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Thameside Stage 1 Surface Water Management Plan

Final Report

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Contract

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Purpose

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Abbreviations and Glossary of Terms

Term	Definition
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
DA	Drainage Area
DBC	Dartford Borough Council
DEM	Digital Elevation Model
Drainage Area	Are defined for the purposes of this study using FMfSW (1 in 200 year (deep)), historic flooding records and policy areas as defined by Kent County Council
DTM	Digital Terrain Model
EA	Environment Agency
EU	European Union
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river
FMfSW	Flood Map for Surface Water
GBC	Gravesham Borough Council
IDB	Internal Drainage Board
JBA	Jeremy Benn Associates
KCC	Kent County Council
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NPPF	National Planning Policy Framework
NRD	National Receptor Dataset – a collection of risk receptors produced by the Environment Agency
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
Pathway	The mechanism or method flood waters are directed to a location/ receptor.
PFRA	Preliminary Flood Risk Assessment
Receptor	The area at risk from receiving flood water
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
RMA	Risk Management Authorities
SAB	SUDS Approving Body - responsible for approving, adopting and maintaining drainage plans and SuDS schemes that meet the National Standards for sustainable drainage.
SDC	Sevenoaks District Council
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment - The Strategic Housing Land Availability Assessment (SHLAA) is a technical piece of evidence to support the Core Strategy and Sites & Policies Development Plan Documents (DPDs). Its

	purpose is to demonstrate that there is a supply of housing land in the District which is suitable and deliverable.
Source	Source of flooding i.e. heavy rainfall
Stakeholder	A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SUDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SW	Southern Water
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.



1 Introduction

1.1 What is a Surface Water Management Plan

A Surface Water Management Plan (SWMP) is a study to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from surface runoff, groundwater, and ordinary watercourses.

SWMPs are led by a partnership of flood risk management authorities who have responsibilities for aspects of local flooding, including the County Council, Local Authority, Sewerage Undertaker and other relevant authorities.

The purpose of a SWMP is to identify what the local flood risk issues are, their effects and what options there may be to manage them. These options are presented in an Action Plan which lists the partners who are responsible for taking the options forward. Although the SWMP provides a full flood history for the study area which may include coastal and fluvial flood sources, the action plan only proposes measures to manage local flooding. The Action Plan is agreed by partners and reviewed periodically.

This SWMP is being undertaken by Kent County Council (KCC) to investigate the local flood risks in Thameside as part of their new remit for strategic oversight of local flood risk management in Kent, conferred on them by the Flood and Water Management Act 2010. Thameside has been identified as an area potentially at risk of local flooding in the Preliminary Flood Risk Assessment¹, which KCC undertook in 2011 for the whole county of Kent. This SWMP will determine whether there are any local flood risks and what further work may be needed. To find out more about KCC's new role and other SWMPs they are undertaking please visit their website

:

http://www.kent.gov.uk/environment_and_planning/flooding.aspx

1.2 Summary of aims and objectives

The main aims and objectives of the Thameside Surface Water Management Plan (SWMP) are detailed below

1. The establishment of a local partnership;
2. The collation of a comprehensive flood history for all relevant local flood risk sources;
3. The identification, collation and mapping of all available flood data and its availability for future use including an assessment of the reliability of the data;
4. The identification, where possible from the available data, of flood prone areas;
5. The identification of areas where existing data may be missing or unreliable, as a consequence of inappropriate local assumptions, additional local features or any other reason, and options to improve our understanding;
6. The identification of areas where the risks are from a combination of sources;
7. Identification of any proposed or allocated development sites and any impacts they may have on local flood risks;
8. The preparation of source pathway receptor models for all the risks and sources that are identified;
9. The suitability of SUDS in the area and the techniques that are appropriate, identifying regional variations where necessary;
10. The identification of any easy win opportunities that are apparent without further work, which may include planning policies or simple flood defence measures; and
11. A plan for further work that may be necessary to manage or better understand the risks identified, including the owner of the actions, the timeframe for undertaking them and indicative costs.

¹ Kent County Council (2011) Preliminary Flood Risk Assessment available at <http://publications.environment-agency.gov.uk/PDF/FLHO1211BVSI-E-E.pdf>
Thameside SWMP Stage 1 Report.doc



1.3 Study area

The SWMP study area combines both Gravesham and Dartford. It is located to the south east of London and the west of Medway. The Thames Estuary provides the northern boundary to the area. Figure 1.1 illustrates the extent of the study area. The land use in Thameside is predominantly urban in the north of the study area with settlements such as Dartford, Swanscombe, Northfleet and Gravesend. As you move away from the River Thames and east of the M25 the land becomes more rural in type.

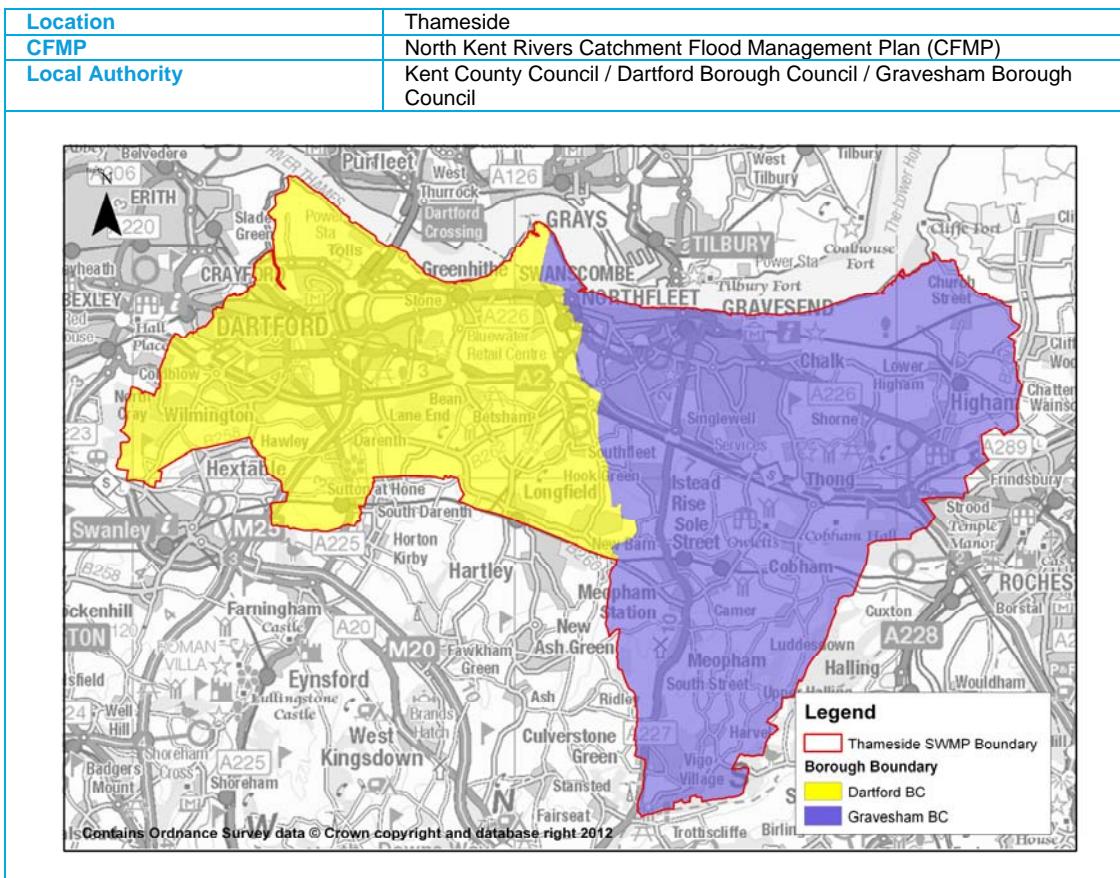


Figure 1.1 Study Area

1.3.1 CFMP

Thameside area falls within the North Kent River Catchment Flood Management Plan (CFMP), as illustrated in Figure 1.2. The CFMP shows that 5 Policy Units are located within Thameside. Within any CFMP six standard flood risk management policies have been applied to each policy unit:

- Policy 1 – No active intervention (including flood warning and maintenance). Continue to monitor and advice.
- Policy 2 – Reduce existing flood risk management actions (accepting that flood risk will increase over time).
- Policy 3 – Continue with existing or alternative actions to manage flood risk at the current level.
- Policy 4 – Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).
- Policy 5 – Take further action to reduce flood risk.
- Policy 6 – Take action to increase the frequency of flooding to deliver benefits locally or elsewhere (which may constitute an overall flood risk reduction, e.g. for habitat inundation).

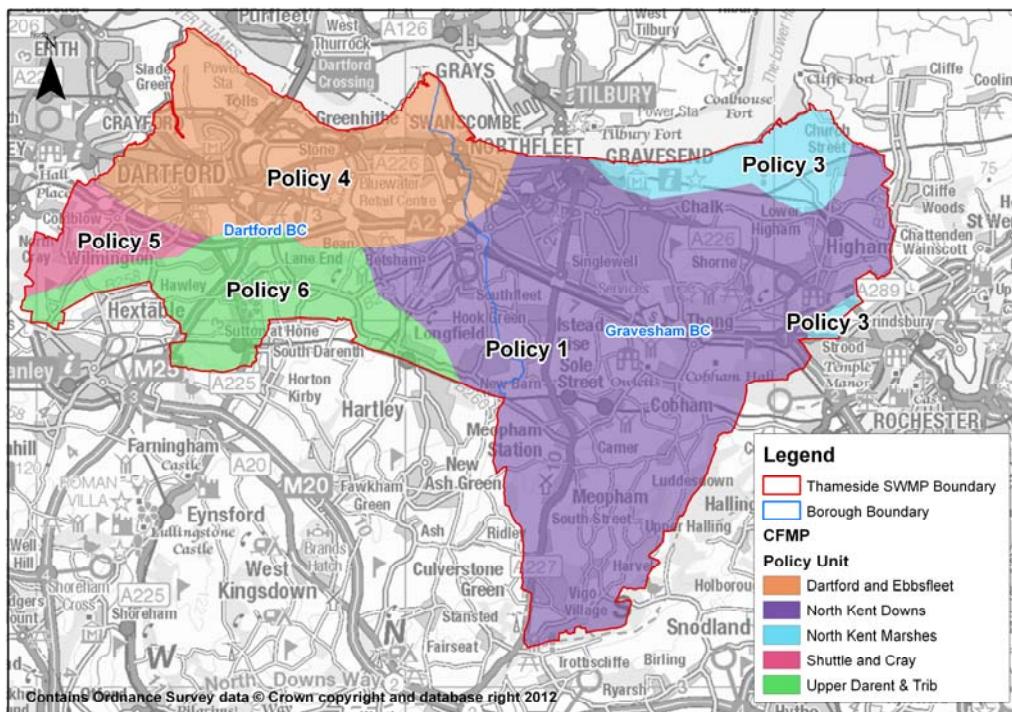


Figure 1.2 CFMP Policy Units and Applicable Policies²

1.3.2 Surface Water

Surface water presents a risk throughout Thameside. When there are instances of heavy rainfall and water fails to infiltrate to the ground or enter the drainage system there is an increased risk of surface water flooding. Ponding generally occurs at low points in the topography. Historically there have been events attributed to surface water; however the likelihood of flooding is dependent on not only the rate of runoff but also the condition of the surface water drainage system (surface water sewer, Kent CC Highways drains and gullies).

There are two sources of information available from the Environment Agency, relating to the identification of potential surface water flood risk in Thameside. These are;

- Areas Susceptible to Surface Water Flooding (AStSWF) - Since July 2009, these maps have been available to Local Resilience Forums and Local Planning Authorities, and provided a starting point in understanding the broad areas where surface water flooding is likely to cause problems
- Flood Maps for Surface Water (FMfSW) - these followed on from the AStSWF maps and provide a more realistic representation than the AStSWF maps in many circumstances. The Environment Agency considers this to be the national source of information³.

For the purposes of this report we will be using the FMfSW datasets.

1.3.3 Watercourses

Main Rivers

The Tidal Thames begins at Teddington Lock upstream of the Thames Barrier near Richmond-upon-Thames downstream to Haven Point on the north bank of the Thames Estuary in Essex and Warden Point on the south bank in Kent.

² The boundaries of the CFMP Policy Units have been digitised approximately from the North Kent Rivers CFMP available from <http://cdn.environment-agency.gov.uk/geso1008bowk-e-e.pdf>

³ Environment Agency (2012) Flooding from Surface Water - available at <http://www.environment-agency.gov.uk/research/planning/109490.aspx>

River Darent flows from south to north into Dartford Borough, close to its junction with the Tidal Thames the River Darent receives water from the River Cray to the west. It flows through the Dartford and Crayford marshes where it discharges to the Tidal Thames downstream of Crayford Ness.

The River Ebbsfleet, designated Main River according to the data received from the Environment Agency begins south of the A2, north of Southfleet. It continues north where it discharges into the Tidal Thames downstream of the Swanscombe Marshes.

The North Kent Marshes stretch from Gravesend in the west to Whitstable in the east and include the Hoo Peninsula, the River Thames the River Medway, the River Swale and Isle of Sheppey. This area is designated as a Special Protection Site, Ramsar Site, National Nature Reserve and a Site of Special Scientific Interest. Within this complex system of drains, some are designated as Main River. North Kent Marshes within the Thameside SWMP boundary from west to east include:

- Dartford Marshes
- Swanscombe Marshes
- Shorne and Higham Marshes

Ordinary Watercourse

Ordinary watercourses are watercourses that are not main rivers. Local authorities and internal drainage boards have powers to manage flood risk from ordinary watercourses, surface water and groundwater. The Environment Agency has powers and responsibilities to maintain and improve main rivers and a responsibility to manage flood risk from main rivers and the sea.

The flooding mechanism for ordinary watercourses is often smaller in nature than flooding from Main Rivers and tends to be localised. The North Kent Marshes are within the boundary of Thameside SWMP and covers an area with a high concentration of ordinary watercourses where drainage is complex and one severe rainfall event can cause flooding on a number of ordinary watercourses simultaneously, a flood event can be exasperated if it is combined with a high tide prevent discharge of watercourse into the Tidal Thames.

1.3.4 Sewers

Responsibility for the sewers within the study area is split between two utility companies; Southern Water and Thames Water. Southern Water covers Gravesham and Swanscombe while Thames Water is responsible for the sewers in Dartford. Data provided shows that there are a various sewer types located within the Thameside study area:

- Combined
- Foul
- Treated effluent
- Surface Water

Records show that the sewers within the study area are predominantly foul sewers with some surface water sewers within the urban areas, particularly in Dartford.

Table 1-1 describes the sewer network models that are available for Thameside.

Table 1-1 Availability of Sewer Network Models - Thameside

Area / Model	Details
Northfleet	Most of the modelled catchment is in Gravesham. Southern Water describes the model as reasonably detailed and covers the whole catchment. It was originally modelled using WALLRUS software. This has since been converted / updated with HydroWorks. The model is described as being reasonably up to date.
Ham Hill	A small part of the catchment is within Gravesham. This part is modelled but is very simplified.
Gravesend	This is described as an old model originally modelled using WALLRUS software and then converted / updated with HydroWorks. This is a simplified model and currently out of date with development / population. Overall, the model requires updating.
Whitewall Creek	This is an old model which was originally built and verified in 1993. The model is simplified, and is currently out of date with development / population.
Motney Hill	A small part of modelled catchment is in Gravesham. This model reasonably detailed and was

	re-built in circa 2005 / 2006 by MWH.
Edenbridge	A detailed model built within the last 2 or 3 years with full coverage of the catchment but only the more central part of the model/catchment could be considered verified.

1.4 Using this report

Use Table 1-2 to find the information that you need.

Table 1-2 Report layout

Section	Description of contents
1. Introduction	This section defines objectives of the stage 1 SWMP and describes the background of the study area.
2. Preparation	This section provides a summary of the key partners and consultation, data collected and a brief summary of the historic flooding collected. It introduces the source-pathway-receptor model and outlines how local sources of flood risk have been assessed.
3. Sustainable Drainage	Provides details on the suitability of SUDS within Thameside.
4. SWMP Action Plan	Provides details of the generic and location specific Action Plan and potential funding opportunities.

2 Preparation

2.1 Partnership Approach

Local flooding cannot be managed by a single authority, organisation or partner; all the key organisations and decision-makers must work together to plan and act to manage local flooding across Thameside. Many organisations have rights and responsibilities for local flood risk management.. Although Kent County Council has commissioned this project, the key partners have been consulted with at appropriate stages in the study. Working in partnership encourages co-operation between different agencies and enables all parties to make informed decisions and agree the most cost effective way of managing local flood risk across the study area over the long term. The partnership process is also designed to encourage the development of innovative solutions and practices; and improve understanding of local flooding.

2.1.1 Key Partners

Partners are defined as organisations with responsibility for the decision or actions that need to be taken to manage local flooding. The key partners involved in this project are:

- Kent County Council
- Kent County Council - Highways
- Gravesham Borough Council
- Dartford Borough Council
- Environment Agency
- Southern Water
- Thames Water

The Stage 1 SWMP was undertaken to determine whether there are any local flood risks within Thameside that may require further work and / or investigation. In fulfilling this objective, the decision was made only to consult with the key partners noted above. Future studies that may be undertaken at a more local level will seek to widen this consultation to include parish and / or town councils, other community groups or local people. During the course of the study the key partners were involved in the following engagement events:

- Inception meeting
- Data gathering exercise
- Action plan workshop

2.2 Data Collation and Review

Data has been collected from the key partners and the quality of the data has been assessed and uncertainty or perceived weakness has been described and discussed with the key partners. A table summarising the data collected is located in Appendix A. A vast array of information was made available to inform the SWMP, including:

- The Environment Agency historical flood maps, FMfSW and LIDAR were used to delineate the individual drainage areas and define the receptive receptors within Thameside.
- Records of historic flooding from GBC, DBC, KCC, Southern Water and Thames Water (were used to identify areas where actions are required within Thameside). It should be noted that many of the historic records, specifically from highways only went back as far as 2008.
- Groundwater vulnerability zones and groundwater source protection zones were informative when determining the applicability of SUDS within Thameside.
- National Receptor Datasets (NRD) were used and found to be informative when quantifying risk and prioritisation potential measures and actions. The NRD was not



used to determine numbers potentially affected by the floods rather to indicate the critical infrastructure that may be impacted by surface water flooding.

- Other data utilised included the Kent Thameside SFRA⁴, the Dartford Town Centre SFRA⁵ and the Environment Agency Flood Zones.

2.3 Historical flooding

Each Risk Management Authority (RMA) provided data on incidents of historical flooding collected. The records begin in 1953 to present; there are a number of records that do not have a date specified. A Flood History Table has been compiled providing further details on each recorded event received from all RMAs, and is documented within Appendix C. A short précis is noted below.

Fluvial

There were recorded incidents of fluvial flooding on the River Darent in December 2002 - January 2003⁶. The Environment Agency reported that 126 properties were inundated by floodwater across Kent County.

Coastal/Tidal

The most notable surge event to occur along the North Kent coastline happened on 31 January 1953, when a massive storm surge coincided closely with the time of a high spring tide. The result of this was one of the worst natural disasters in Northern Europe in the last two centuries, leading locally to flooding. Another notable event occurred in January 1978. Whilst this event was not too dissimilar to 1953 in terms of surge magnitude, the impact of the event was much reduced due to the construction of sea defences along the North Kent coastline following the 1953 event.

Surface Water

The historical records provided were mainly from Kent County Council Highways, anecdotal records of depths and sources of flooding on highways were described. For the most part surface water flooding could be attributed to heavy rainfall overloading carriageways, drains/gullies. In other instances, the cause of flooding was perceived to be from blocked drains/gullies.

Sewer

Southern Water and Thames Water records of flooding were based on postcode polygons, and within these records indication was given as to the count of flooding whether this flooding was internal, within the curtilage of a property or external.

2.4 Source Pathway Receptor

The Source-Pathway-Receptor concept can be used to highlight the processes that influence the flood risk in a given area. A simple schematic is illustrated in Figure 2.1.

⁴ Kent Thameside Strategy Flood Risk Assessment (2009) available at

http://docs.gravesham.gov.uk/WebDocs/Environment%20and%20Planning/LDF/Strategic_Flood_Risk_Assessment_Update.pdf

⁵ Dartford Borough Council (2009) Dartford Town Centre SFRA available at
http://winweb.dartford.gov.uk/media/EB54SFRA2008andAppendices_001.pdf

⁷ Environment Agency Flood Maps available at www.environment-agency.gov.uk/homeandleisure/37837.aspx
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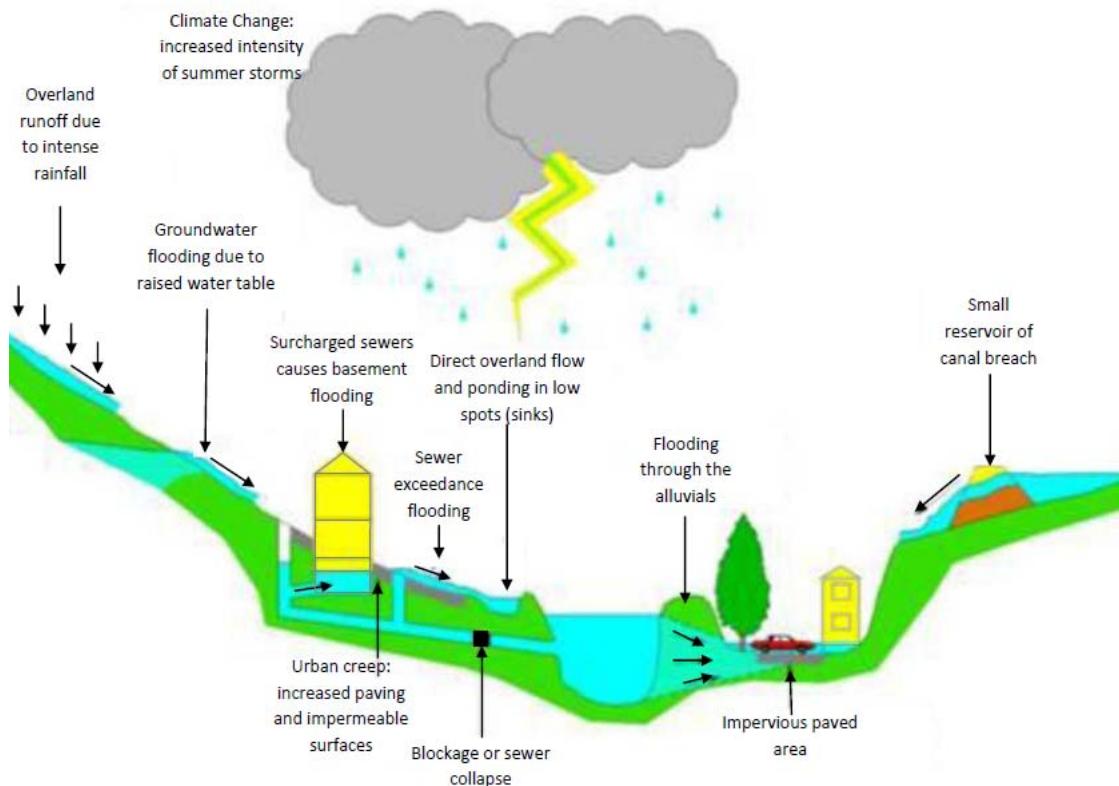


Figure 2.1 Source-Pathway-Receptor

The sources of flood water in the study catchment are summarised below:

- Heavy rainfall
- Rivers - overtopping of river banks

The pathway of flood risk is the sewer network, drains and gullies and river networks within Thameside. Further detail on pathways is located in the summary sheets in Appendix B (see section 2.5 for discussion on summary sheets).

Receptors within the Thameside study area were highlighted where supplied historic records indicate groupings of flood incidents in particular locations. In addition the FMfSW - 1 in 200 year (deep) was used to indicate where potential receptors may be located. It should be noted that the location of the receptor is not intended to specifically pinpoint an exact location (i.e. house, business or street) as a receptor. Rather, a receptor has been used to highlight an area, such as a settlement, for example, Lower Higham is illustrated below as receptor A, see Figure 2.2.

Please Note - The Flood Map for Surface Water provides an indicative outline of areas that may be susceptible to surface water flood risk, it does not indicate actual risk.

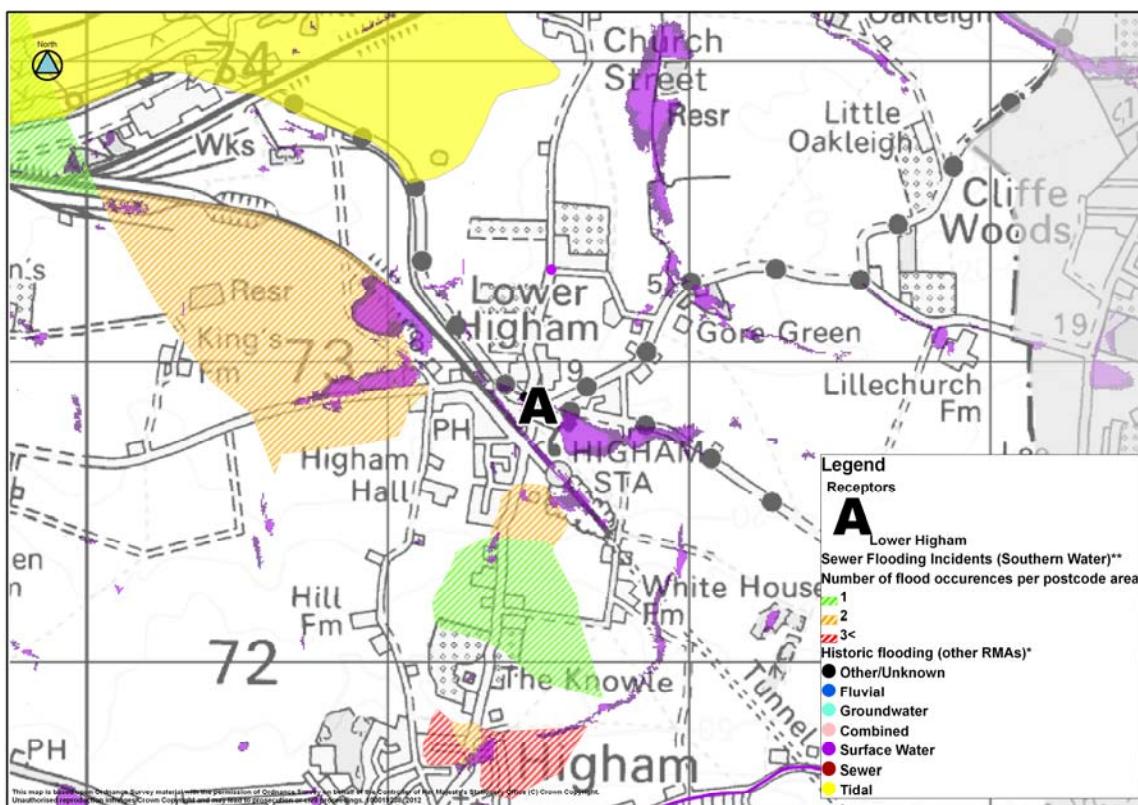


Figure 2.2 Example of a Thameside SWMP Receptor

2.5 Communicating and mapping the risk

In order to consider the study area in more detail and enable partners and other interested parties to be able to focus in on certain areas of interest (aside from the whole SWMP area), the study area has been split into four drainage areas, see Table 2-1 and Figure 2.3. The drainage areas have been split using the topography of the landscape (DTM), historic events (from RMAs), mapped outlines (Flood Zones and Flood Maps for Surface Water (1 in 200yr, deep)), and where appropriate they have been informed by KCCs Local Flood Risk Management Strategy policy units.

Table 2-1 Thameside Drainage Areas

Drainage Area	Location
DA01	Dartford Town
DA02	Gravesend
DA03	Gravesham Rural
DA04	Dartford Rural

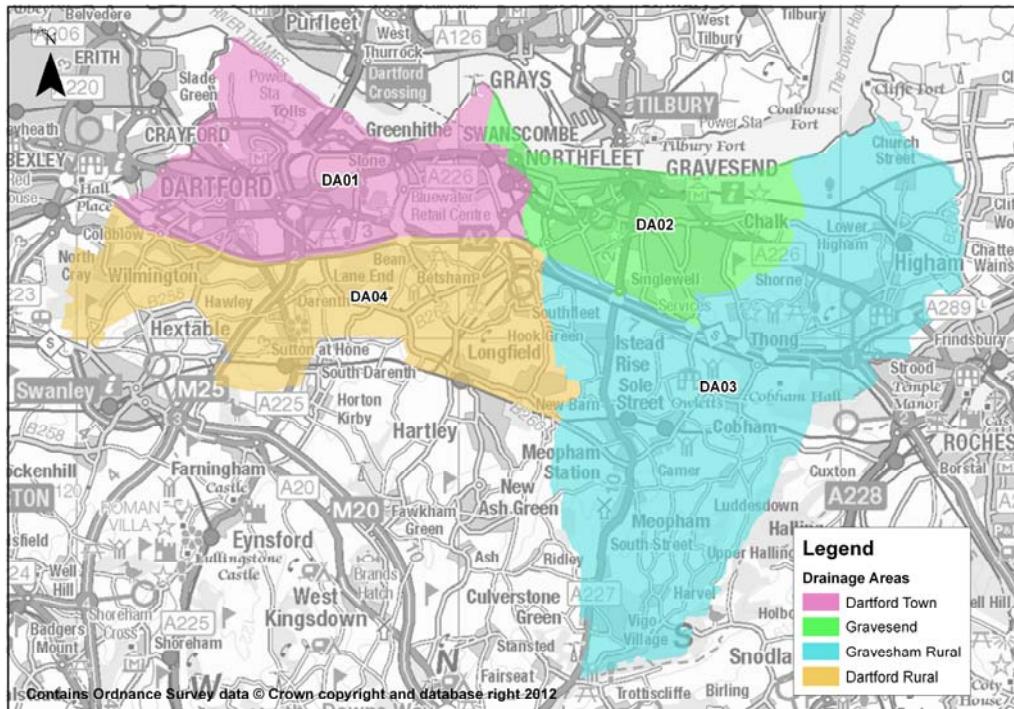


Figure 2.3 Thameside Drainage Areas

Each drainage area has been described in detail in a corresponding Summary Sheet in Appendix B. Each summary sheet provides an overview of;

- the drainage area;
- its size;
- drainage assets i.e. main river, ordinary watercourse and sewer network;
- and highlights the source-pathway-receptor model within each area;

In addition, each drainage area has a corresponding flood history table, which provides details of all recorded historic data, as provided by the key partners. The flood history tables are located in Appendix C, they include details on the:

- year of the incident;
- general location;
- perceived source as per the data provided;
- whether property was recorded as being affected; and
- any additional comments provided within the historic datasets.

Maps to accompany the summary sheets are also provided for each drainage area illustrating:

- Historic Flooding - this map details the location of the historic flood data as provided by the key partners.
- Surface Water and Critical Infrastructure - this map illustrates the FMfSW and the NRD.
- Watercourses and Drainage Systems - this map illustrates the rivers and sewer network within Thameside as per the data provided by Southern Water and Thames Water.

3 Sustainable Drainage Systems

3.1 Feasibility of SUDS in Thameside

The choice of SUDS technique is site-specific, depending on the nature of the proposed development and local conditions. The suitability of areas for different types of SUDS techniques is often determined by existing landuse and in the case of SUDS which involve infiltration, soil type, underlying geology and ground water conditions also need to be considered.

The underlying geology in Thameside mostly permeable due to the bedrock formed of Seaford and Newhaven Sand Formation, with pockets of the Thanet Sand Formation and Seaford Chalk Formation. Maps indicate the presence of London Clay at Bean, Shorne Wood, Shore Marshes and Cliffe Woods. Within the western section of the Thameside the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation is predominant.

When considering infiltration options, groundwater source protection zones must also be considered. The Environment Agency's website provides a web based resource in order to check the Groundwater Source Protection Zone in their "What's in my backyard" section⁷. There are Zone I - Inner protection Zones and Zone II - Outer Protection Zones within the Thameside study area, see Figure 3.1. The Environment Agency have defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk, Figure 3.1 show three main zones (inner, outer and total catchment) and a fourth zone of special interest which may apply to a groundwater source.⁸

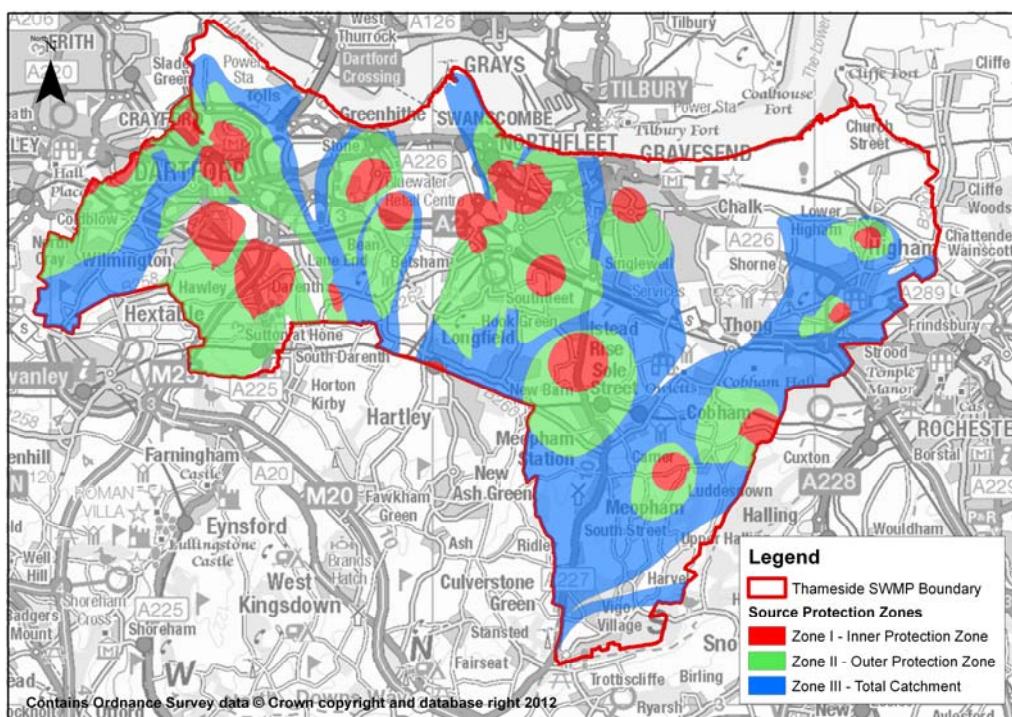


Figure 3.1 Groundwater Source Protection Zone

Kent Thameside SFRA supports the use of SUDS, and a movement away from discharging surface water into sewers. It does not specifically identify methods to use within the Kent

gov.uk/homeandleisure/37837.aspx

ov.uk/wiyby/wiybyController?ep=maptopics&lang=_e

⁸ <http://www.environment-agency.gov.uk/homeandleisure/37833.aspx>

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Thameside area. However the Kent Thameside Water Cycle Strategy⁹ provides guidance on the use of SUDS within Dartford and Gravesham Borough Councils. It shows the development types that are permissible in each ground protection zone and the techniques required to control pollution before it is discharged.¹⁰

Further background information with regards the use and types of SUDs is provided within Appendix D.

⁹ Kent Thameside Regeneration Strategy (2009) Kent Thameside Water Cycle Strategy - Phase 1 available at <http://winweb.dartford.gov.uk/media/01WaterCycleStratFinal.pdf>

¹⁰ Kent Thameside Regeneration Strategy (2009) Kent Thameside Water Cycle Strategy - Phase 1 available at <http://winweb.dartford.gov.uk/media/01WaterCycleStratFinal.pdf> - Chapter 6 -

4 SWMP Action Plan

4.1 Introduction

The SWMP has identified a range of recommended actions for the reduction of flood risk across the Thameside SWMP area. The Action Plan collates all information undertaken and collated as part of this SWMP study and:

- Outlines the actions required and where and how they should be undertaken;
- Sets out which partner or stakeholder is responsible for implementing the actions and who will support them;
- Provides indicative costs; and
- Identifies priorities.

4.2 Generic Action Plan

Table 4-1 describes the generic actions to be applied throughout all drainage areas (DA01- DA04), it should be noted that the first and fourth action highlighting areas that may need may need monitoring in the future.

Table 4-1 Generic Action Plan

Ref	Applicable Drainage Areas	Action/Option (What?)	Priority Actions (How?)	Lead Action Owner	Supporting Action Owner(s)*	Priority (When?) **	Indicative Relative Cost
1	All Drainage Areas	<p>Develop and implement a targeted maintenance schedule.</p> <p>KCC, GBC, DBC, EA, Southern Water and Thames Water should develop and implement a targeted maintenance schedule so that the highway gullies, drains and other drainage assets (including SuDS), watercourses and sewers operate effectively to their design capacity.</p> <p>KCC has maintenance schedules and programmes for gullies. As a priority these should be reviewed in consultation with other partners.</p>	<p>1. Use the stage 1 SWMP to identify and record where existing drainage infrastructure is, where it drains to and who owns and/or is responsible for maintaining it.</p> <p>Records of assets should be available to all partners.</p> <p>2. Partners to develop a coordinated maintenance schedule using information in the SWMP (i.e. areas at high risk of flooding, natural flow routes, etc).</p> <p>3. Continue to invest in hydraulic improvements, including de-silting, root removal and minor collapse repair, to reduce the risk of property flooding.</p> <p>4. Communicate coordinated maintenance</p>	KCC	EA, GBC, DBC TW & SW	Quick win	High

Ref	Applicable Drainage Areas	Action/Option (What?)	Priority Actions (How?)	Lead Action Owner	Supporting Action Owner(s)*	Priority (When?) **	Indicative Relative Cost
			activities to the public to manage expectations.		DBC TW & SW	Term	
2	All Drainage Areas	<p>Raise awareness within the LLFA, partner organisations, developers and the general public regarding the policies for surface water management, specifically SuDS, within existing evidence base documents:</p> <p>Kent Thameside SFRA</p> <p>Dartford Borough Council Town Centre SFRA</p> <p>DBC Adopted Core Strategy</p> <p>GBC Adopted Core Strategy</p>	1. Ensure new developments incorporate SuDS in accordance with : the NPPF, relevant local planning documents; and requirements of the relevant SuDS Approving Body (SAP)	GBC, DBC	EA, KCC	Long Term	Low
			2. Ensure new developments do not increase the risk of surcharge of sewer network within their catchment.	EA, GBC, DBC, TW & SW	KCC	Long Term	Low
			3. Stakeholder engagement to inform the public about the benefits of rainwater reuse and recycling for e.g. Rainwater harvesting.	KCC, EA, GBC, DBC	TW & SW	Long term	Low
3	All Drainage areas	Develop and implement a monitoring strategy for areas highlighted within the FMfSW deep.	1. Use the Stage 1 SWMP to identify a list of areas highlighted within the FMfSW at risk from deep flooding.	EA, KCC	GBC, DBC	Long Term	Low
			2. Develop a monitoring schedule of these areas to check and verify the mapping during extreme events	EA, KCC	GBC, DBC	Long Term	Low
			3. Use records of flood incidents to check against the FMfSW annually, to ascertain whether any further areas highlighted as being at risk in the national mapping needed further work / investigation.	EA, KCC	GBC, DBC	Long Term	Low
5	All Drainage Areas	Improve the understanding within LLFA and partners of the natural and manmade drainage systems.	Develop and implement a strategy for effective land and drainage management.	KCC	SW TW GBC, DBC	Long Term	Medium
6	All Drainage Areas	Raise awareness within the Districts/ Boroughs of the problems caused by inappropriate disposal of Fats Oil and Grease (FOG) to drains and gullies.	Reduce the inappropriate dumping of Fats Oils and Grease by developing and implementing a campaign to educate the public of the impacts on drainage. In addition, consideration, along with stakeholder engagement as to the whether a collection for of Fats Oil and Grease (FOG) within the relevant authority areas, could reduce	KCC, GBC, DBC	EA,	Long term	Medium

Ref	Applicable Drainage Areas	Action/Option (What?)	Priority Actions (How?)	Lead Action Owner	Supporting Action Owner(s)*	Priority (When?) **	Indicative Relative Cost
7	DA01 and DA02	As a result of the findings of the Stage 1 SWMP certain areas have been highlighted as being at high risk. It is recommended that further detailed SWMPs are completed in Dartford, Swanscombe and Gravesend.	the inappropriate disposal of FOGs	Complete detailed SWMPs for these areas	KCC	EA DBC GBC	Short Term Up to 50k (per SWMP)

DBC - Dartford Borough Council
 EA - Environment Agency
 GBC - Gravesham Borough Council
 KCC - Kent County Council

SDC - Sevenoaks District Council
 SW - Southern Water
 TW - Thames Water
 SDC - Sevenoaks District Council

****Priority:** Quick win = within 12 months. Short Term = up to 2 years. Medium Term = up to 5 years. Ongoing = regular monitoring.

4.3 Location Specific Action Plan

Table 4-2 describes the action plan for specific locations. Each action has been defined into its particular drainage area and receptor. Through discussion with the key partners specific actions for this stage of the Surface Water Management Plan were defined. It should be noted that a specific action has not been defined for every receptor.

Table 4-2 Location Specific Action Plan

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
DA01	Dartford North West (A)	Dartford North West	There are repeated events in recent years where blocked/ overloaded drains have caused issues for this area; the following may be feasible:						
			Complete a study to investigate the condition of gullies and drains.	Improved conveyance through gullies	Include study within future schedule of works	DBC, KCC	EA, TW	Short term	Up to 50k
			Consider use of green infrastructure or localised measures (kerbing, minor bunding, signage, fringe interception etc) to improve management of surface water during intense rainfall.	Improved surface water management	Include study within future schedule of works	DBC, KCC	EA, TW	Short term	Up to 50k
		Priory Road	Priory Road was linked to the surface water pipe that outfalls to the River Darent. There is a lack of fall and capacity to the sewers that join at the back of properties.						
			Investigate the possibility of increasing the size of the outfall draining the road to the River Darent	Improved drainage to Priory Road	Include study within future schedule of works	KCC	DBC/EA	Quick Win	Up to 50k
DA01	Dartford Central (B)	Spring Vale	<i>Repeated events on Spring Vale even following clearance of gullies suggest there are issues that need to be considered. KCC Highways are aware of the problem and have an action programmed for this year to replace the pumping station</i>						
			KCC Highways to replace pumping station as part of this year's (2012) programmed works.		Study included within 2012 schedule of works	KCC	EA, TW, DBC	Quick Win	Up to 100k
			KCC Highways to monitor the situation		Include study	KCC	EA, TW,	Long	Up to 50k

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
					within future schedule of works		DBC	Term	
DA01	Dartford Central (B)	Princes Road (B & C)	Complete a study to investigate the condition of gullies and drains.	May reduce the events of surface water flooding	Include study within future schedule of works	DBC, KCC	EA, TW	Short term	Up to 50k
DA01	Dartford South/ Hawley Road (C)	Hawley Road	<i>There are regular incidences of flooding on this road and records describe that this is due to an inadequate carrier pipe. At Hawley Road there used to be an outfall from Hawley Road to the river. When there was excavation for gravel, DBC believes this pipe was not reinstated and therefore this is one of the causes of the problem in this area. KCC Highways have included within their programmed works for this year (2012) to carry out an investigation of the drains and gullies at Hawley road, involving catchment analysis, CCTV survey, and assessment of drain/gully capacity.</i>						
		Norman Road	Complete a study to investigate the condition of gullies and drains.	Will identify the issue at Hawley Road	Study included within 2012 schedule of works	KCC	EA, TW	Short term	Up to 50k
			Investigate the possibility of reinstating the outfall draining the road to the River Darent	Hawley Road	Include study within future schedule of works	KCC	DBC/EA		Up to 50k
			<i>A property was affected and water levels reached a car door height. DBC referred to an outfall to Brooklands Lake where the drainage problem relates to the gradient of the pipe.</i>	Drainage of Norman Road	Include study within future schedule of works	KCC, TW	DBC/EA	Long Term	Up to 50k
		Green Street Green Road,	<i>DBC confirmed that the problem here is due to maintenance of the soakaways</i>						

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
DA01	Dartford South/ Hawley Road (C)	Princes Street, Dartford	Investigate the state of the soakaway and depending on the outcome of the study to replace or improve the existing soakaway.	Improved surface water management	Include study within future schedule of works	KCC	DBC	Medium term	Up to 50k
		Milestone Road	<i>DBC describes flooding here is due to an inadequate soakaway</i> Investigate the state of the soakaway and depending on the outcome of the study to replace or improve the existing soakaway.	Improved surface water management	Include study within future schedule of works	KCC	DBC	Medium term	Up to 50k
DA01	Dartford South/ Hawley Road (C)	Park Road, Dartford	<i>Dartford Borough Council (2004) have highlighted within their records provided as part of this study that the "carrier pipe size is inadequate". Since 2004 a scheme was prepared and handed across to KCC Highways, and included reshaping of the highway</i> KCC to review the priority of this scheme.						
				Park Road, Dartford	Include study within future schedule of works	KCC	DBC	Quick Win	Up to 50k
DA01	Dartford South East (D)	Watling Street	<i>There is a dip in the road and regular problems are reported here. Reason may be due to a blockage in the drainage system / soakaway not being of sufficient capacity.</i> Investigate the efficiency of the existing soakaways/ drainage system with a view to improving or replacing						
				Improved drainage around the Hospital and to Watling Street	Include study within future schedule of works	KCC	EA	Short term	Up to 50k
DA01	Stone (E)	Stone Recreation Ground,	<i>There have been repeated incidents of flooding on the London Road, through Stone. Mostly these events are due to an accumulation of runoff. KCC Highways explained that soakaways have been reinstated at the recreation grounds in Stone this year (2012)</i>						

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
			KCC Highways to monitor the situation.	To ensure new soakaway is working.	Include study within future schedule of works	KCC	EA, TW, DBC	Long Term	Up to 50k
DA01	Swanscombe (G)	Craylands Lane	<i>There are repeated incidents of flooding on Craylands Lane, predominantly these are located at the junction with London Road, the following solutions may be feasible:</i>	Improve driving conditions	Include study within future schedule of works	KCC, & SW	DBC/EA	Short term	Up to 50k
			Investigate the method of surface water drainage on this road, i.e. check records to assess where the surface water is draining to.		Include study within future schedule of works	KCC	DBC	Short term	Up to 50k
			Install green infrastructure or localised measures (kerbing, minor bunding, signage etc) to improve management of surface water during intense rainfall.						
DA01	Swanscombe (G)	Manor Way	<i>Anecdotal evidence suggests that Manor Way floods extensively and a number of business premises are affected. Southern Water has contributed substantial investment into the refurbishment of Manor Way pumping station. KCC highways are aware of the problem at Manor Way, Swanscombe.</i>	Business Premises on Manor Way	Include within future programme of works	KCC, TW	DBC/EA	Long term	Up to 50k
			KCC Highways, has negotiated that a new development at Manor Way is required to upgrade the existing drainage system via a Section 278 Agreement ¹¹						
		Southfleet Road	<i>11 incidents of flooding recorded over the past 4 years - anecdotal evidence suggest possible causes include burst water main, surface water and blocked gullies. It would be feasible to ascertain what is the overall cause of the issue at this location therefore the following options are recommended</i>	Identification of drainage paths	Include study within future schedule of works	KCC, TW	DBC/EA	Short Term	Up to 50k

¹¹ Facility to allow private developers to either pay for or carry out off-site works to public highways

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
			A CCTV study to investigate the condition of drains and gullies. (This has been included within KCC programme of works for the next financial year)	Identify potential blockages	Study included within 2013 schedule of works	KCC	TDC	Medium Term	Up to 50k
DA02	Northfleet (C)	Campbell Road	<i>Records describe a number of properties affected by flooding from surface water since the installation of dropped kerbs</i>						
			Investigate the method of surface water drainage on this road, i.e. check records to assess where the surface water is draining to.	Identification of drainage paths	Include study within future schedule of works	KCC, SW	GBC/EA	Short Term	Up to 50k
			Install green infrastructure or localised measures (reinstate high kerbs, minor bunding, signage etc) to improve management of surface water during intense rainfall.	Residents of Campbell Road	Include study within future schedule of works	KCC	GBC	Long term	Up to 50k
DA02	Gravesend South (D)	Orchard Avenue	<i>Anecdotal evidence reports that a blocked drain caused a property to flood with a water depth of 7 inches- this is a recurring problem</i>						
			A CCTV study to investigate the condition of drains and gullies.	Identify potential blockages	Include study within future schedule of works	KCC	GBC	Medium term	Up to 50k
		Pinnocks Avenue	<i>Reports describe the carriageway was flooded. Flood waters were described as also affecting garages and gardens of properties The FMFSW indicate this is a low lying spot therefore it may be feasible to consider the following:</i>						
DA02	Westcourt South (H)	Valley Drive	Investigate the current method of surface water drainage on this road, i.e. check records to assess whether the surface water is draining to foul or surface water sewer.	Identification of drainage paths	Include study within future schedule of works	KCC, SW	GBC/EA	Short Term	Up to 50k
			Consider implementing some form of SUDS such as retention, or storage to alleviate issues during heavy rainfall events	Improved surface water management	Include study within future schedule of works	KCC, SW	GBC/EA	Long term	Up to 50k
DA02	Westcourt South (H)	Valley Drive	<i>Reports show that blocked drains caused the carriageway, a number of properties and vehicles to flood.</i>						

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
			Install green infrastructure or localised measures (the kerbing, minor bunding, signage etc) to improve management of surface water during intense rainfall.	Improved surface water management	Include study within future schedule of works	KCC	GBC	Long term	Up to 50k
DA03	Istead Rise (B) Hook Green (D),	Wrotham Road	<i>There are nine incidents recorded along Wrotham Road across various locations. KCC Highways described that a hotspot for flooding is located opposite the junction with Norwood Lane. Highways described that four new soakaways were placed in parish land adjacent to the highway to aid with the drainage on Wrotham Road. Also additional soakaways are planned on Wrotham Road through Istead Rise.</i>						
			Monitor the performance of the newly installed soakaways.	Improved surface water management	Include study within future schedule of works	KCC	GBC	Long term	Up to 50k
DA03	Istead Rise (B),	School Lane	<i>2010 volume and intensity of water cause three manholes to lift – no properties were affected.</i>						
			Investigate the method of surface water drainage on this road, i.e. check records to assess where the surface water is draining to.	Identification of drainage paths	Include study within future schedule of works	KCC, SW	GBC/EA	Short Term	Up to 50k
DA04	Birchwood Road (A)	Birchwood Road	Anecdotal evidence describes this as a recurring problem with recorded depths of 1.5ft. DBC explains that there is an issue with a lagoon that requires desilting. Flooding on Birchwood Road also has a knock on affect in Bexley; DBC describes that flooding affects 3 properties in Bexley.						
			Desilt the lagoon on Birchwood Road.	Improve drainage	Include study within future schedule of works	KCC, TW	DBC /EA	Quick Win	Up to 50k
		Summerhouse Drive	Flooded road conditions have caused road accidents in the past						

DA	Area of benefit	Location of action	Action	Benefits	Next Steps	Action Owner	Supporter	Priority *	Indicative Cost (£) **
			A CCTV study to investigate the condition of drains and gullies.		Include study within future schedule of works	KCC	DBC	Medium term	Up to 50k
DA04	Heath Side and Willmington (B)	Clayton Croft Road & Common Lane	There are repeated events described at this locations in historic data from various source, DBC explains that the issues here are due to a soakaway that does not work.						
			Investigate the efficiency of the existing soakaways/ drainage system with a view to improving or replacing	Improved drainage around the Hospital and to Watling Street	Include study within future schedule of works	KCC, EA, DBC		Short term	Up to 50k
DA04	Sutton at Hone (D)	Main road	Historic records describe silt and mud being washed down from the field. DBC describes that this is an on-going problem due to the method a local farmer uses to plough his field; he explained that residents are very aware of this and have policed the situation in the past by calling highways if they see the farmer ploughing his field incorrectly. Future action will involve resident 'self policing' and monitoring the situation.						
			Residents are to inform KCC highways when field is being ploughed incorrectly and surface water run off becomes an issue.	n/a		KCC and Residents	DBC	Medium term	Up to 50k
DA04	Darenth (E)	Green Street Green Road	There are repeated incidents of flooding on this road; records suggest that soakaways are inefficient in this area. KCC Highways have recently installed soakaways.						
			KCC Highways to monitor the situation		Include monitoring within future schedule of works	KCC	EA, TW, DBC	Long Term	Up to 50k
DA04	Dartford Rural East (F)	Station Road	Anecdotal evidence suggests there are issues at this location with drainage ditches, blocked gullies and surface water. A new soakaway has been installed recently.						
			KCC Highways are to increase the frequency of maintenance on this road	Improve the effectiveness of the drainage system	Include Station road within future schedule of works	KCC	DBC	Medium term	Up to 50k

* Priority: Quick win = within 12 months. Short Term = up to 2 years. Medium Term = up to 5 years. Ongoing = regular monitoring.



***** Indicative Cost: Up to 50k, 50-150k, 150-250k or 250+k***

4.4 Review Timeframe and Responsibilities

The project partners have reviewed and commented upon the actions during the Action Plan workshop.

High priority actions identified in the ‘Action Plan’ are likely to be those addressed first. However, this report can only consider relative priorities *within* Thameside. Some partner organisations, the Environment Agency, Southern Water, Thames Water Kent County Council have flood risk management responsibilities beyond the geographic scope of this study, and therefore the priority of actions within Thameside will have to be assessed against actions in other areas. Kent County Council is currently embarking upon a number of more strategic-scale SWMPs in a number of other settlements across the county.

Actions leading to capital works will initially require a detailed local study that provides robust estimates of costs and justification (i.e. tangible benefits) of the scheme. If a study demonstrates that a scheme is beneficial funding will need to be obtained before it can be delivered. Applications for funding and the implementation of solutions on the ground, all of the detailed study and availability of funding have the potential to change the findings and recommendations of this report.

It is recommended that an annual review of the High and Medium Priority actions is undertaken. This will allow for forward financial planning in line with external partners and internal budget allocations. Low priority actions should be reviewed on a three-year cycle.

4.5 Sources of funding

Funding for local flood risk management may come from a wide range of sources. In Thameside these may include:

- Dartford Borough Council
- Defra (Flood Defence Grant in Aid through the Environment Agency)
- Gravesham Borough Council
- Industrial estate owners and businesses
- Kent County Council (highways)
- Local communities
- Network Rail
- New developments (directly through the developer or through CIL)
- Southern Water
- Thames Water

It is likely that not all schemes in Thameside will have sufficiently strong cost-benefit ratios to attract 100% funding from Defra Flood Defence Grant in Aid (FDGiA), and would therefore require a portfolio of funding to be developed from various sources, including funding sources available for delivering other objectives such as improvements to highways, public open spaces and bio-diversity.

4.6 Ongoing Monitoring

The partnership arrangements established as part of the SWMP process should continue beyond the completion of the SWMP in order to discuss the implementation of the proposed actions, review opportunities for operational efficiency and to review any legislative changes.

The SWMP Action Plan should be reviewed and updated once every six years as a minimum, but there may be circumstances which might trigger a review and/or an update of the action plan in the interim, for example:

- Occurrence of a surface water flood event;
- Additional data or modelling becoming available, which may alter the understanding of risk within the study area;



- Outcome of investment decisions by partners is different to the preferred option, which may require a revision to the action plan, and;
- Additional (major) development or other changes in the catchment which may affect the surface water flood risk.

The action plan should act as a live document that is updated and amended on a regular basis, and as a minimum this should be as agreed in the Local Flood Risk Management Strategy for Kent, although individual partners may wish to review their actions more regularly.



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