LONDON
FLOOD REVIEW

Summary for policy-makers – Stage 4 Report

July 2022

Contents

Executive summary

This Stage 4 report is the final of four reports comprising the London Flood Review led by the Independent Expert Group, investigating the severe flooding which occurred across London in July 2021.

The purpose of Stage 4 is to summarise the findings of the Review and put forward recommendations so that the impacts of similar events may be reduced in the future.

The overall findings confirm that the sheer volume of rain that fell during the two storms was the main cause of flooding. During the events, significant areas received rainfall of over 50mm, with the most affected place seeing more than 90mm. The volume of rain that fell in each event was around twice the monthly average rainfall and greater than any existing sewer systems are designed for.

Managing sewer flood risk is Thames Water's responsibility, while surface water flood risk is managed by the Lead Local Flood Authority (LLFA). The storms caused both sewer flooding and surface water flooding, which means the responsibility for managing flood preparation and responses for the July 2021 events was shared.

For example, in Kensington and Chelsea, the sewer system was surcharged because it was not designed to cope with the flow, as the event exceeded what the sewer system is designed for. The sewer system capacity was exceeded and, as a result, manhole covers were lifted and flood water was expelled onto the street, adding to surface water flooding. Conversely, in Waltham Forest, the gully capacity was such that flows could not get into the sewer system. As a result, the area experienced extensive surface water flooding, while the below-ground network apparently still had capacity in some locations.

The varied types of flooding – surface only, sewer flooding only and combined sewer and surface flooding – and the extreme nature of the events mean that it is not possible to identify a single solution that could have prevented the flooding or a single organisation that is responsible for the flooding.

There were other factors which played a part in worsening the impacts of flooding in some locations but, had these not been present, significant flooding would still have occurred. Both rainfall events exceeded the current design capacity of the below-ground system. Even if the system had been built to a 1-in-30 year design standard the system would have been significantly overwhelmed. However, we also found that, even with capacity apparently available in the sewer systems in some areas, flows were held up on the surface by the gullies. These did not have the capacity to deal with the flow rates in some locations, regardless of whether they were blocked or free flowing.

Such events are likely to occur more frequently in the future and the various organisations which manage flood risk will need to work collaboratively to ensure that the impacts of flooding are managed appropriately. It will not be economical or realistic to contain all flows in every event. Even if all the recommendations in this report are taken forward by the risk management authorities, there is still potential

for large-scale flooding to occur. It will be how we manage the impact in future that will make the most difference.

Our recommendations include:

- Establishing a body with a strategic view and governance, with representation from all parties with responsibility for flood management, so that surface water and sewer systems can be assessed in combination, and investments designed to optimise outcomes across different organisational boundaries
- Sharing data across multiple organisations relating to flood risk management assets (such as pumping stations and storage tanks), including high-risk areas and vulnerable customers, including across Boroughs where flood risk may originate from other areas.
- Improving forecasting and monitoring of the development of extreme events
- Improving preparedness for emergencies and enabling cross-organisational collaboration at short notice, including establishing roles and responsibilities in advance so this is clear ahead of any emergency. Existing actions taken under the London Resilience Framework may be drawn on to achieve this
- Using data and digital tools to more rapidly assess sewer network performance and prioritise responses in extreme events
- Protecting those at highest risk of flooding by installing anti-flood devices such as non-return valves, FLIPs or flood gates depending on the flood mechanisms
- Supporting homeowners and tenants to understand how they can best protect their homes from flooding, including opportunities to build in resilience
- Influencing planning policy and collaborating with developers to reduce flood risk to others from new developments and basement renovations
- Encouraging asset owners to fully understand, develop and maintain their assets so they perform at their optimum level during high intensity events
- Understanding how the combined above and below ground systems operates when flow capacity of the sewers is exceeded, who will be affected and how the landscape can be altered to allow safe passage of flood waters to areas away from properties
- Adopting a suite of flood risk measures, including a combination of green (i.e. Sustainable Drainage Systems (SuDS) Figures 1.1 and 1.2 below) and grey engineering (i.e. traditional) solutions which can be installed in alignment with the planning policy to provide an agreed level of service across all organisations

Figure 1.1: SuDS features installed as part of CCFAS

Source: Mott MacDonald

Figure 1.2: Example of a rain garden

Source: Montgomery County Department of Environmental Protection

- Understanding risk at the hydrological catchment level, rather than being constrained by the boundaries of LLFAs, including the modelling and assessment of flood risk

We recognise that there are limitations with what may be achieved with the current funding and resources available. Flooding is not any one organisation's responsibility: parties must work together to identify solutions and potential funding to manage multiple sources of flooding. Promoted schemes will be assessed on the benefits they provide to customers and on the costs required to build and operate the asset. Consideration should be given to how other assets may be affected, especially across different organisations.

1 Introduction

1.1 What happened on 12 and 25 July 2021?

In July 2021, extreme rainfall caused severe flash-flooding across London and the South East. These storms were typical of convective storms and caused major disruption to the road and railway networks, damaged properties and businesses, and badly affected residents and their livelihoods.

On 12 July, a significant amount of rainfall fell over West London during a period of just over two hours. On 25 July, a similar event occurred, but this time the rain fell over a larger part of London and Essex and lasted for around four hours. Both events occurred at or around high tide and resulted in more than 1500 properties reporting flooding.

1.2 The Independent Expert Group

Thames Water (TW) commissioned an Independent Expert Group (IEG) to undertake the London Flood Review to investigate reports of extensive flooding in London in July 2021. TW appointed Mott MacDonald (MM), with approval of the IEG, to support the IEG in its role. To ensure independence, MM is under direction from the IEG and not TW. More information about the IEG, including its membership, can be found on the London Flood Review website.

1.3 Engagement with stakeholders

The IEG created a Strategic Stakeholder Panel (SSP) to consult on the Review objectives, provide input, guidance and feedback, and help deliver its recommendations where appropriate. The SSP comprised:

- Greater London Authority
- London Councils
- London Drainage Engineers' Group
- Environment Agency
- Thames Regional Flood & Coastal Committee
- Consumer Council for Water
- Thames Water
- Transport for London
- Ofwat (observer)

Although the Review was independent, Thames Water also worked as part of the SSP to provide necessary information and progress updates but exercised no direction over the Review.

The Review also sought information and views from a wider stakeholder group including:

- Affected residents

- Lead Local Flood Authorities
- Local politicians
- Community groups

1.4 Aims of the Review

The London Flood Review consisted of four key stages, investigating the flooding that occurred and the performance of assets within the catchment:

- Stage 1 - Investigation of reported flooding on 12 and 25 July 2021
- Stage 2 - Investigation into the catchment response and root causes that led to flooding on 12 and 25 July 2021
- Stage 3 - Assessment of the performance of TW assets, including flood alleviation schemes, critical pumping stations and operational performance of the network on 12 and 25 July 2021
- Stage 4 - Recommendations to improve resilience to future flooding events

The aim of the Review was to identify improvements to current ways of working with the full stakeholder group to minimise the impact of flooding and to optimise performance of assets for similar events in the future.

The full Stage 4 report includes a summary of the findings of the Review so far plus recommendations that may be taken forward by TW, the SSP and other organisations. It considers a wide range of options related to data management, cross-party working, design of flooding schemes, rainfall forecasting and monitoring, modelling (surface and sub-surface), and planning policy. We acknowledge that some recommendations are already underway, following outcomes from existing workstreams.

1.5 Timeline of the Review

For the Review to be timely and relevant, it was concluded within a seven-month period from November 2021 to June 2022. This included gathering information, carrying out analysis, drawing conclusions and making recommendations. Due to the short timescale, the Review required formal stages to allow for a single progression through the process without revisiting previous stages or reworking.

While one report was being reviewed, much of our analysis for the next report was already concluded and we were writing the report for the next stage. This meant that some data received by the Review team through engagement may only have been identified once the analysis was complete.

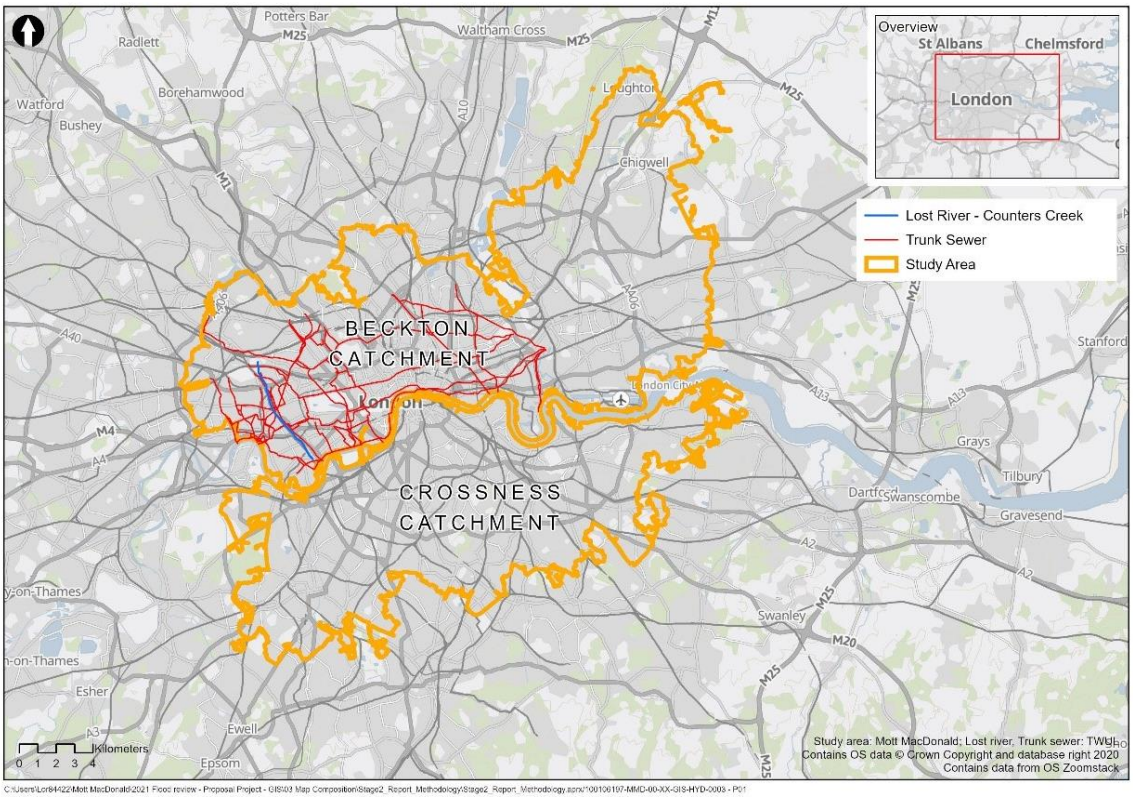
We initially sent out an appeal for data from a wide range of stakeholders. We also received feedback from residents and other affected parties via the London Flood Review website inbox throughout the Review process. As we only had seven months to complete the Review, it was difficult to incorporate all data received following Stage 1. We gave a cut-off date of January 2022 for receiving information, and our analysis includes all data received by that date.

Another challenge we faced was obtaining relevant data during Stage 1, such as hydraulic models held by the local authorities. The local authorities were not always able to provide the data and suggested contacting the original consultant for the

models. However, in some instances it was not possible to receive these models from the consultant within the timescale required for the Review.

We focused our study area on the Beckton and Crossness drainage catchments, which cover Central London where most flooding was reported (see Figure 1.1). Thames Water provided the network models which represent the sewer system for these catchments to inform our analysis. However, we appreciate that flooding also occurred outside of these catchments. Many of the themes and recommendations of the Review are applicable at a wider scale for other catchments in London and the South East, and for most urban cityscapes.

Figure 1.1: Beckton and Crossness catchment areas



1.6 Purpose of this document

This document provides a summary of the Stage 4 report and outlines the key findings and recommendations in a shorter, easier to navigate format. We have also produced a Non-Technical Summary for the general public, which explains the Stage 4 findings and recommendations in lay terms.

2 Conclusions and findings of the Review

2.1 Return periods

We analysed the return periods for both storm events using radar rainfall data. It is not possible to give a single return period for the events in July, due to the different durations and areas over which the rain fell. The flood event return period will also have been affected by the occurrence of high tide at or around the peak of both events.

However, for the 12 July 2021 event, we can say that 69km^2 of the catchment exceeded the 1-in-30 year event; and for the 25 July 2021 event, 123km^2 exceeded the 1-in-30 year event. At its peak intensity, the 12 July event exceeded a 1-in-200 year return period across 9km^2 of London and the 25 July event was above 1-in-100 year return period across 9km^2 of London.

New sewer systems are designed such that all flows are contained within the sewer (no flooding at ground level) up to a 1-in-30 year return period. Typically, Thames Water (TW) uses a 1-in-30 year return period design standard for new flood protection schemes. Older, or legacy, sewer systems do not have the same requirements. While the Victorian sewer system for London had ample capacity at the time of its construction, the evolution of the cityscape has had an effect on the ability of the sewerage system to cope with the current flows which drain to it, which has resulted in some areas now not being able to cope with a 1-in-5 year event. When considering other countries, this design standard is considered to be high: in Denmark a 1-in-10 year standard of protection for sewer flooding is stipulated.

For an explanation of return periods, please see the Stage 3 FAQ section of the London Flood Review website.

2.2 Communication and response to flooding

Our analysis of communication on the days suggests that, while TW has procedures in place to deal with severe weather events, these were not fully effective during the 12 and 25 July events. This in part, resulted from the under-predicted weather warning from the Met Office, which affected TW's preparedness for the events and its subsequent ability to communicate adequately with its customers. Our analysis also highlights the lack of really effective communication between key stakeholders across London before, during and after the events, and the lack of high-level, cross-agency strategic planning to manage the impacts of flooding.

The analysis of communications that happened on the days of the flooding events highlights where lessons were learned, particularly following the 12 July event, and examples of good practice that can be built on. TW has already put new procedures in place since July 2021 which are expected to improve planning and response during and after events and these are outlined in the Stage 4 report.

The London Resilience Group has also established a 'Strategic Flood Response Framework' which identifies certain triggers, actions and responsibilities during a flooding event across multiple organisations. We acknowledge that the production of this preparation and response to flooding is a significant improvement.

2.3 Root causes of flooding

We used the InfoWorks ICM model to determine the flooding mechanisms in each London Borough covered by the model, acknowledging some data gaps and data unreliability in some areas. We agreed to address these gaps by setting up several sensitivity scenarios to determine how the model predictions changed depending on the variable being assessed. It should be noted that the catchment models were built several years ago and have been updated and refined as further information on catchment performance was made available. The model is reviewed following a significant event to compare how it performs against monitored data, which means we had reasonable confidence in the model outputs at a strategic, whole system, level.

The aim of the sensitivity analysis was to determine which variables had the most significant impact on the sewer system levels, by varying parameters in the data provided as part of Stage 1.

The variables considered included:

- The amount of rainfall that was able to enter the sewer network – to consider the split of flows that may be retained on the surface or enter the below-ground network
- Rainfall trajectory shifts – to consider how significant the location of the centre of the storm was
- Dry weather flow peak timing – to consider if the storm occurred when the normal foul sewage flow was at its peak and if so, did this exacerbate the effects of the storm
- Thames Barrier closure – to consider if a closure of the Thames Barrier would have mitigated the flooding to any extent
- Impact of tidal levels on flood risk – to consider the effect of the high tide coinciding with the flood peak

For each variable, a scenario was set up in the model. Each scenario was compared against the baseline model results to determine the differences in sewer top water levels, predicted flooding volumes and observed depth monitor data. We concluded that the variables which most affected the extents of flooding related to the rainfall trajectory and the variation in tide levels. Other variables had smaller and more localised impacts.

We used the data from the sensitivity tests, plus a range of other data, to produce a root cause analysis for each London Borough we studied. If a Borough is missing it is either because the extents of flooding overlapped with another Borough with the same flooding mechanism, and are, therefore, covered by the same hotspot, or it was outside of the current study area covered by the Beckton and Crossness catchment models.

Our conclusions were:

- **City of London** – sewer overload, surface water flooding, high tide
- **City of Westminster** – sewer overload, surface water flooding, high tide
- **London Borough of Camden** – sewer overload, surface water flooding,
- **London Borough of Greenwich** – surface water flooding
- **London Borough of Hackney** – sewer overload

- **London Borough of Hammersmith & Fulham** – sewer overload, surface water flooding, high tide and slightly impacted by pump operations
- **London Borough of Haringey** – sewer overload, surface water flooding
- **London Borough of Islington** – sewer overload, high tide
- **Royal Borough of Kensington & Chelsea** – sewer overload, surface water flooding, high tide and impacted by pump operations
- **London Borough of Lambeth** – sewer overload, surface water flooding, high tide
- **London Borough of Lewisham** – sewer overload, surface water flooding
- **London Borough of Newham** – sewer overload
- **London Borough of Redbridge** – sewer overload, surface water flooding, high tide
- **London Borough of Southwark** – sewer overload, surface water flooding, high tide
- **London Borough of Waltham Forest** – surface water flooding

2.4 Operational performance

Some of the scenarios we tested related to the operation of TW's network. These included:

- Hammersmith Pumping Station operation – to consider if the pumping station was operated in accordance with its rules
- Lots Road Pumping Station operation – to consider if the pumping station was operated in accordance with its rules
- Impact of blockages in sewer system on pipe capacity – to consider if the presence of blockages affected flooding
- Unaccounted-for base flow in the sewers – to consider if the groundwater or other infiltration affected flooding

The results of the analysis confirmed that the system was not sensitive to these factors, while recognising that any amount of increased water level can result in flooding that has significant impact on people's well-being and livelihoods. The overall extent of flooding in the event would have been similar without these influences. The full analysis can be found in our Stage 2 report.

2.5 Scheme performance

We analysed four TW sewer improvement schemes using the 1D hydraulic model to see whether they performed as designed during the July 2021 events. An explanation of the modelling we used in the Review can be found in the Background Information section of the London Flood Review website.

The findings of the analysis are described below:

- Westbourne Grove Flood Alleviation Scheme (FAS): The scheme operated as designed, by diverting flows into a storage tank. Levels in the main sewer were reduced by 400mm, reducing flood risk in the area. Four properties which had been designed to be protected through the scheme experienced flooding in July, potentially due to FLIP failure or inundation from surface water flooding. Further investigations are being carried out by TW.
- Maida Vale FAS: the scheme covers three distinct areas:

  - The Tamplin Mews scheme performed as designed. Properties that did flood may not have been disconnected from the trunk sewer, as they had not previously reported flooding.
  - The Formosa Street/Westbourne Green scheme performed as designed. The principle of the scheme is to divert flows away from locations which previously reported flooding. As a result, water levels are increased in other areas as a result of changes to flow routes. Some properties which newly reported flooding in July are likely to drain to sewers where the top water level has increased as a result of the scheme. We recommend that TW investigate these areas of potential detriment further to determine potential solutions.
  - Cambridge Gardens performed as designed.
- London Tideway Tunnels (LTT): not yet completed. Hypothetical analysis suggested that, in both events, there would have been a minor improvement in reducing levels near to interceptions. Therefore, the tunnel will not lead to a significant reduction in flood risk for similar storms once connected under current operating protocols.
- Counters Creek Flood Alleviation Scheme (CCFAS) (as constructed): Performed as designed. 21 properties with FLIPs did report flooding: it is not known if this is related to a failure of the FLIP or by inundation from surface water. There were an additional 444 properties which reported flooding for the first time which were not addressed through the scheme.

In addition, we reviewed the Counters Creek tunnel (a previous design that was rejected in favour of FLIPs) to determine the level of benefit it may have provided during such an event. Our analysis of this hypothetical situation identified that 31 of the 64 properties which reported flooding in the area may have benefited from the tunnel. A cost-benefit analysis of the tunnel scheme has not been undertaken as part of this Review.

3 Recommendations

We identified a number of local solutions that can be implemented by Thames Water (TW) in the short-term within each London Borough, as well as several longer-term strategic recommendations which will involve all parties with wider flood management responsibilities. Traditionally, strategic solutions developed by TW have been large below-ground infrastructure, but this approach needs to change due to the scale of the flooding now experienced as a result of climate change.

The future of strategic options will be more around the management of land and the landscaping of our cities. This will require collaboration across all organisational bodies responsible for flooding, and also the wider network of organisations responsible for planning and developing London and other cities. All designers need to consider the risks from these types of events and maximise any opportunity to deliver resilience. This change in approach will require changes in roles, policy, design specification, and the education of the civil engineering profession on these issues.

Our recommendations are grouped into five key themes, which are broadly aligned with the findings of the Surface Water Task and Finish Group (SWTFG), which was established by the Mayor of London following the flooding event in July 2021.

Our key recommendations are outlined below. The background, context and rationale for each recommendation can be found in the full Stage 4 report.

3.1 Governance

SWTFG finding: No single organisation is in overall charge of managing surface and sub-surface water flood risk in London. Furthermore, there is a lack of understanding of the overlaps and interactions between the differing responsibilities among a wide range of organisations.

Our recommendations:

3.1.1 Roles and responsibilities for flood risk management

1. TW to work with other agencies to develop a multi-agency strategy to respond to flooding. Engage with other organisations to identify clear roles and responsibilities during the event.
2. Set up an organisational body to develop strategic plans for management of surface water over Greater London. Report annually on progress against these plans.

3.1.2 Planning and development

3. Review the planning process to consider adding water companies as statutory consultees in the planning process, to provide comments related to sewer flooding risk and network availability.

3.2 Funding

SWTFG finding: There is insufficient funding mobilised to manage the risk. There is a lack of knowledge about potential funding opportunities and a lack of understanding of what is needed to develop and submit proposals to secure the needed funds.

Our recommendations:

3.2.1 Funding for flood risk schemes and sustainable drainage systems

4. Review the process of applying for and securing funding for flood risk schemes.
5. Seek opportunities for partnerships working in areas of known flood risk to spread the cost of potential schemes, including consideration of source control as well as schemes which protect receptors. Identify blockers which prevent effective schemes being taken forward and lobby for additional resources to be made available to achieve funding.
6. Ring-fence funding to Lead Local Flood Authorities (LLFAs) for flood risk duties. Lobby for additional funds to be made available so that the full remit of duties can be met.

3.2.2 Incident response

7. Enable the Strategic Surface Water Management Group to manage and coordinate response to flooding, including deployment of clean-up crews to areas of greatest need.

3.2.3 Insurance

8. Work with those who flooded to support their access to the FloodRe reinsurance scheme, the Build Back Better fund, and feedback any necessary improvements to the scheme. Consider lobbying for further investment into FloodRe scheme to include cover for houses of multiple occupancy and commercial properties to ensure they have access to insurance.

3.3 Evidence

SWTFG finding: There is a lack of understanding of what flood assets are currently available, who owns and maintains them, and what condition they are in. In addition, there is also a lack of modelling that can help organisations understand where floods are likely to occur and what efforts should be undertaken to reduce the risk.

Our recommendations:

3.3.1 Monitoring and forecasting

9. Investigate timescales and suitable application for multi-agency response to improve forecasting. Use forecasting to identify event risk zones and consider use of ICMLive models to develop computer learning models as a predictive tool to identify impact and operational response during an event.

3.3.2 Modelling

10. Develop existing modelling specifications, or create new ones, which provide clear guidance on the use of rainfall, boundary conditions and complex flow

mechanisms. Ensure that a common model environment is used so that shared risks between LLFAs and TW are well understood.

3.3.3 Asset performance

11. Review critical assets and identify ways of monitoring data and information, such as data sharing platforms, during an event to inform decision-making and prioritisation. This may draw on data from all organisations as well as freely available data. Consider whether a digital twin is of benefit to replicate the system and understand the impact of various operations on system performance.
12. Assess impact of gully cleaning to determine the gullies which should be cleaned most frequently. This may not be the gullies where flows pond but may be further upstream to allow for flows to get into the system and be conveyed away from risk zones. The impact on other infrastructure should be considered.

3.3.4 Reporting and forming evidence bases for future investment

13. Review current data collection processes across all stakeholders and identify improvements. Establish a suitable data platform to host flooding history data and manage appropriately. Appoint a data manager to be responsible for data and how it is shared.

3.4 Communications

SWTFG finding: There is a lack of understanding of the risks of surface water flooding and the responsibilities of the various stakeholders to lower such risks.

Our recommendations:

3.4.1 Preparing for events

14. Set trigger points, likely to be aligned with the multi-agency flood plan and London Resilience Group's triggers, to mobilise operational and TW Customer Contact Centre staff and engage with key stakeholders to prewarn of a potential event.
15. Ensure that the current response plan includes alerting customers who have either signed up to be notified of risks in their area, previously experienced flooding, or are on the priority services register, that there is a potential risk of extreme weather in advance of the event so that they may prepare.
16. Carry out exercises to practice new flood response and communications plans to improve preparedness and cooperation across multiple organisations

3.4.2 Responding during events

17. Implement process for updates to website messaging and key lines of communication to be shared across all key stakeholders as an event unfolds.

3.4.3 Post-event response and clean-up

18. Create and disseminate an 'emergency communications group messaging' briefing document to staff and stakeholders. Update regularly during and after

flooding events to enable clear and consistent messaging across the various stakeholders.

3.4.4 Coordinating and sharing information across organisational bodies

19. Establish a data sharing agreement between TW and other relevant stakeholders which sets out what and how data is shared. Enable LLFAs quick access to data.

3.4.5 Coordinating and sharing information for customers

20. Create cross-organisation educational campaign regarding flood risk to help residents and businesses to understand their risk and steps that they can take to reduce that risk and gain insurance.
21. TW to share policy on procedure for assessing FLIP installation with stakeholders for clarity and openness.
22. Understand where customers implement their own measures. This data will help RMAs to understand the cumulative impact of these measures on flood risk. Create digital form for consultation process so that TW is informed.

3.5 Strategic plan

SWTFG finding: The absence of an overall strategic plan and vision, as well as a body tasked with its development and implementation, underpins all of these issues.

Our recommendations:

3.5.1 Asset resilience

23. Set out clear terms of reference of what flood risk resilience schemes are aiming to achieve, in terms of acceptable levels of risk, desired standard of protection and design requirements, in conjunction with Recommendation 11. Agree across the RMAs. Understanding the flood risk mechanisms in play will result in a scheme which delivers the maximum benefit potential to all stakeholders.
24. Strategic Surface Water Management Group to assess criticality of strategic assets and assign required standard of protection. Review measures in place to ensure continuity of performance during flooding events. Review current Flood Asset Register compiled by LoDEG and make recommendations to improve consistency and understanding of assets. Assess assets which are critical for flood risk management and the implications on other assets where they may fail. Communicate findings to all stakeholders.

3.5.2 Re-greening London

25. Consider incentivisation of Nature Based Solutions to form part of the flood risk management infrastructure to improve the 'grey to green' water and reduce runoff into the drainage network to encourage widespread promotion and uptake of installation.

3.5.3 Planning policy

26. Identify the significant flow paths in the city, which often follow the path of the lost rivers. These should be formally designated as protected overland flow

routes. Formalisation of these routes may involve minor but wholesale amendments to kerb lines, low point attenuation areas (i.e. blue corridors and informal detention basins) to make these routes safe for conveying flood waters. Additional policy should be written preventing changes within these designated routes without a full assessment and understanding of how these changes may affect their function.

27. Local authorities to consider implementing more stringent development policies so that greenfield runoff rates must be achieved. This should also be followed up to encourage developers to implement realistic and functional solutions.
28. Local planning authorities to amend their planning policies where there is a known risk of sewer flooding to incorporate any basement development or construction work. This will increase the workload of the planning authorities, so it is recommended that funding is increased to meet this change in demand.

3.6 Links to other reports

- The Stage 4 report should be read alongside other reports relating to flood risk management. We have reviewed these against our own findings and referred to them when making our recommendations.
- The London Resilience Forum: London Strategic Flood Response Framework
- The Surface Water Task and Finish Group: Surface Water Flood Risk Management in London | London Councils
- Thames Water: Internal Review into the 12 and 25 July storms in London

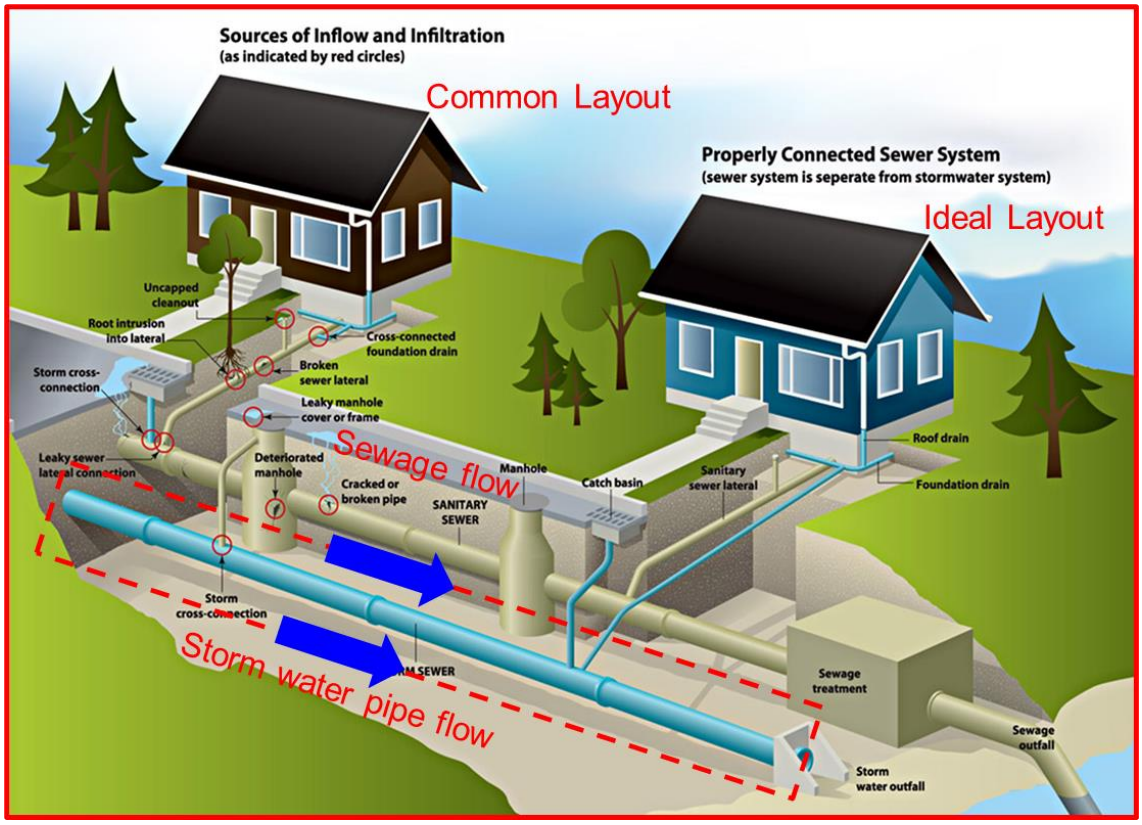
3.7 Discounted options

Throughout the study, our engagement with stakeholders has generated numerous suggestions for possible changes that TW and other bodies could make, which we investigated but rejected as recommendations. The Stage 4 report outlines these discounted options, including reasons why they were discounted.

Discounted options:

- **Upsizing all the pipes in London** – potential to move stormwater to areas of higher risk by increasing capacity; pressure on existing assets (e.g. pumping stations); overall cost and impact on water bills.
- **Separating out the wastewater and stormwater flow systems** – extremely difficult to separate stormwater from an existing combined system as connections will need to be relocated; new sewer systems or surface water conveyance systems will need to be constructed in already constrained space, see Figure 3.1.

Figure 3.1: Example of a combined and separate sewer system



- **Bigger pumps** – upsizing pumps was considered but water would not be able to get to the pumping station without increasing the pipe sizes upstream. There are also space constraints and many of these pumps transfer flows to another part of the network which is not sized to receive the additional flows, and this could make flooding worse for properties downstream.
- **Large formal storage areas** – London is very constrained for space, both above and below-ground, so to store that amount of water would not be practical.
- **Sustainable Drainage Systems (SuDS)** – it is unlikely that SuDS as the sole solution to this type of flooding is practical. Many of the challenges are similar to the challenges of large storage areas – the volume of water for these extreme events is so vast it is not possible to accommodate the flood water through storage and infiltration of SuDS.
- **Urban deculverting (opening up river systems that are currently within pipes to form open channels)** – the lost river watercourses have been so integrated into the sewer network over time that the water is not clean so there would be a hygiene concern if they were open channels. There are so many connections and cross connections in the system it would be a hugely difficult and costly process to separate these systems from the rest of the sewer network to allow for them to be opened up.
- **Using the Thames Barrier** – even if a sufficient warning system could be established, it is unlikely to have the required lead time for the barrier to be mobilised. If it could be closed in time, the Thames Barrier would be used more frequently, which would affect its performance and lifespan. It would also require a

change in legislation at UK government level to enable the Thames Barrier to be used to reduce the impact of tide-locking on sewer outfalls.

- **Pre-emptive gully cleaning** – requires significant advance warning to allow anyone to mobilise teams to clean critical gullies ahead of the events.

4 Next steps

It seems imperative in the face of the current and future risks of flooding that the approach taken across London is consistent and, therefore, a cross-London approach is recommended. This Review provides a first step in identifying possible actions to improve the resilience to this type of extreme event in the future. Many of the actions fall under the responsibility of multiple agencies so the implementation of these recommendations may not be straightforward.

4.1 Dissemination

The Independent Expert Group (IEG) will be focussing, over the next few months, on engaging with wider stakeholders and the general public regarding the findings of the report. The stakeholders consist of two key groups:

- Political stakeholders, such as Members of Parliament, Councillors of London Boroughs and Secretaries of State and their advisors
- Technical bodies, such as the Institution of Civil Engineers (ICE), the Chartered Institution of Water and Environmental Management (CIWEM), and technical bodies advising government such as the National Infrastructure Commission (NIC) and the London Council's Transport and Environment Committee. The London Drainage Engineers' Group (LoDEG) and flooding officers within the Lead Local Flood Authorities (LLFAs) may also be considered to fall within this group as they have a technical interest in the findings of the Review.

We will prepare and distribute briefing packs for these groups to inform discussion around the key recommendations. We encourage debate and engagement among practitioners and the general public as to how these recommendations may be achieved.

We have received much communication from the wider public as part of the Review process. This indicates that there is a lot of interest in our findings. Members of the IEG are willing to attend town hall discussions to share the findings and recommendations of the Review, however, this may be limited due to timescales and availability. We encourage council members and MPs to reach out to the IEG via the website.

4.2 Implementation

The purpose of the Review is to identify and propose recommendations. However, our report has no regulatory force, and we cannot make or require the changes we recommend, so the process for implementing any recommendations will evolve over a period of time. Through this process, various stakeholders, along with the newly formed Strategic Surface Water Management Group, the Environment Agency, Regional Flood and Coastal Committee, NIC, and others, will need to confront many of the high-level governance and associated funding issues which we have discussed in Sections 4.1 and 4.2.

The recently formed Strategic Surface Water Management Group is likely to be the best group to formulate or at least monitor the implementation plan, where there are

strategic recommendations which need collaboration across multiple organisations. Individual organisations should reflect on what they could implement and develop their own action plans. For transparency, we recommend that each member of the Strategic Stakeholder Panel shows what steps they will take and which recommendations they will take forward. We recognise that the recommendations are quite strategic and will likely be turned into implementation plans. These will cover the steps required to achieve the recommendation, identify responsibilities and drive SMART actions to encourage those progressing these recommendations to be accountable.

It is likely that some recommendations will not be achievable in the short-term due to the need for funding or legislative changes. Bold changes should be considered, such as forming a single organisation responsible for surface water flooding management. For these recommendations, a roadmap should be identified to outline the steps that must be taken to ensure progress is still made towards these longer-term goals. By identifying the desired approach, structure and funding mechanisms, it will be possible to influence new and changing legislation, taking a more proactive approach in future.

In addition to the recommendations outlined in this Review, there will also be progress by TW and the LLFAs to develop further flood schemes to address the areas thought to be at greatest risk, which can only be achieved by working together collaboratively. TW is currently developing a plan for implementing further FLIPs and considering local schemes in a response to this Review. The next steps to this progress will include an update to the information on actual flooding during the July events, allowing for information missing from this Review to be incorporated prior to any decision being made on where new schemes are to be prioritised.

4.3 Yearly reviews

The Strategic Surface Water Management Group will be best placed to carry out an annual review of the progress towards actioning the recommendations and provide a brief report on progress that should be made publicly available. Some recommendations may be considered quick wins and, therefore, will be easy to demonstrate that they have been achieved. Others will experience difficulties due to the complexity of the current organisational structure and step changes will be required to enable recommendations to be taken forward. The report will include progress on these interim steps. If blockers are identified, the Strategic Surface Water Management Group should be enabled to challenge these blockers and seek ways to drive forward the necessary changes.