

North Kent Rivers Catchment Flood Management Plan

Summary Report December 2009

managing flood risk



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Introduction



I am pleased to introduce our summary of the North Kent Rivers Catchment Flood Management Plan (CFMP). This CFMP gives an overview of the flood risk in the North Kent Rivers catchment and sets out our preferred plan for sustainable flood risk management over the next 50 to 100 years.

The North Kent Rivers CFMP is one of 77 CFMPs for England and Wales. Through the CFMPs, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, groundwater, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). Our coverage of surface and groundwater is however limited due to a lack of available information.

The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMPs to help us target our limited resources where the risks are greatest.

This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process, however it is only the first step towards an integrated approach to flood risk management. As we all work together to achieve our objectives, we must monitor and listen to each others progress, discuss what has been achieved and consider where we may need to review parts of the CFMP.

The main sources of flood risk in the North Kent Rivers CFMP area are localised river flooding along the Darent, Shuttle and Cray and surface water flooding in

urban areas including the Medway Towns, and some villages on the Isle of Sheppey.

We cannot reduce flood risk on our own, we will therefore work closely with all our partners to improve the co-ordination of flood risk activities and agree the most effective way to management flood risk in the future. The key partners we have worked with are Kent County Council, Upper and Lower Medway IDB, Medway Unitary Authority, Maidstone District Council, Swale District Council, Tandridge District Council, Sevenoaks District Council, London Borough of Bromley, Gravesham District Council, Mid Kent Water, London Borough of Bexley, London Borough of Greenwich, Dartford Borough Council, Thames Water, Tonbridge & Malling Borough Council, Sutton & East Surrey Water, Natural England, South East Water, Southern Water, Surrey County Council, Darent River Preservation Society and Canterbury City Council.

This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing enquiries@environment-agency.gov.uk or alternatively paper copies can be viewed at any of our offices in Southern Region.

A handwritten signature in dark ink, appearing to read 'T. Willison', written in a cursive style.

Toby Willison
Regional Director, Southern Region

Contents

The purpose of a CFMP in managing flood risk	5
Catchment overview	6
Current and future flood risk	8
Future direction for flood risk management	11
Sub-areas	
1 Shuttle and Upper Cray	13
2 Upper Darent and tributaries	14
3 Dartford and Ebbsfleet	15
4 North Kent Marshes	16
5 North Kent Downs	17
6 Medway Tributaries	18
Map of CFMP policies	19

The purpose of a CFMP in managing flood risk

CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

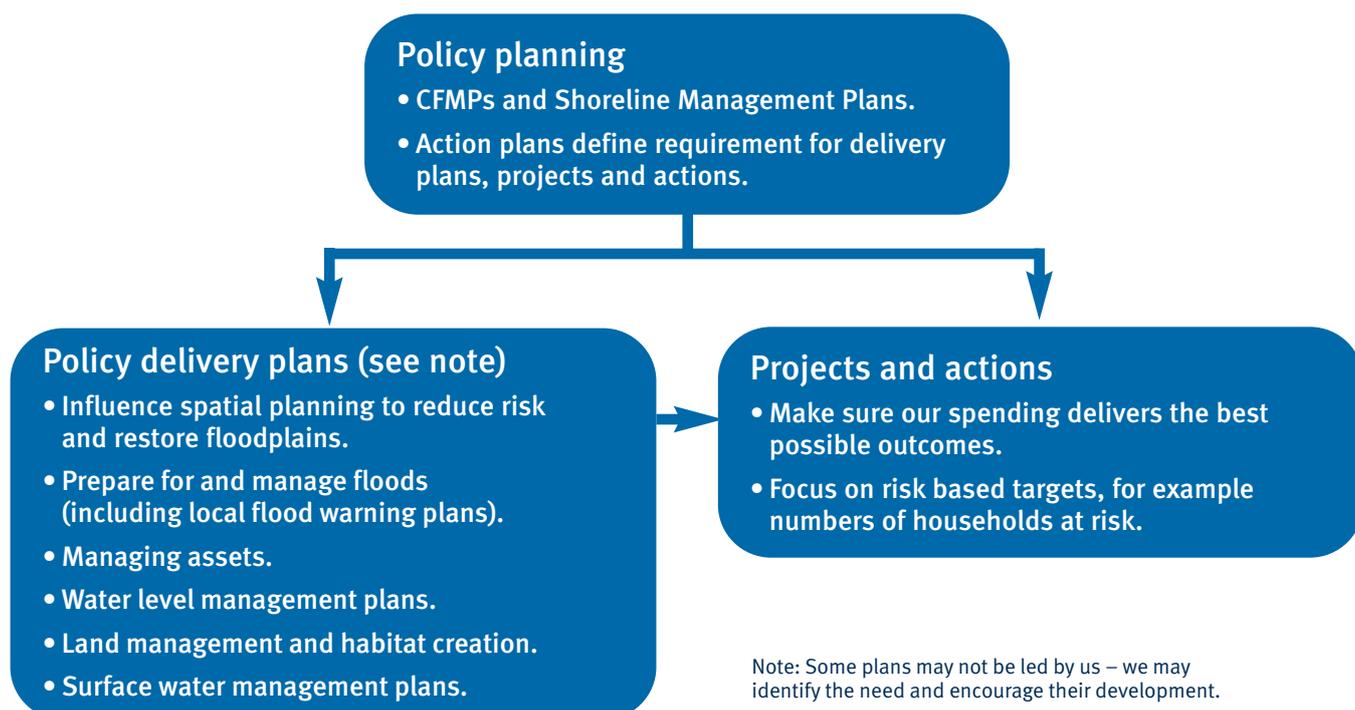
- The Environment Agency, who will use the plan to guide decisions on investment in further plans, projects or actions;
- Regional planning bodies and local authorities who can use the plan to inform spatial planning activities and emergency planning;

- IDBs, water companies and other utilities to help plan their activities in the wider context of the catchment;
- Transportation planners;
- Land owners, farmers and land managers that manage and operate land for agriculture, conservation and amenity purposes;
- The public and businesses to enhance their understanding of flood risk and how it will be managed.

CFMPs aim to promote more sustainable approaches to managing flood risk. The policies identified in the CFMP will be delivered through a combination of different approaches. Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

The relationship between the CFMP, delivery plans, strategies, projects and actions is shown in figure 1.

Figure 1. The relationship between CFMPs, delivery plans, projects and actions.



Catchment overview

The main characteristics of the North Kent Rivers CFMP area are different topography and geology, with significant groundwater components in the headwaters and narrow valleys of the chalk block. More dense river networks, broad valleys and active floodplains where geology and soils are impermeable. The tidal influence has a major bearing on the character of the lower parts of the River Darent and the marshes that border the estuaries. The catchment is split by

a ridge of high ground, the North Downs, running east to west, separating the upper and lower reaches of both the narrow, steep River Darent and the low flat River Medway.

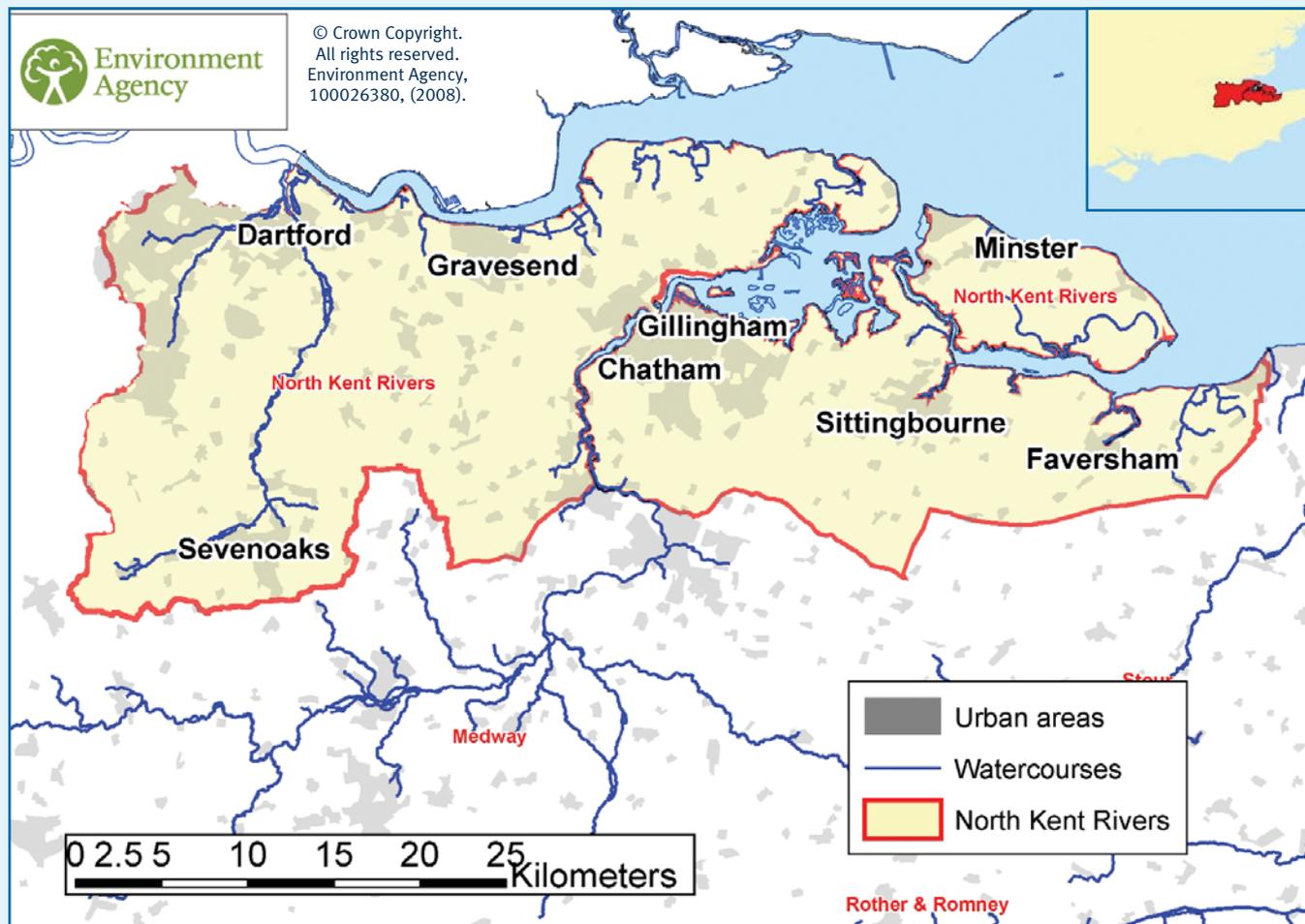
The area is home to around 880,000 people and includes several important urban centres, which are mainly concentrated near the estuaries. These include Dartford, Gravesend, Sittingbourne, Faversham, and the Medway Towns

(Chatham, Rochester and Gillingham). These towns, as well as many smaller towns and villages, contribute to the regional economy and are focal points for many of the visitors to the region every year. Important issues are the availability of water resources, the urban development of Thames Gateway and the environmental designations of the Marshes and the North Downs.



← High flood waters at Church Street Bridge, Shoreham, Kent.

Map 1. Overview map of the North Kent Rivers catchment.



‘The North Kent Rivers catchment is split by a ridge of high ground, the North Downs, running east to west, separating the upper and lower reaches of both the narrow, steep River Darent and the low flat River Medway’

Current and future flood risk

Overview of the current flood risk

Flood risk is the combination of the likelihood of a flood occurring and the consequences when it does. The main sources of flood risk in the North Kent Rivers area are from river flooding along the Darent, combinations of fluvial and surface water flooding in the Cray and Shuttle sub-area, localised flooding due to the poor passage of water and blockage of outfalls by high tide along the coast (tide-locking). Floods bring consequences to people, properties and the environment. The risk of non-tidal flooding in the CFMP area is small compared to the risk of tidal flooding, however, all floods can cause significant disruption and stress. We have assessed flood risk across the CFMP area using broad-

scale computer modelling, though making best use of existing knowledge and models where appropriate. Flood risk figures take into account current flood defences.

Historical records show intense storms have caused flooding since 1897. The main river flooding occurs either along the Darent or in the Cray/Shuttle sub-area, this flooding is caused by high rainfall in conjunction with an impervious catchment, for example it is already saturated by rain. Intense thunderstorms are the main cause of flooding in the smaller, steeper and more urbanised Cray and Shuttle catchment, and these tend to happen in the summer.

Where is the risk?

The map on page 10 illustrates the distribution of the flood risk from a one in 100 year river flooding event and one in 200 year coastal inundation in the North Kent Rivers CFMP area.

The areas with the highest concentration of properties at risk from river flooding are tabulated on page 9.

How we currently manage the risk

There are considerable tidal defences in the North Kent Rivers catchment but these are not discussed in this document. For information about tidal



↑ Aylesford Bridge.

flooding and risk in this area please see the Medway Estuary and Swale and Isle of Grain to South Foreland Shoreline Management Plans.

- **Maintenance of existing and commission of new flood defences and structures** such as the Darent channel was realigned and enhanced at Westerham, while at Chipstead a flood relief channel diverts floodwaters to a storage lake. The improvement works consisted of walls and embankments from Dartford Creek Barrier up to the town centre. We have carried out flood defence improvements in Brasted and are investigating a flood alleviation scheme at Aylesford.
- **Flood forecasting and warnings** at present, we provide warnings through the flood warnings direct service to 1350 households and 24 professional partner organisations in the North Kent Rivers catchment.
- **Development control** to influence spatial planning so that new developments are sited away from flood risk areas, or take appropriate mitigation measures.
- **Flood risk mapping** to ensure we understand future and current flood risk.
- **Strategic planning** to plan long term investment.
- **Environmental improvements** such as seeking opportunities to add eel passes to flood risk management structures.

Table 1. Locations of towns and villages with 25 or more properties at risk in a 1% annual probability river flood.

Number of properties at risk	Locations
>1000	Dartford and Ebbsfleet, Shuttle and Upper Cray, North Kent Marshes
500 to 1000	Upper Darent and tributaries
100 to 500	Medway Tributaries
50 to 100	None
25 to 50	None

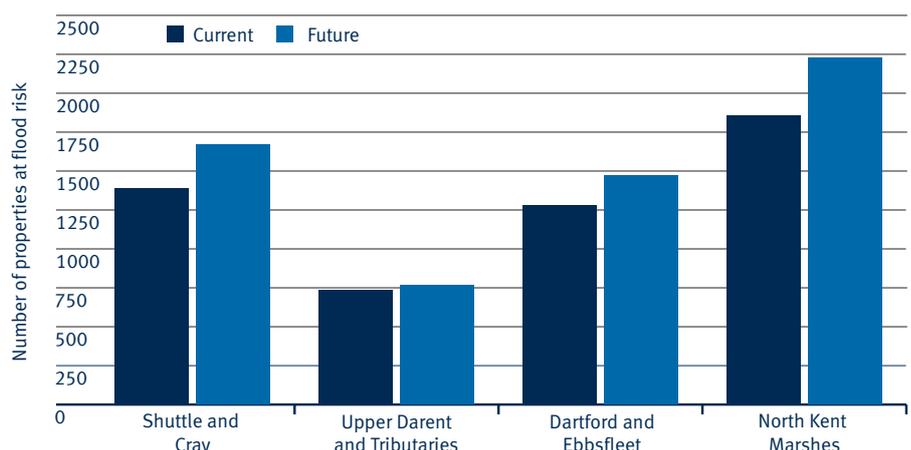
Table 2. Critical infrastructure at risk:

2 emergency services, 2 hospital/clinics, 14 electricity sub-stations, 5 schools

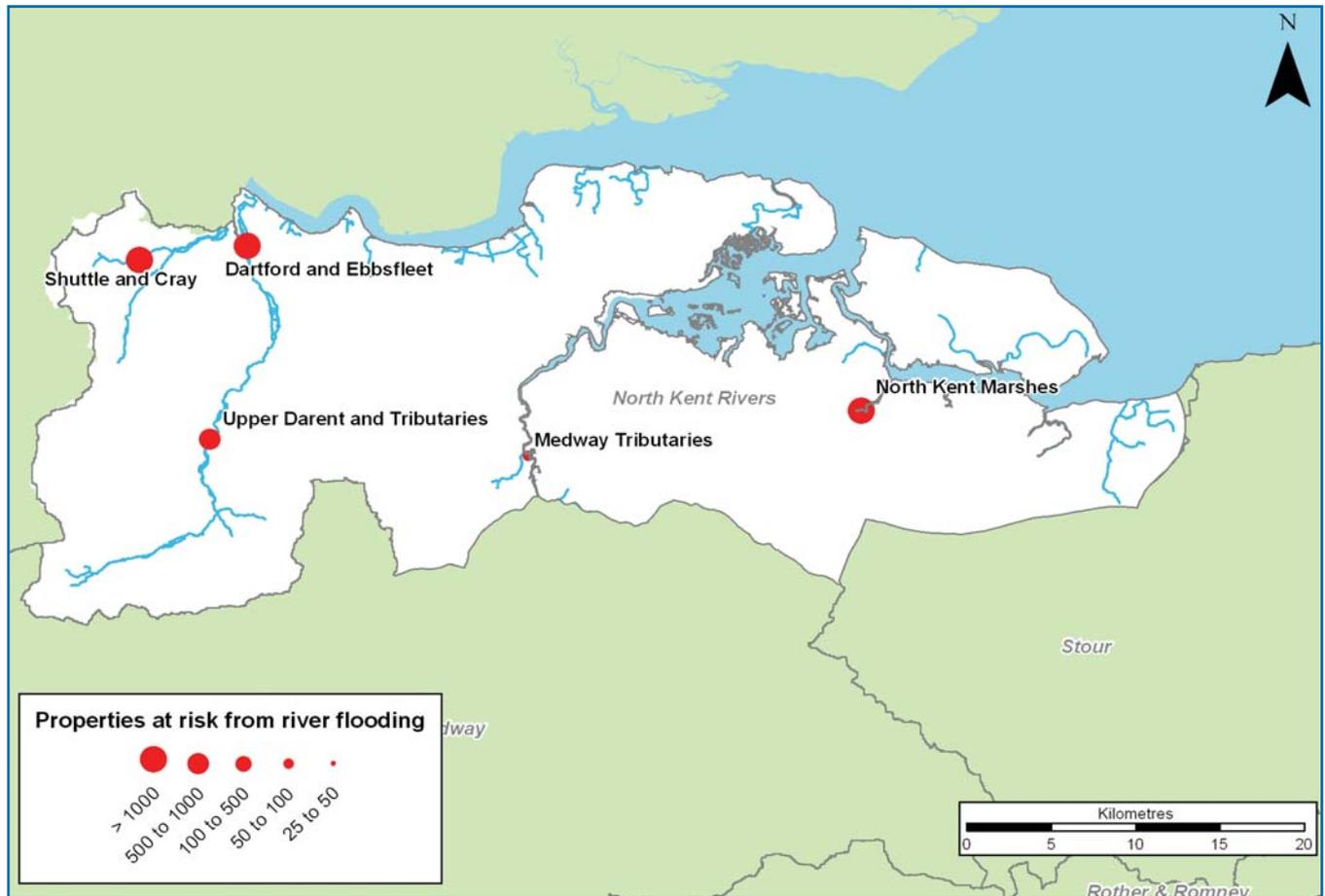
Table 3. Designated sites at risk:

The Swale, Thames Estuary and Marshes, Medway Estuary and Marshes Special Protection Areas and Ramsar

Figure 2. Current and future (2100) flood risk to property from a 1% annual probability river flood, taking into account current flood defences.



Map 2. Flood risk to property in a 1% annual probability river flood, taking into account current flood defences.



The impact of climate change and future flood risk

The effect that flooding will have in the future is influenced by a range of issues such as climate change, changes in land use such as development, and changes in how land is managed.

Predictions of future change are based on understanding the existing condition of the catchment, an extrapolation of trends over the long term (up to 100 years), and a high level review of likely future change based on research findings and knowledge. The broadscale modelling found the future urban development scenario to have no significant impact on fluvial flooding. While the sensitivity tests show that land management changes are significant, our current best estimate and

feedback from consultation show that the dramatic changes in land management required to influence flood risk at a catchment scale are highly unlikely. This means that there will be no net effect of land use change on flood risk, so we propose to use an unchanged land use in our scenario for 2100. From the three drivers tested, climate change had the largest impact on the North Kent Rivers catchment with up to 20% increase in peak flood flows.

This scenario is used to assess likely impacts in the catchment. In the North Kent Rivers catchment the future flood risk is likely to be from river flooding and, to a lesser degree, surface water flooding. Our appraisal of the future risk

in the catchment reveals the number of properties at risk to the 1% annual probability event will increase from 5523 to 6443 properties by the year 2100. The majority of these properties are located in the North Kent Marshes, Dartford, Ebbsfleet and along the River Darent.

The key trends are:

- More frequent and intense storms causing more widespread and regular flooding from drainage systems and some rivers.
- More rain in winter, increasing the likelihood of large scale flood events.

Future direction for flood risk management

Approaches in each sub-area

We have divided the North Kent Rivers catchment into six distinct sub-areas which have similar physical characteristics, sources of flooding and level of risk. We have identified the most appropriate approach to managing flood risk for each of the sub-areas and allocated one of six generic flood risk management policies, shown in Table 4.

To select the most appropriate policy, the plan has considered how social, economic and environmental objectives are affected by flood risk management activities under each policy option.

Map 3. Sub-areas and flood risk management policies.

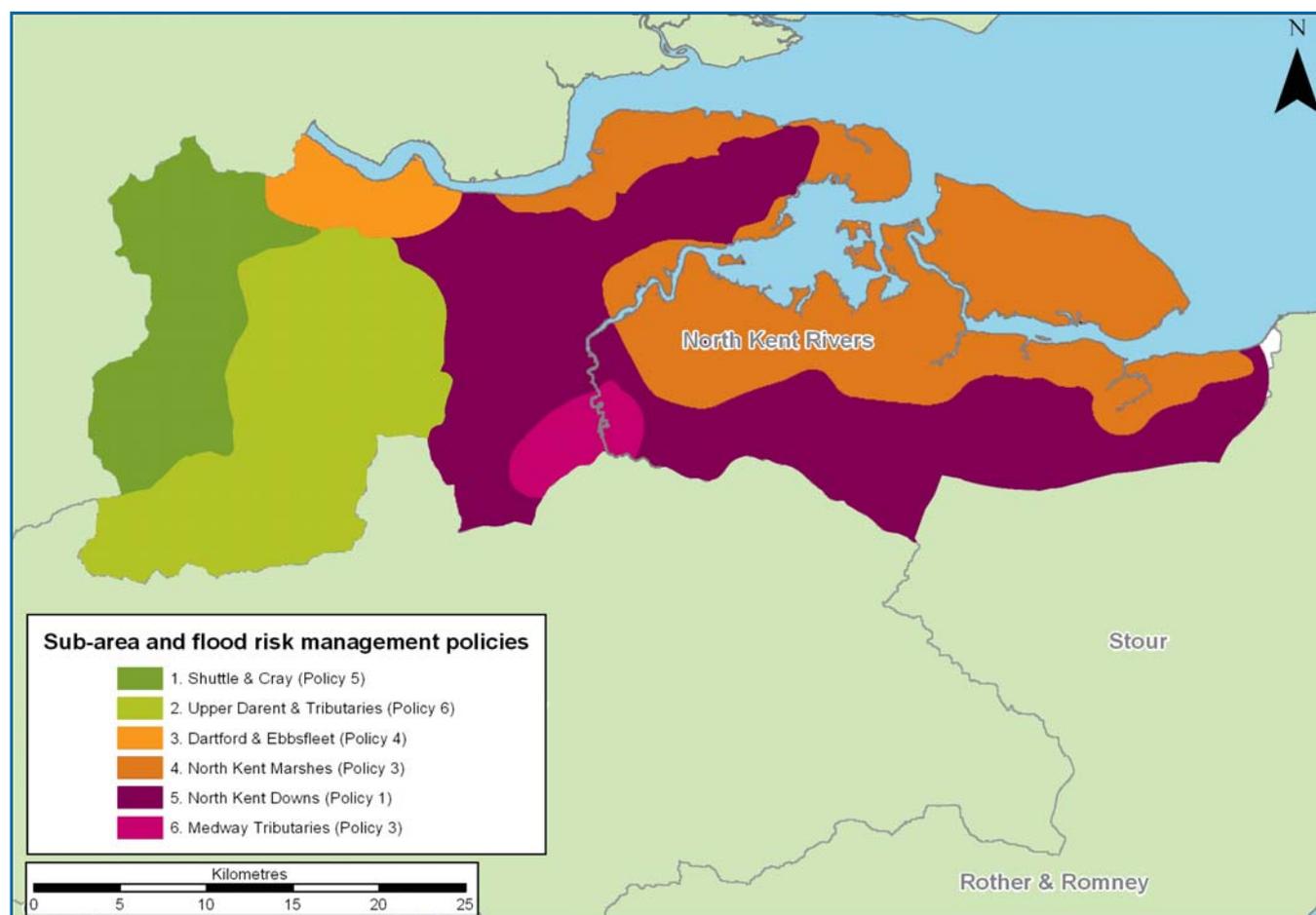


Table 4. Policy options.

→ Policy 1

Areas of little or no flood risk where we will continue to monitor and advise

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

→ Policy 2

Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

→ Policy 3

Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

→ Policy 4

Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

→ Policy 5

Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

→ Policy 6

Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

Shuttle and Upper Cray

Our key partners are:

London Borough of Bexley

London Borough of Greenwich

London Borough of Bromley

Dartford Borough Council and
Sevenoaks District Council

The issues in this sub-area

The main source of flooding is from a combination of overwhelmed surface drains and high flows in the Shuttle and Cray themselves. Significant flooding has occurred in 1897, 1958, 1977, and 2005 to some of the major conurbations in the area.

The vision and preferred policy

Policy Option 5 – areas of moderate to high flood risk where we can generally take further action to reduce flood risk.

The key messages

This policy supports sustainability (economic, social and environmental) through decreasing the level of risk for sustainable development, reducing impacts of flooding on infrastructure, human health, and upon conservation sites.

Impact of a 1% annual probability flood event

	Today	Future (2100)
Number of properties at risk	1389	1667*

* Future scenario figure extrapolated from similar catchment modelling in Southern Region.

Proposed actions to implement the preferred approach:

- Encourage the take up of flood resilience measures by people living within the floodplain.
- Work with the local authorities to provide development control advice to ensure no increase in run-off from new developments.
- Install high flow telemetry gauge on upper Cray to remodel Shuttle and Cray for flood mapping and warning. Explore ways to increase the warning time given to the public.
- Work with the London Borough of Bexley to undertake a Surface Water Management Plan (SWMP) to ensure that flooding from urban watercourses, drainage and main rivers are considered together.
- Work with the London Borough of Bromley to investigate non-main river flooding in Orpington.
- Work with the London Borough of Bexley to support the Crayford strategy in renaturalising the river Cray and river Wantsunt and reducing flood risk in the redevelopment of the area.
- Develop a System Asset Management Plan (SAMP). This plan should aim to reduce flood risk.



← B2186 Bridge in Crayford.

Upper Darent and tributaries

Our key partners are:

Dartford Borough Council

Sevenoaks District Council

Tandridge District Council,

Tonbridge and Malling Borough Council

Natural England

The issues in this sub-area

The sub-area covers the River Darent from its source and main tributaries include the Honeypot and Watercress streams near Sevenoaks. Flooding within this sub-area is caused by a combination of high river flows with other factors such as blocked culverts and bridges or problems with the operation of sluices.

The vision and preferred policy

Policy Option 6 – areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

Impact of a 1% annual probability flood event

	Today	Future (2100)
Number of properties at risk	737	767

The key messages

This policy supports sustainability (economic, social and environmental) through decreasing the level of risk for sustainable development, reducing impacts of flooding on infrastructure, human health, and upon three designated sites. (Knole Park (acid grassland), Dryhill (rock structures and fossils), and Sevenoaks gravel Pit).



↑ The River Darent at Eynsford.



↑ Under flood waters in 2000.

Proposed actions to implement the preferred approach:

- Undertake an operational review of privately owned/maintained structures.
- Investigate how the Chipstead Valley Lake system works.
- Encourage the take up of flood resilience measures by people living within the floodplain.
- Remodelling of Darent Valley with improved hydrology and with recent style rainfall events.
- Seek opportunities to work with landowners to create wetland habitat.
- Undertake feasibility study into reducing flood risk in the sub-area.
- Develop a System Asset Management Plan (SAMP). This plan should aim to reduce flood risk.
- Investigate soil erosion and land management. To provide recommendations for catchment wide measures to improve land management.
- Investigate surface water flooding risk.
- Groundwater flood warning.

Dartford and Ebbsfleet

Our key partners are:

Dartford Borough Council

Gravesham Borough Council and London Borough of Bexley

Impact of a 1% annual probability flood event

	Today	Future (2100)
Number of properties at risk	1282	1471

The issues in this sub-area

The sub-area covers the lower reaches of the River Cray from Crayford down to where the river joins both the Crayford and Dartford Creeks which converge with the Thames estuary. The tidal flooding consequences are extremely severe and therefore a high level standard of protection exists to protect Dartford town centre from a 0.1% event.



↑ Flood storage reservoir, Hall Place Gardens, Dartford.

The key messages

Flood risk in areas to be developed needs to be well understood so that proposed developments do not put more people at risk. This policy supports sustainability (economic, social and environmental) through maintaining the current level of risk to people and infrastructure (electricity, water, power and transportation).



↑ Surface water flooding in East Dartford, 1998.

The vision and preferred policy

Policy Option 4 – areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

Proposed actions to implement the preferred approach:

- Work with local authorities to provide development control advice to ensure no increase in run-off from new developments.
- Encourage the take up of flood resilience measures by people living within the floodplain.
- Remodelling of Darent Valley with improved hydrology.
- Formalise procedures for the use of Dartford Creek Tidal Barrier for river purposes.
- Develop a System Asset Management Plan (SAMP) to sustain the current level of flood risk into the future taking account of these actions.
- Review procedures for operations of sluices.
- Investigate flood routes from upstream of Dartford through the industrial areas.
- Gravesham Borough Council to investigate options for groundwater pumping at Ebbsfleet.

North Kent Marshes

Our key partners are:

Medway Council

Gravesham Borough Council

Swale Borough Council and
Canterbury City Council

Natural England

Southern Water

Impact of a 1% annual probability flood event

	Today	Future (2108)
Number of properties at risk	1856	2227*

* Future scenario figure extrapolated from similar catchment modelling in Southern Region.

The issues in this sub-area

The sub-area includes many smaller watercourses that flow from the Downs to the Thames Estuary and the Isles of Grain and Sheppey, including conurbations Sittingbourne, Faversham, Sheerness, Wallend, and Minster. Additionally, the Marshes are an important designated habitat for wading birds.

The vision and preferred policy

Policy Option 3 – areas of low to moderate flood risk where we are generally managing existing flood risk effectively.



↑ North Kent Marshes, Elmley Nature Reserve.

The key messages

This policy supports economic, social and environmental development by maintaining the current level of risk but accepting that the impacts of flooding will increase with time due to climate

change. Maintain link with the Medway and Swale Estuary and Isle of Grain to South Foreland Shoreline Management Plans (SMPs) to ensure integrated approach for coastal defence, river drainage and biodiversity on the marshes.

Proposed actions to implement the preferred approach:

- Encourage the take up of flood resilience measures by people living within the floodplain.
- Maintain outfalls for elvers and fishing interest.
- Ensure flood risk management does not adversely affect conservation interest in the marshes.
- Undertake further investigation of rapid response catchment identified in Chatham.
- Develop a System Asset Management Plan (SAMP). This plan should aim to reduce flood risk now or in the future in the urban areas whilst reducing maintenance costs for example by combining outfalls in the rural areas.
- Work with local authorities to investigate non-main river flooding in Borden, Chatham, Sittingbourne, Conyer, Faversham, Denton Marshes.
- Continue with flood risk investigation at Iwade.
- Investigate opportunities to work with landowners to create and restore wetland habitat in the marshes.
- Work with Swale Borough Council and Southern Water to undertake Integrated Surface Water Management Plans (SWMP).

North Kent Downs

Our key partners are:

Dartford Borough Council

Sevenoaks District Council

Gravesham Borough Council

Tonbridge and Malling
Borough Council

Medway Council

Maidstone Borough Council

Swale Borough Council

Canterbury City Council

Impact of a 1% annual probability flood event

	Today	Future (2100)
Number of properties at risk	0	0*

* Future scenario figure extrapolated from similar catchment modelling in Southern Region.

The key messages

The local authorities and water companies will need to continue to maintain drainage assets in urban areas to prevent local flood risk from surface water and minor drains.

Proposed actions to implement the preferred approach:

- Continue to monitor and advise.

The issues in this sub-area

This sub-area covers the upper reaches of several smaller watercourses in the North Kent Downs and plains. It includes the major Medway towns of Rochester, Gillingham, and Rainham; and the large towns along the Thames including Northfleet and Gravesend. Flood risk is low in this area. No flood damage has been identified within this sub-area. No people or property, are affected by flooding.

The vision and preferred policy

Policy Option 1 – areas of little or no flood risk where we will continue to monitor and advise.



↑ Luddenham Marshes.

Medway Tributaries

Our key partners are:

Tonbridge and Malling
Borough Council

The issues in this sub-area

The sub-area covers the tributaries of the tidal Medway from Aylesford downstream to Holborough and includes the communities of New Hythe, Aylesford, Leybourne, Snodland, and West Malling. The most significant flood risk in this unit is from the tide. There are 259 properties currently at risk from the one in 100 year flood event and blocked culverts and inadequate surface water drainage could increase the depth and extent of flooding.

Impact of a 1% annual probability flood event

	Today	Future (2100)
Number of properties at risk	259	310*

* Future scenario figure extrapolated from similar catchment modelling in Southern Region.

The vision and preferred policy

Policy Option 3 – areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

The key messages

This policy supports sustainability (economic, social and environmental) through maintaining the current level of risks to people and the A20 whilst further investigations are underway.

Proposed actions to implement the preferred approach:

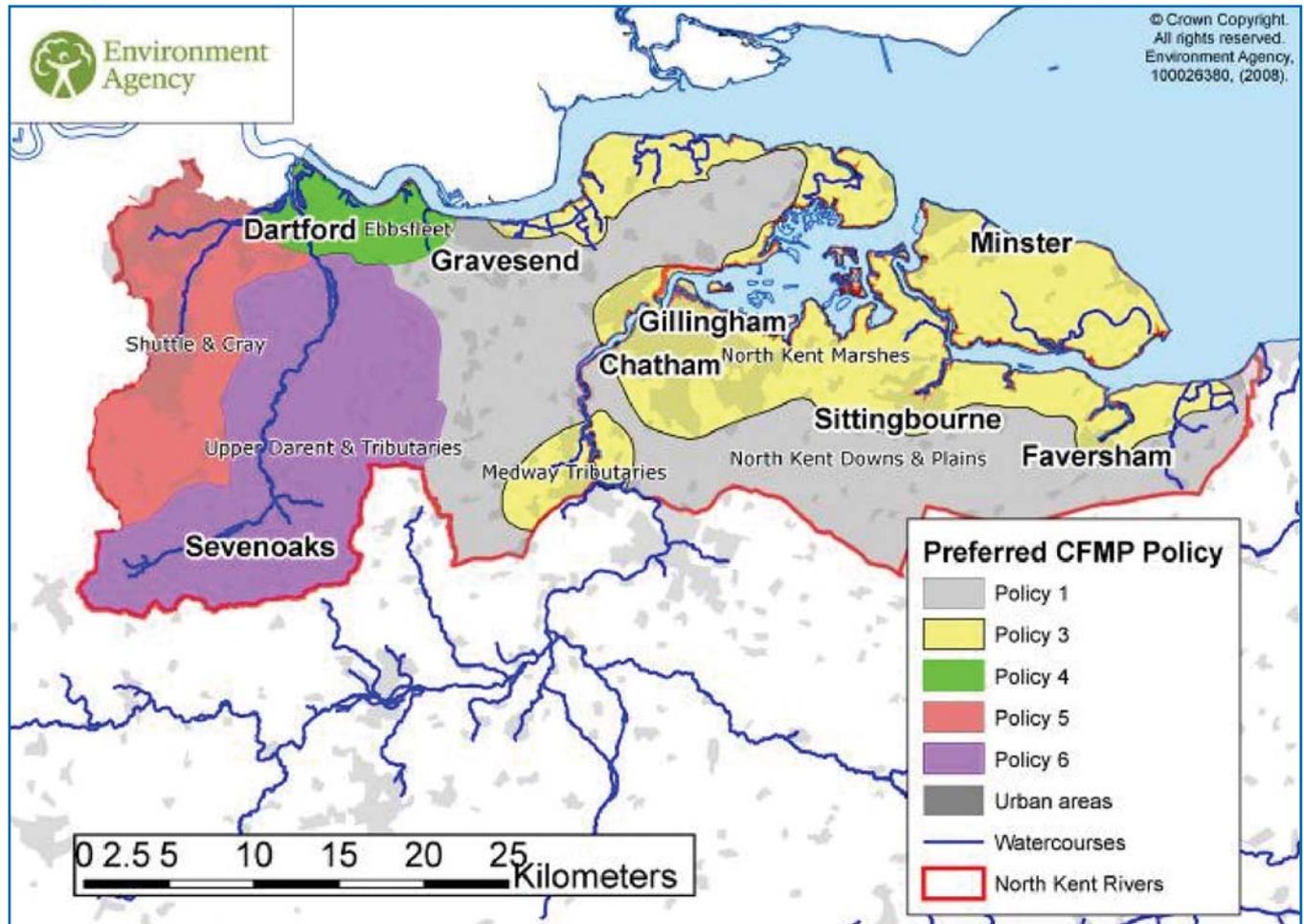
- Work with Tonbridge and Malling Borough Council to provide development control advice to ensure no increase in run-off from new developments planned seeking opportunities to reduce current run-off rates where possible.
- Encourage the take up of flood resilience measures by people living within the floodplain.
- Undertake study for Snodland Mill Stream to enhance understanding of flood risk in this policy unit.
- Tonbridge and Malling Borough Council to investigate non-Main River flooding in West Malling, Leybourne and New Hythe.
- Develop a System Asset Management Plan (SAMP).



↑ Isle of Sheppey salt marshes, Elmley Nature Reserve.

Map of CFMP policies

Map of the policies in the North Kent Rivers catchment.



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