



Counters Creek
Technical Appendix
Information



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Section 1

Introduction

- 1.1 This is a technical appendix which provides supplementary information to the main Counters Creek Understanding of Flood Risk and Long-Term Strategy report. Table 1 shows the clauses in the performance commitment which the supporting evidence relates to.

Table 1: Relevant clauses of the performance commitment

Requirement	Appendix section
A general improvement in the depth, scale and quality of information available to the company, making use of information from both its own datasets as well as from third party stakeholders and organisations.	2
A sufficient level of understanding in regard to the interaction of the company's drainage assets with Lead Local Flooding Authority (LLFA) and third-party assets, where relevant, in relation to flood prevention in the Counters Creek catchment.	3
It is expected that company will pursue a co-operative approach working with and sharing knowledge with stakeholders as required by Section 13 of the Flood and Water Management Act 2010	2 and 3



Section 2

Improvements in information available to us

A Range of data collected

- 2.1 Over the last three years, we have significantly improved the depth, scale and quality of information available for the Counters Creek area. During the London Flood Review we worked with external stakeholders to identify and collate an additional 28 types of data relevant to the Counters Creek area, 13 of which were from third parties. This is in addition to the data collected which is mentioned in other technical appendices.
- 2.2 A full report of the data improvement, including an assessment of the completeness and credibility of the data, can be found in the London Flooding Review Stage 1 Report – Data and Discovery and Initial Analysis Report. Although this report refers to flooding that occurred on 12 and 25 July 2021 the data sources can be used to assess the risk of flooding on any date.
- 2.3 A summary of data and how it is used to assess risk or in our long-term strategy is included in Table 2.



Table 2: Summary of data

Source	Description	Originator	How data is used to assess risk
Met Office Storm Analysis Reports	<p>Rainfall reports per location and date includes daily and hourly rain gauge data and radar (hourly and 5-minute) data. Information is limited and therefore it is not used in modelling but as a secondary source of data.</p> <p>Provides a synopsis of the day's rainfall, if there are comments about the performance of the radar network and if there were any outages and infilling of data from other stations during the event to provide context to the magnitude of the event.</p>	Met Office	Consideration of the risk of flooding from rainfall across a widespread area both internal and external to the Counters Creek catchment.
Radar rainfall data	1292 grid squares of 1km resolution radar rainfall covering the Beckton and Crossness catchments. Meteorological Office data is made up of a composite from the three radar stations in the southeast of the UK covering the Thames Water catchments. Time varying radar rainfall data for each 1km grid square is provided at 5-min intervals.	Thames Water	Consideration of the risk of flooding from rainfall across a widespread area both internal and external to the Counters Creek catchment.
Sewer flooding historic database records	Records of all flooding reported to Thames Water	Thames Water – Sewer flooding history database	A sufficient level of understanding of historic flood incidents within the Counters Creek catchment including those reported to LLFAs, Thames Water or another body.
Internet search of photos of flooding	Used for calibration and validation of flooding reports and to identify where flooding has occurred but may not be reported	BBC, ITV News, Sky News, Twitter	A sufficient level of understanding of historic flood incidents within the Counters Creek catchment including those reported to LLFAs, Thames Water or another body.



Source	Description	Originator	How data is used to assess risk
London Fire Service Data from events	Geographical call-in information related to flooding events used for validation of flooding events.	London Fire Service	A sufficient level of understanding of historic flood incidents within the Counters Creek catchment including those reported to LLFAs, Thames Water or another body.
Council Identified Flooding	<p>Mapped flooding London Borough of Hammersmith and Fulham. Mapped flooding City of Westminster. Mapped flooding Royal Borough of Kensington and Chelsea.</p> <p>We work in partnership with local authorities to share data both ways. We support the Lead Local Flood Authorities with their statutory Flood and Water Management Act (2010) Section 19 duties to investigate flooding.</p>	LBHF CoW RBKC	A sufficient level of understanding of historic flood incidents within the Counters Creek catchment including those reported to LLFAs, Thames Water or another body.
London Resilience Partnership Report	Report outlining post-mortem of events and responses to flooding across multiple parties.	London Resilience Partnership	A sufficient level of understanding of historic flood incidents within the Counters Creek catchment and how the company will ensure it has processes in place to allow it to investigate and understand future flooding incidents when they occur. This applies to flooding incidents, whether they are reported to the LLFA, Thames Water and/or any other body. It is expected the company will pursue a co-operative approach working with and sharing knowledge with stakeholders required by Section 13 of the Flood and Water Management Act (2010).
DWMP Brava Outputs	Risk assessment based on DWMP Plans for the whole Beckton Catchment identifies where flooding is at risk of occurring.	Thames Water	Assessment of emerging risks.



Source	Description	Originator	How data is used to assess risk
Sewer Depth Monitor Database	GIS layer showing the locations and reason for installation (blockage, flooding, trunk sewer operation etc.) of long-term monitors	Thames Water	A sufficient level of understanding of operational issues and how factors like silt are likely to influence the risk of flooding within the network.
Lost Rivers	Data collated as part of the 'Lost Rivers' project, where old rivers of London have been culverted and are now considered a Thames Water asset. Alignment of watercourses to Thames Water asset data is not always exact, but approximate locations match with known Thames Water storm relief sewers.	Thames Water/TfL	Assessment of the impact groundwater and infiltration may have on the effectual drainage and flooding within the Counters Creek catchment.
TfL Maintenance	Reports of network affected/maintenance. Entrances/potential sources of inflow to network. Data has been provided related to pump operations on the day of flooding events, pump capacity and locations of network affected.	TfL	Assessment of the impact of 3 rd party generated flows may have on the effectual drainage and flooding within the Counters Creek catchment.
Network Rail	Location of drainage assets	Network Rail	A sufficient level of understanding with regards to the interaction of the company's drainage assets with Lead Local Flood Authority and third-party assets, where relevant in relation to flood prevention in the Counters Creek catchment.
Lidar	Provides accurate elevation data at 1m spatial resolution to understand where sewer flooding will flow.	Data.gov.uk	Further model build and verification work.
Trunk Sewer Layer	GIS layer created as part of Counters Creek Flood Allievation Scheme (CCFAS) based on all named sewers on the Beckton catchment schematic.	Thames Water	A sufficient understanding of predicted flooding and flows in the extremities of, and external to, the Counters Creek catchment so that any transfer of flows or risk from outside the Counters Creek catchment to



Source	Description	Originator	How data is used to assess risk
			within the Counters Creek catchment are fully understood.
Flap Valve Map	Digitised layer of flap valves in CCFAS found in network by CCTV, and status.	Thames Water	A sufficient level of understanding regarding legacy flap valves or other control devices within the network. Operational and maintenance strategy
Depth Monitor Data	Observed data from flow monitors across the catchment.	Thames Water	Used to assess the performance of the model during post event storm analysis looking at pump performance, storm tank operation and interaction between the local, trunk and storm relief systems.
FLIP Locations AMP5 and AMP6	Layer of all FLIPs 'Injector Pumps'	Thames Water	Operational and maintenance strategy
Maida Vale Flood Alleviation Scheme (FAS) Protected Properties	The FAS was separated into three elements, Tamplin Mews, Westbourne Green and Cambridge Gardens.	Thames Water	A sufficient level of understanding of historic flood incidents within the Counters Creek catchment including those reported to LLFAs, Thames Water or another body.
CCFAS – Basement Connectivity	Database from CCFAS relating to properties. All 44,000 assumed basements are assumed to connect to the sewers via the nearest node, assigned through an automated GIS routine.	Thames Water	The inclusion in the model of basements and domestic connections at key flooding locations, to a Type III level of detail, as per the CIWEM Urban Drainage Group (UDG) (2017) Code of Practice for the Hydraulic Modelling of Urban Drainage Systems, where necessary, to predict the onset of flooding at property level.
CCFAS – RAG Layer	Historical GIS layer from CCFAS related to model-predicted flooding and first flood. Red is flooding predicted < 1:10yr RP; Amber is 10-30yr RP;	Thames Water	The inclusion in the model of basements and domestic connections at key flooding locations, to a Type III level of detail, as per the CIWEM Urban Drainage Group



Source	Description	Originator	How data is used to assess risk
	Green is not predicted to flood up to 1:30. Refers to basement properties only. Property flooding is based on linear interpolation to nearest sewer, length along the sewer and u/s and d/s modelled maximum water levels.		(UDG) (2017) Code of Practice for the Hydraulic Modelling of Urban Drainage Systems, where necessary, to predict the onset of flooding at property level.
CCFAS – LB Layer	Low Basement layer – all properties from CCFAS basement layer where basement level is lower than soffit of sewer, or highest downstream soffit. Some may be assumed.	Thames Water	The inclusion in the model of basements and domestic connections at key flooding locations, to a Type III level of detail, as per the CIWEM Urban Drainage Group (UDG) (2017) Code of Practice for the Hydraulic Modelling of Urban Drainage Systems, where necessary, to predict the onset of flooding at property level.
CCFAS – Willingness to Pay	Dataset of basements, threshold levels and costs generated for CCFAS. Master list can be used to assess confidence in threshold levels and mechanisms.	Thames Water	The inclusion in the model of basements and domestic connections at key flooding locations, to a Type III level of detail, as per the CIWEM Urban Drainage Group (UDG) (2017) Code of Practice for the Hydraulic Modelling of Urban Drainage Systems, where necessary, to predict the onset of flooding at property level.
Tide Levels	Tide levels recorded by river gauges at Erith, Charlton, Chelsea, Silvertown, Richmond, Southend, Tower Pier and Westminster. Data given is minimum, average and maximum levels for given date.	EA (riverlevels.uk)	Assessment of the impact of tides on the effectual drainage and flooding within the Counters Creek catchment.
Tide Levels	Time-varying data for a given date range – used to understand when the tide levels are high and may cause overflow flaps to close causing backing up of the sewerage system.	Thames Water	Assessment of the impact of tides on the drainage and flooding within the Counters Creek catchment.



Source	Description	Originator	How data is used to assess risk
Thames Water Maintenance records	Record of maintenance, including cleared and attended blockages, sewer collapses and repairs, manhole repairs, sewer cleaning.	Thames Water – Vistec system	A sufficient level of understanding of operational issues and how factors like silt are likely to influence the risk of flooding within the network. Operational and maintenance strategy
National Receptor Database	Property location and threshold data for the Beckton and Crossness catchments.	EA	A sufficient level of understanding with regards to the interaction of the company's drainage assets with Lead Local Flood Authority and third-party assets, where relevant in relation to flood prevention in the Counters Creek catchment.
Asset Information Management System (AIMS)	Flood defences and asset register.	EA	A sufficient level of understanding with regards to the interaction of the company's drainage assets with Lead Local Flood Authority and third-party assets, where relevant in relation to flood prevention in the Counters Creek catchment.
Gully locations and highway drainage information	GIS layers from each Borough and from TfL denoting gullies and highway drainage.	LBHF RBKC TfL	A sufficient level of understanding with regards to the interaction of the company's drainage assets with Lead Local Flood Authority and third-party assets, where relevant in relation to flood prevention in the Counters Creek catchment.

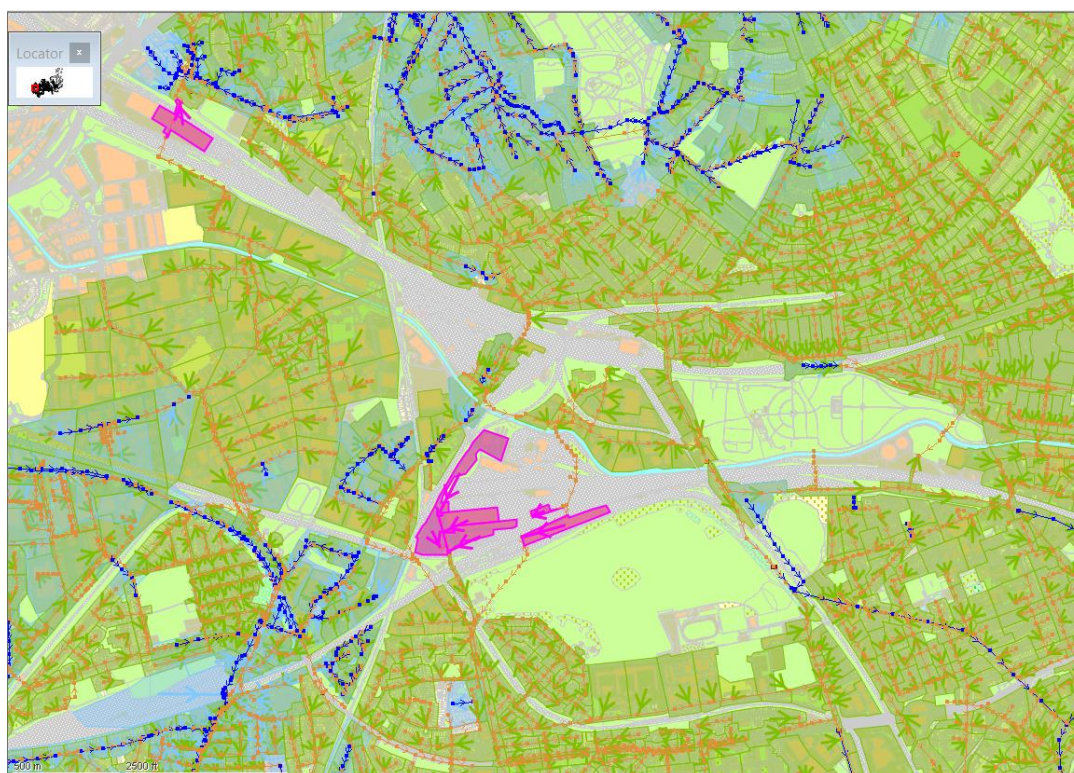
Section 3

Improvements in asset data from third parties

A Improvements in asset data from Network Rail

- 3.1 We have an emerging picture of asset data from Network Rail. The data set is still limited, but the data that we received in 2022 has been mapped to identify possible interactions with the sewerage network.
- 3.2 An assessment of the network model has been carried out which shows almost no contributing areas have been defined along the Network Rail track corridors. In Figure 1, the green and blue polygons represent drainage sub catchments to the foul/combined and surface water networks respectively. The magenta polygons are the only ones in the Counters Creek catchment where it has been proved that there is a direct connection to the sewerage system.

Figure 1: Locations of Network Rail drainage assets in relation to sewers



- 3.3 The main connections are associated with the Old Oak Common railway junction which has seen significant redevelopment in the last 5-10 years. Crossrail and High Speed 2 (HS2) operations has seen the old marshalling yards and track in the area redeveloped. Detailed flow monitoring and impact assessments studies have been carried out by consultants Stantec on behalf of HS2 to ensure that any new development does not pose an increase in flood risk to the receiving sewerage system.
- 3.4 When the network model was updated in 2008 a detailed flow survey of 72 flow monitors was installed across the Counters Creek catchment. The verification has been

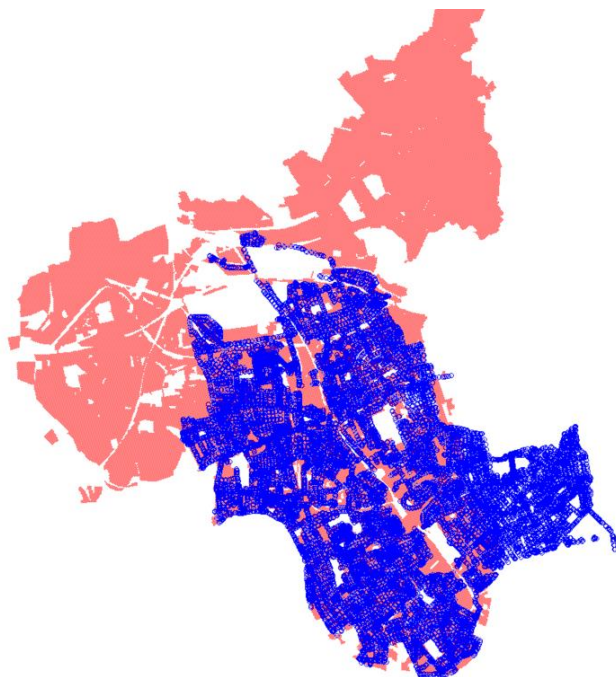
independently audited and there have been no concerns raised regarding unaccounted inflows from possible track drainage. Subsequent modelling work and analysis following large storm events and flooding has not identified any interactions that need further investigation. It has therefore been concluded that this development will not increase flood risk. Long term flow depth loggers have been installed within the network and more are planned within the trunk sewers to monitor day to day operations. Any unexpected flow patterns can then be investigated further if they are detected.

- 3.5 HS2 studies associated with Euston Station, and possible refurbishment of track and the main station building, identified historic connections to the trunk sewerage system. These areas had already been accounted for in the old macro model and have since been updated in the detailed model based on new surveys.

B Improvements in highway gully location data

- 3.6 In 2022 information on highway drainage and gully locations was provided by the Royal Borough of Kensington and Chelsea, London Borough of Hammersmith and Fulham, and TfL. This was used to ensure the hydraulic model replicates what is really happening in the sewer network, and that flows from these sources are accounted for. Figure 2 shows we were able to confirm that within the Counters Creek catchment, our model already includes runoff from the roads and pavements. This runoff is routed to the combined sewers, so it is already accounted for in our assessment of flood risk.
- 3.7 The dataset could be used to further improve our understanding of extreme flooding events, such as the July 2021 events, if used for 2D overland flow modelling.

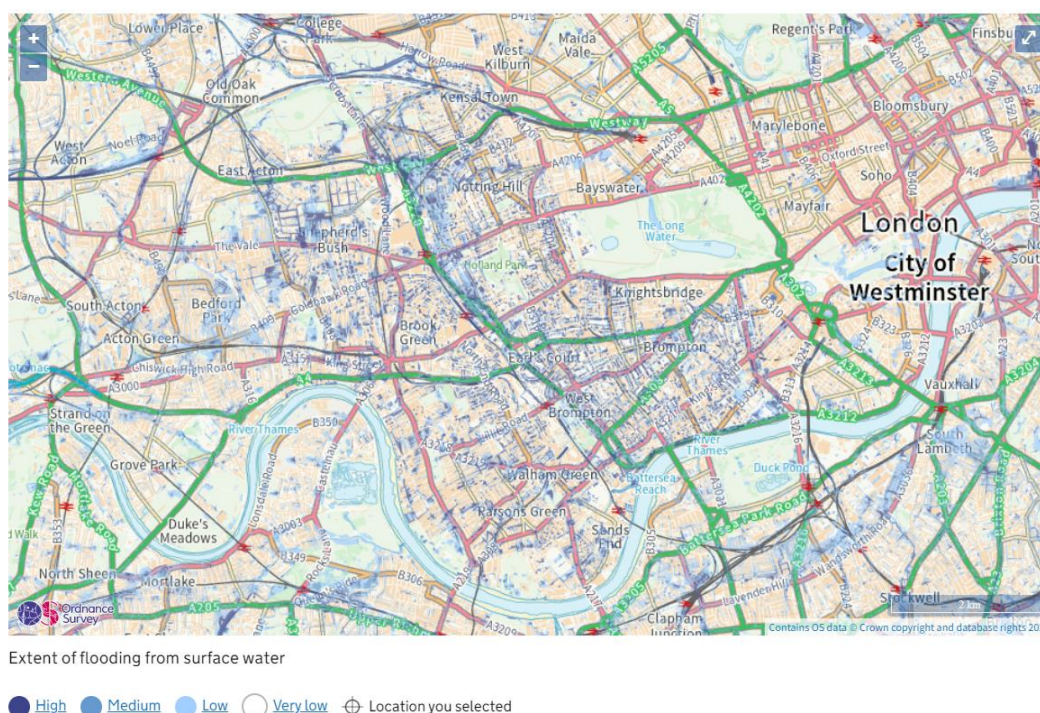
Figure 2: Overlap between locations of gullies (blue) and modelled sub-catchments contributing flows to the sewers (red)



C Improvements in data from the Environment Agency

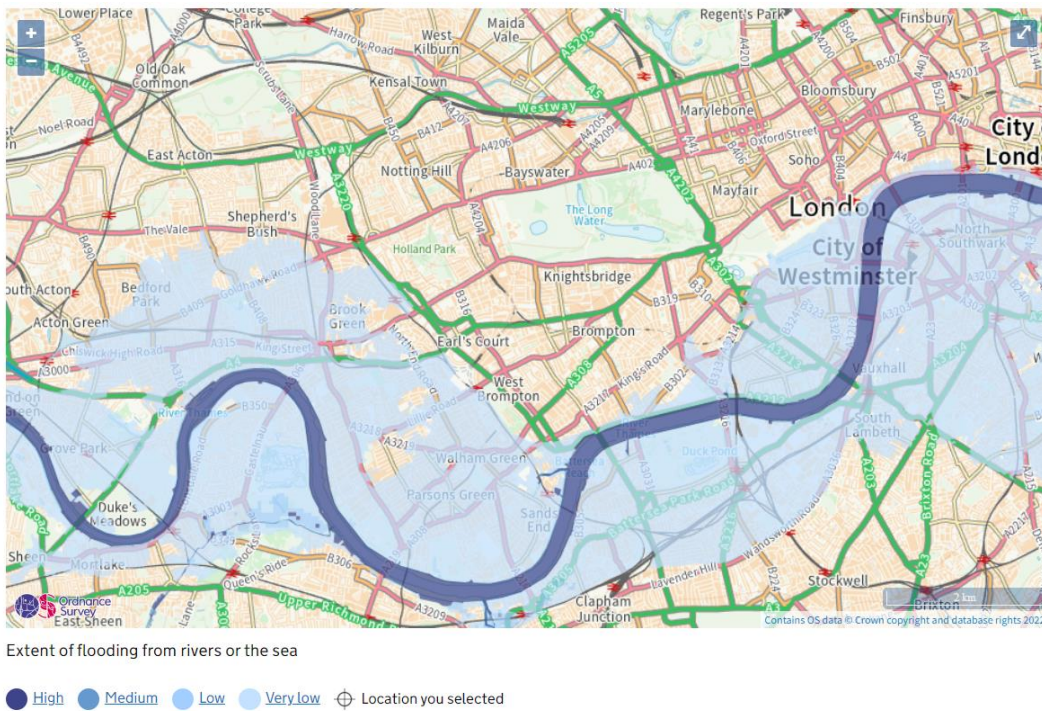
- 3.8 The Environment Agency provides flood risk data for surface water, river flooding and reservoir flood risk. All flood risk mapping is readily available on the Government website [Check the long term flood risk for an area in England - GOV.UK \(www.gov.uk\)](https://www.gov.uk).
- 3.9 Figure 3 shows the flood risk from surface water based on a 2D assessment of overland flow paths and low points. This map indicates that the majority of the Counters Creek area is at very low risk from surface water flooding, however, there are localised areas which have a low, medium or high flood risk. As anticipated, some of these areas are associated with repeat flooding occurrences according to our records.

Figure 3: Flood risk map of the Counters Creek area – flood risk from surface water



- 3.10 Figure 4 shows the flood risk from rivers or the sea in the Counters Creek area. This map indicates that the majority of the Counters Creek area is at very low risk of river flooding.
- 3.11 It is interesting to note that the Thames Barrier significantly reduced flood risk from the river, and subsequently planning restrictions were relaxed on subterranean developments leading to more and more basements being built or converted (and connected to the sewer network) since the 1980s. However – even though the flood risk from the river is now lower – the sewer outfalls are still tide-locked at high tide levels, indirectly leading to an increased risk of internal sewer flooding in these low-lying areas. This was apparent during the July 2021 flooding event.

Figure 4: Flood risk map of the Counters Creek area – flood risk from rivers or the sea



3.12 Figure 5 shows the flood risk from reservoirs in the Counters Creek area. This map indicates that the majority of the Counters Creek area is at very low risk of flooding from reservoirs when the river levels are normal, and that the flood risk is only slightly increased when there is also flooding from rivers.

Figure 5: Flood risk map of the Counters Creek area – flood risk from reservoirs

