style-type: none"> • Under the Land Drainage Act 1991, any works (temporary or permanent) which may change or impact water within an ordinary watercourse will require consent from Croydon Council prior to any works being carried out. • Croydon Council have the power to notify riparian landowners along ordinary watercourses which require maintenance to reduce flooding and serve notice. • Croydon Council can serve notice on a person to rectify a nuisance related to an ordinary watercourse which is erected or altered without prior consent as required under Section 23 of the Land Drainage Act 1991.
Environment Agency	Strategic and operational role	<ul style="list-style-type: none"> • Provide strategic overview for managing all sources of flooding and coastal erosion. • Responsible for managing flood risk from main rivers and the sea.
Thames Water	Sewerage Undertaker	<ul style="list-style-type: none"> • Responsible for provision and maintenance of the sewer network to reduce the risk and impact of flooding and pollution.

		<ul style="list-style-type: none"> Responsible for the upgrade of sewer network to facilitate increased drainage capacity requirements. Responsible for surface water drainage from development via adopted sewers. <p>Since October 2011, water and sewerage companies are responsible for private sewers. These are sewers which were previously owned by the property owners. Despite this, not all private sewers were included. Further information regarding these exemptions may be found on the Thames Water website.</p>
Transport for London	Transport infrastructure provider	<ul style="list-style-type: none"> Duty to maintain its highways under the Highways Act 1980. This includes responsibility for drains, kerbs, road gullies, ditches and the pipe network which connects to the sewers.

In addition to RMAs, the local community and businesses have an important role in managing the local flood risk.

Authority	Function	Responsibilities
Residents	Property and riparian owners	<ul style="list-style-type: none"> Responsible for flood resistance and resilience associated with properties. Responsible for emergency and contingency planning associated with properties. Responsible for protecting their property from flooding. Riparian owners are responsible for maintaining flood defences on their property. Riparian owners are responsible for maintaining the flow of water in watercourses on their property. <p>Practical guidance for individuals to ensure their home is protected from flooding can be found on the Environment Agency website here (link).</p>
Businesses	Property owners	<ul style="list-style-type: none"> Responsible for ensuring that their activities do not lead to the obstruction of drains or watercourses. Responsible for ensuring waste is correctly stored and disposed of.
Infrastructure Providers	Developers	<ul style="list-style-type: none"> Responsible for considering how their assets and land may impact surrounding flood risk. Must work with Croydon Council to identify multiple benefits of works and maximise added value. Must prioritise sustainable drainage techniques and water conscious urban design.

Appendix C – Action Plan

Signpost to Section 9 (4) requirements of The Act, this section deals with:

(e) how and when the measures are expected to be implemented

Appendix D- List of Acronyms

AEP – Annual Exceedance Probability

CDA – Critical Drainage Areas

CIL – Community Infrastructure Levy

CRF – Community Resilience Forum

FCERM – Flood and Coastal Erosion Risk Management

GiA – Grant in Aid

LLFA – Lead Local Flood Authority

LFRMS – Local Flood Risk Management Strategy

LPA – Local Planning Authority

LoDEG – London Drainage Engineers Group

RoFSW – Risk of Flooding from Surface Water

RMA – Risk Management Authority

SA – Sustainability Assessment

SEA – Strategic Environmental Assessment

SES – Sutton and East Surrey

SuDS – Sustainable Urban Drainage System

SWMP – Surface Water Management Plan

TfL – Transport for London

WFD – Water Framework Directive

Appendix E – Croydon flood risk maps