

Thames Estuary 2100



Managing flood risk through London and the Thames estuary

TE2100 Plan

Consultation Document

April 2009

We are the Environment Agency. It's our job to look after your environment and make it **a better place** – now, and for future generations.

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April 2009



David Wardle
Thames Estuary Programme
Executive Manager
Environment Agency

I am pleased to present our Thames Estuary 2100 (TE2100) Plan for consultation. This document sets out our recommendations for flood risk management for London and the Thames estuary through to the end of the century. London and the Thames estuary communities benefit from a robust and well organised system of tidal flood risk management but increasing pressures, including climate change, mean that flood risk is increasing. The Government's 2004 Foresight¹ project reviewed the long-term impact of climate change on the UK and concluded that "Hard choices need to be taken – we must either invest more in sustainable approaches to flood and coastal management or learn to live with increased flooding."

TE2100 is the first major flood risk project in the UK to have put climate change adaptation at its core. Working with the Met Office Hadley Centre and other key organisations, we have used the latest science and improved our understanding of future climate change impacts in the Thames estuary. This gives us confidence that our Plan is adaptable to future climate change.

Flooding, from any source, can cause great distress and disturbance to those that experience it. The summer 2007 floods in the north-east and west midlands, highlighted in the recent Pitt Review², were an unwelcome reminder of the devastation that unpredictable high intensity

"Hard choices need to be taken – we must either invest more in sustainable approaches to flood and coastal management or learn to live with increased flooding."

rainfall, and river flooding can bring to local communities. The primary risk of flooding to the Thames estuary communities however is from the sea. It is this tidal flood risk that this Plan seeks to manage. The potential impacts of a tidal flood could be far more catastrophic than those from rivers or surface drains, however some of the lessons learned in the Pitt Review are equally relevant. We recognise in this Plan the importance of working in partnership with other organisations to improve our preparedness for flooding, and in

reducing the consequences of a tidal flood in the unlikely event it happens.

Our Plan is needed to provide confidence to those who live and work in London and the Estuary area that flood risk is understood and is manageable. Planners and investors will be reassured that there is an effective plan to manage flood risk today and for future generations.

A primary purpose of the TE2100 project has been to plan proactively for the future rather than waiting for the next flood catastrophe to provoke society into action. Our Plan is founded on sound science and an understanding of the opportunities and constraints in the Thames estuary, with adaptability to future change at its heart.

Our Plan is the result of many years of serious investigation, study and dialogue with planners, investors and those who live and work in the Thames estuary tidal flood risk area. We have already consulted with a wide range of partners throughout the development of this Plan and worked hard to ensure that the plans and strategies of other organisations are able to take

¹ Foresight: Flood and Coastal Defence, Sir David King, Government Chief Scientific Adviser, April 2004

² Sir Michael Pitt's review of the summer 2007 floods



account of our ideas as we have progressed. I am delighted that the Greater London Authority's Climate Change Adaptation Plan and Communities and Local Government's Thames Gateway Eco-Region Prospectus, to name but two, have already identified our work in helping to deliver their objectives. This demonstrates that we cannot plan for the future alone, therefore your input through this consultation is vital.

I hope that you will participate fully in our consultation to enable us to develop a TE2100 Plan which is effective in managing flood risk over the next 100 years, is workable and is supported by the community it serves.

A handwritten signature in black ink, appearing to be 'D. Ford'.

How to use this document

Understanding the icons and navigation

The icons below are used throughout this document to help communicate important messages.

Time horizons

The following icons are used to illustrate three distinct phases defining the actions required over the Short, Medium and Long Term. The icon colours are also used as a highlight behind text as an additional visual aid.



Flood risk management policy

The following icons are used to illustrate the five levels of flood risk management policies.



Information icon

The following icon is used to signify that more information is available.



Question icon

The following icon is used to denote where we invite your feedback.




Colour-coded page navigation

The following colour-coded page tabs are used for cross-referencing the policy units within each of the action zones. Each action zone is identified by a different colour.



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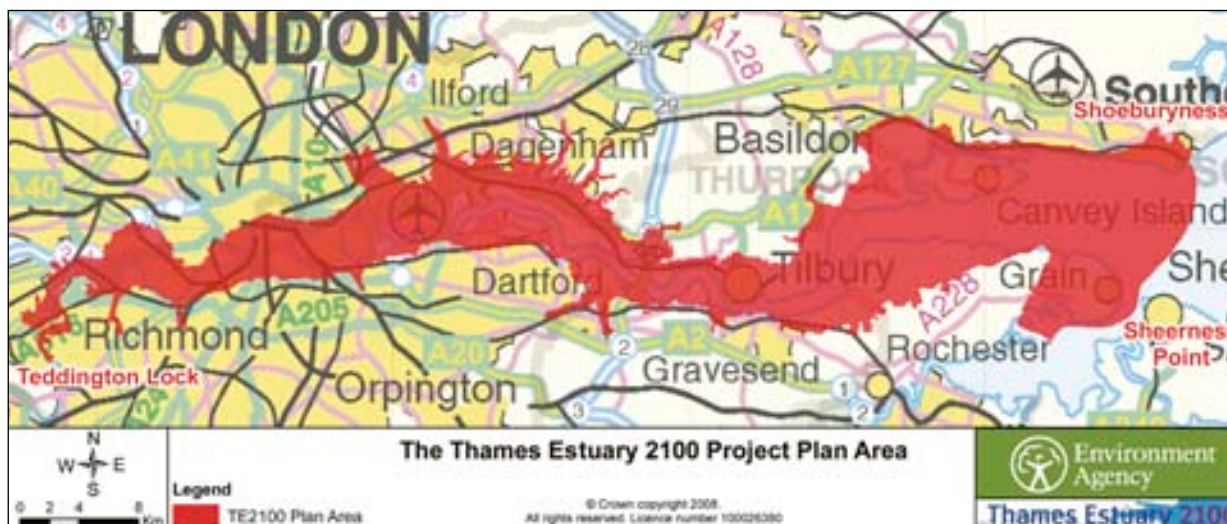
Chapter 1: Introduction and purpose of this consultation

Thames Estuary 2100

The Thames Estuary 2100 project was established by the Environment Agency in 2002 with the aim of developing a strategic flood risk management plan for London and the Thames estuary through to the end of the century. The key driver for the project was to consider how tidal flood risk was likely to change in response to future changes in climate and people and property in the floodplain. Additional to this there was an understanding that many of the existing flood walls, embankments and barriers were getting older and would need to be raised or replaced to manage rising water levels. It was time to plan for the future and make recommendations on what actions were needed to adapt to a changing estuary.

Over the past six years we have undertaken a wide range of studies and worked with many organisations across the Thames estuary to gain a thorough understanding of how flood risk is managed today, and the options and actions that could manage tidal flooding through this century.

The TE2100 Plan covers the tidal Thames and its floodplain from Teddington in the west to Sheerness / Shoeburyness in the east. It connects our adjoining catchment flood management plans (CFMPs), which cover non-tidal flood risk management, with the shoreline management



plans (SMPs) in Kent and Essex, which cover coastal flood and erosion risk management. This suite of plans sets the strategic direction for future flood risk management in the areas which adjoin the Thames estuary.

The good news is that we start our planning from a position of strength. We have a world class system of tidal flood risk management which includes the Thames Barrier and associated defences. Our TE2100 investigations have shown that there is greater capacity in the current flood management

system than had been previously understood. This means that although we must maintain our high standards of maintenance and operation and make some improvements, major changes to the structure of the system will not be needed until much later in the century (2070) under Government's current climate change guidance.

Why are we seeking your views?

By giving us your views on this plan you have an opportunity to influence how tidal flood risk is managed through this century.

Chapter 1: Introduction and purpose of this consultation

We have already contacted and met many strategic organisations and local interest groups over the last six years and we have drawn heavily on the information and suggestions they have given us. Up until now however we have not presented a full and final picture of how we see tidal flood risk being managed through this century and the actions that need to be taken. In 2005 we consulted on our Plan objectives and our Early Conceptual Options; the many ways of managing rising water levels across the estuary. More recently we consulted on our High-Level Options; the set of options which could manage and adapt to a range of different water levels. We have now completed our studies and taken on board much that you have told us. We are now ready to present our full findings and recommendations before we finalise the Plan and submit it to Government in January 2010.

Who should respond?

This consultation is for everyone who has a professional or personal interest in future tidal flood management and how the actions we are recommending will shape the future of the Estuary.

The Thames Estuary 2100 Plan will set the strategic direction and determine the future actions and expenditure that are needed to manage tidal flood risk through this century. It will

have a direct impact, both now and in the future, on all who live and work in the Thames estuary.

Although our task is to produce a flood risk management plan, we understand that the recommendations we make have the potential to impact on a wide range of interests in the Estuary. These interests include the activities of people who work on the river or enjoy it for leisure activities, the rich variety of natural environments found along the Estuary, and the land owners and people who live in the defended flood plain.

Flood risk management is not just our responsibility. We work jointly with many organisations across the Thames estuary to ensure that people are aware of the flood risk where they live, and that those organisations who help us manage floods have the right information and tools to do their job.

Many of the actions we are recommending are outside our direct responsibilities. Therefore we need to make sure that we have identified the right actions and the right organisations to deliver them.

It will never be possible to satisfy all the varied and competing interests in the Estuary; however by obtaining your views we will produce a Plan which has incorporated, as far as possible, the needs and aspirations of people and

the environment across the Estuary and its floodplain. Where we are not able to incorporate your views and recommendations, we will explain the reason why.

More information on how you can respond and the other information to support this plan for consultation is explained in chapters 10 and 11.

What does this Plan for consultation contain?

This Plan sets out the recommendations and actions that are needed to manage flood risk through this century. In developing this Plan we have investigated and understood flood risk in the Estuary today, how it might change in the future and the many ways we can manage and adapt to those changes. It contains recommendations on:

- **The future shape of flood risk management and the range of options which can manage a change in water levels through this century.** To put together an estuary-wide approach requires local decisions on what action is needed alongside estuary-wide options to manage and reduce future flood risk. To achieve this we have split the Estuary into 23 policy units which share similar flooding characteristics and assets at risk. These are set out in Chapter 6.

Chapter 1: Introduction and purpose of this consultation

- **How we have decided on the Plan through the assessment, appraisal and selection of what strategic action is needed and the range of options to achieve this.** We have appraised each of the 23 policy units considering the social, economic and environmental costs and benefits of undertaking future flood risk management activities. This has set the policy or future direction of flood management at a local level. Each of the estuary-wide options that we have recommended have been appraised and their environmental impacts identified, along with how they comply with environmental legislation. This is explained in Chapter 7.
- **What local actions are needed in the short, medium and long term.** Who needs to work with us to deliver the actions and how we think this can be done. We have taken the policies we have identified for each policy unit and identified the flood risk management actions that are needed to achieve them. We have split the action plans into three time horizons which are driven by our current understanding of how the climate is going to increase flood risk and the ability of the existing flood defences, spatial and emergency planning to manage it. The action plan provides the basis of the long term implementation plan which will form a major part of the final Plan we submit to

Government in January 2010. This is set out in the TE2100 action plan in Chapters 8 and 9.

- **How we need to address the impact of rising sea-levels on the environment.** We have examined the impact of our existing flood defences on the internationally designated habitats along the margins of the Estuary. We estimate that during the life of our Plan 1200 hectares of this important habitat will be lost through “coastal squeeze”. As sea levels rise these habitats are squeezed between the river and our existing flood defences resulting in the habitats being washed away. These habitats support a wide range of plants and animals, all of which make the Estuary not only a beautiful place but a valuable place. Estuarine mudflats and saltmarshes provide the feeding and breeding grounds for commercial fish and shellfish. We have a responsibility to replace these habitats and our recommendations for potential sites are set out in the TE2100 action plans in Chapters 8 and 9.

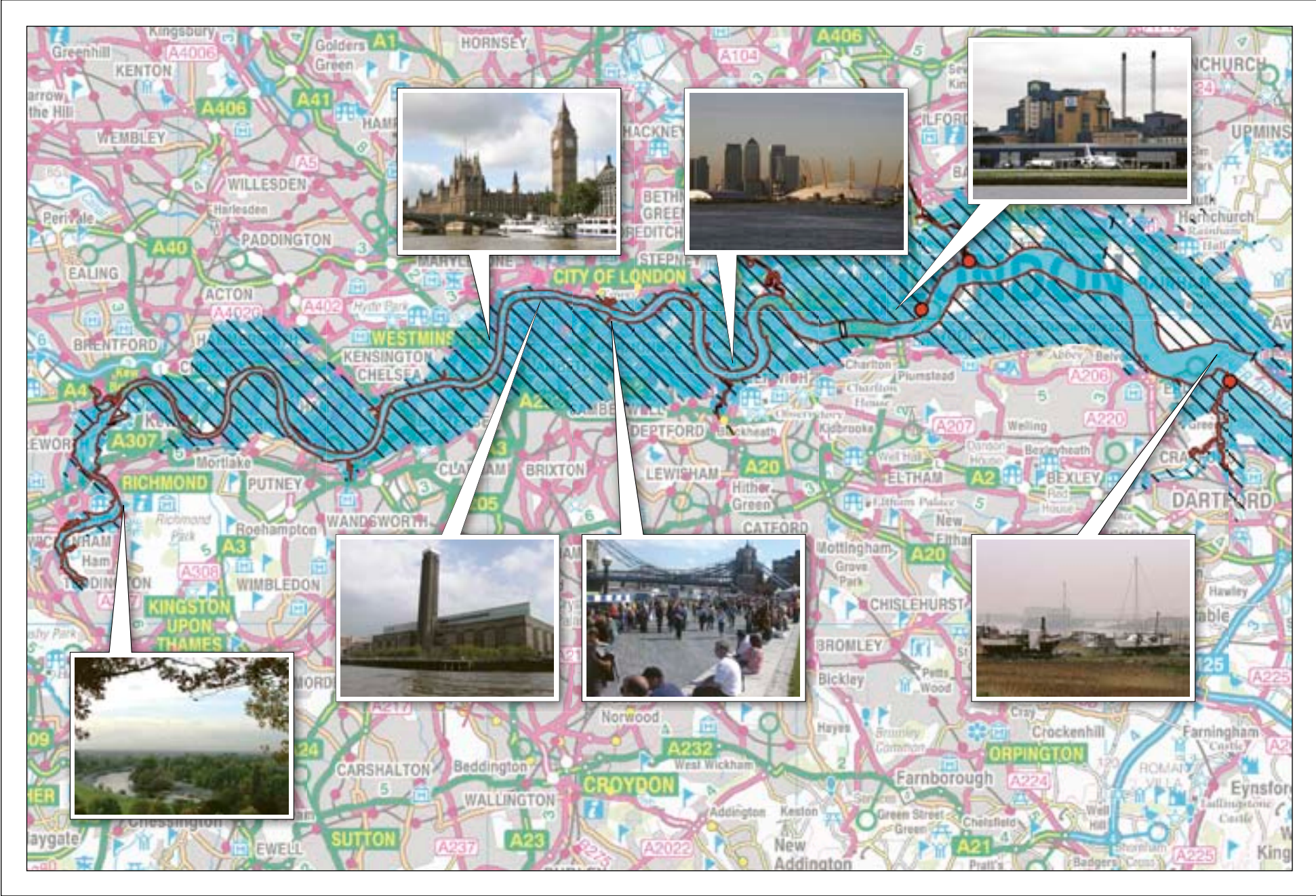
The Plan is explained in Chapter 5 and supported by the TE2100 Technical Report and Environmental Report. 📄 Should you wish to find out more detail about a particular aspect of the Plan these reports can be made available. Details on how to find these are in Chapter 11.

What will the Plan do?

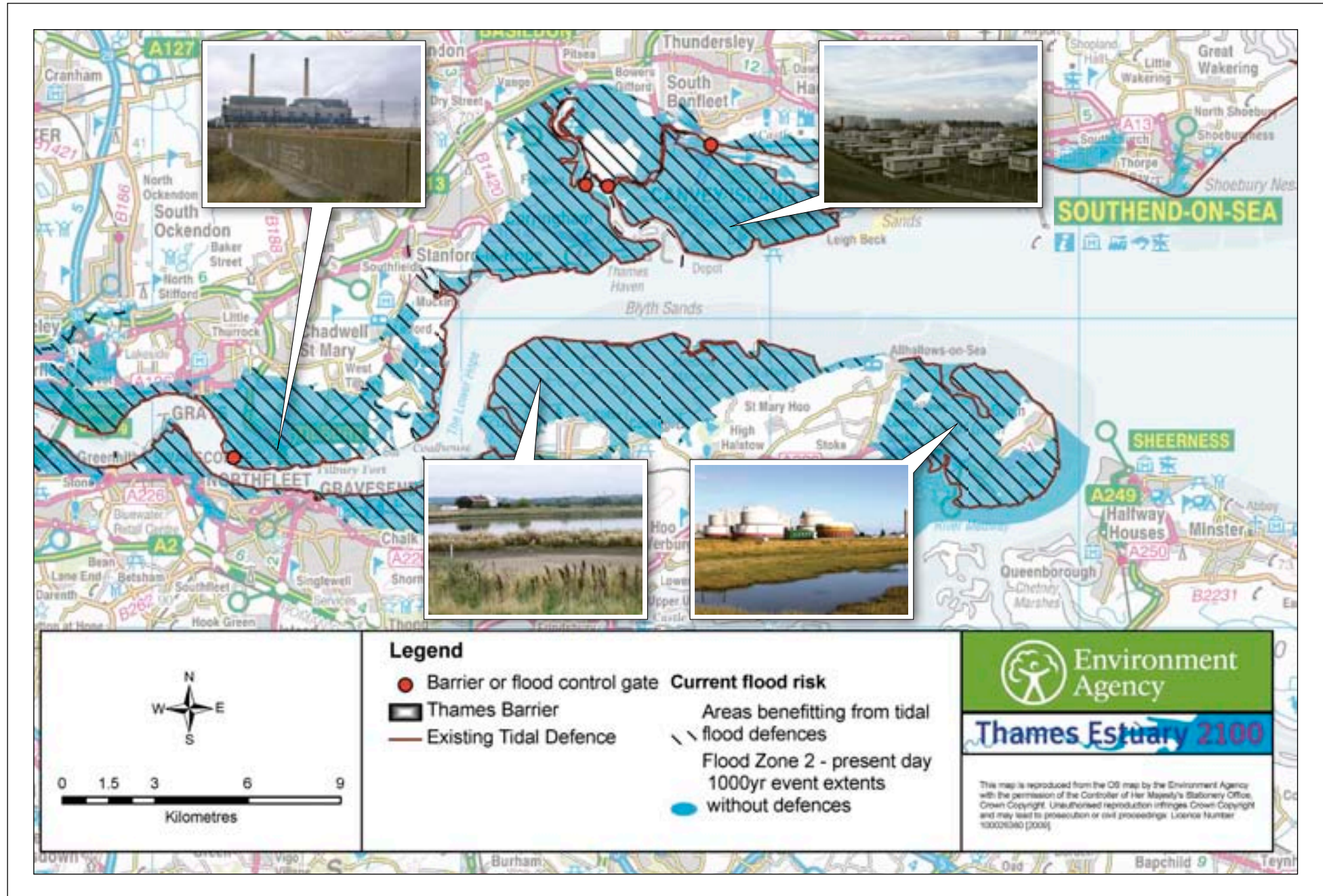
- It will direct our future work on flood warning, flood awareness, and expenditure needed to maintain and replace the 330 km of walls, embankments, flood barrier and gates.
- It will inform the work and expenditure of our partners who are responsible for flood planning and recovery such as local authorities, resilience planning forums and the blue light services.
- It will provide key information and actions for regional and local government to inform their spatial plans and help them make decisions on new and regenerated developments across the floodplain.
- It will raise awareness and improve the knowledge of tidal flooding for people living and working in the floodplain, as well as those building new homes and businesses and those involved in insurance and conveyancing of properties.

The consultation on the Plan will close at the end of June 2009. During the summer and autumn of 2009 we will finalise our Plan and it will be submitted to Government in January 2010.

Chapter 2: The Thames estuary – tidal flood risk today



Chapter 2: The Thames estuary – tidal flood risk today



Sources of flooding on the Thames estuary

The Thames estuary is the meeting place of the freshwater River Thames, its many tributaries and the North Sea. The blue floodplain on the map on the previous page shows the extent of the area which could flood from a combination of freshwater flow and tidal waters. Everyday, twice a day the freshwater Thames which flows across Teddington Weir in West London is met by the incoming tide from the North Sea. The Thames estuary has an average daily rise and fall of water levels of 7 m.

In addition to the daily tides, the Thames estuary is prone to an increase in water levels caused by a North Sea surge. Surge tides occur when a band of low pressure or 'depression' moves across the Atlantic towards the British Isles, the sea under it rises above the normal level creating a hump of water. This hump moves with the depression, passing the north of Scotland and moves south into the North Sea. A surge tide happens when this mass of water from the deep ocean reaches the relatively shallow parts of the North Sea just outside the Thames estuary. On top of this, strong northerly winds can increase the height of the surge. A surge tide entering the Thames estuary can increase water levels by over 1 m and can be a major flood threat especially if this happens during a 'spring' tide when normal tide levels are higher.



The Thames flowing over Teddington Weir



Low tide at Tower beach



Storm Surge; Depression originating in the Atlantic



Depression passes Northern Scotland and enters the North Sea

Chapter 2: The Thames estuary – tidal flood risk today



High tide in central London



Surge tide event at the Thames Barrier



Surge moves down the East Coast towards the Thames estuary



Surge tide approaches the Thames estuary



Surge tide enters the Thames estuary

What is at risk?

The Thames tidal floodplain forms a corridor which passes through London and eastwards through North Kent and South Essex towards the North Sea. In addition to the large number of people who live and work on the floodplains, there are vital institutional and business centres and heritage sites. These include the Houses of Parliament, central and local government buildings, the Canary Wharf business district, the Tower of London and the National Theatre. There are also major transport links and numerous schools, hospitals, power stations and other key sites. The assets and people at risk in the tidal Thames floodplain are summarised in the table.

Table 2.1. Assets and people at risk in the tidal Thames floodplain

350 sq km land area
55 sq km designated habitat sites
1.25 million residents (plus commuters, tourists and other visitors)
Over 500,000 homes
40,000 commercial and industrial properties
£200 billion current property value
Key Government buildings
400 schools
16 hospitals
8 Power stations
More than 1000 electricity substations
4 World Heritage sites
Art galleries and historic buildings
167 km of railway
35 Tube stations
51 Rail stations (25 mainline, 25 DLR, 1 international)
Over 300 km of Roads



Newspaper headline following 1953 flood

Chapter 2: The Thames estuary – tidal flood risk today

What is at stake? 1: Central and local government



Despite some dispersal of central government functions to the regions over recent decades, most recently following the 2004 Lyons Review of Public Sector relocation, London remains a vital seat of government and parliamentary activity for the UK and the city region. The central government district of Whitehall is

wholly within the natural Thames floodplain, as are the Houses of Parliament and the Greater London Authority's City Hall. Much of Pimlico and Victoria, where significant government offices are also situated, are similarly vulnerable. This includes Westminster City Hall. Hammersmith, Tower Hamlets and Lewisham town halls are also within the natural floodplains of the Thames or its tributaries.

Despite business continuity arrangements for major crises, the costs of dislocation to public sector activity and Parliament arising from a major flood in central London would still be severe. As an illustration, if the London-based central civil service (numbering 87,000 people) lost only one working day after a major tidal flood, the cost in lost staff time alone is estimated at £10 m.

Source of data: Well placed to deliver? The Lyons Review of Public Sector relocation, HM Treasury, July 2004

What is at stake? 2: Commerce

London is the UK's largest urban cluster of economic activity, contributing some £250 bn in goods and services annually. A number of its business sectors are important players internationally. In particular, the financial and business services sectors operate in the global marketplace alongside New York and Frankfurt. Although the traditional "square mile" of the city of London is outside the natural floodplain of



the Thames, the more recent centre of Docklands (left) is wholly within it. Whilst well protected against flooding now, climate change will make existing defences vulnerable, and the costs of a major flood would be severe in terms of damage and disruption.

The costs to the London financial sector are particularly significant because its competitors are in other international centres, so any economic costs will tend to be losses to the nation as a whole. This could also be true for the tourism sector as London's losses would to some extent be taken up by other European and international capitals, at least for a period.

Sources: GVA estimates from London's Economic Outlook, GLA

What is at stake? 3: The people living and working in London



Some 1.25 million people live in the Thames tidal floodplain and are therefore vulnerable to flooding if the current defences were to fail or be overtaken by more serious flooding as a result of sea level rise induced by climate change. In addition, there are 400 schools at risk, so the basic infrastructure of family life would be seriously damaged and disrupted in a London-wide flood. Moreover, the facilities that would help recovery from a major flood are also at risk.

This applies to fire stations, police stations, clinics, and the shops and suppliers that would be needed to provide the necessary repair and replacement items damaged in the flood. There are 16 hospitals in the flood risk area, including major facilities such as St Thomas's and St Bartholomew's. Therefore not only would people's homes be damaged but the necessary conditions for response and recovery would themselves be unavailable to the population affected.

What is at stake? 4: Heritage and culture

A large number of London's most significant cultural assets are within the natural Thames floodplain, the defence of which will come under increasing pressure with climate change. The following are examples of assets which lie in the floodplain and which could be affected by a major tidal flood which overwhelms existing defences:

- Westminster Abbey* and Cathedral
- Palace of Westminster* and Parliament Square
- St James' and Battersea Parks
- Tate Gallery and Tate Modern
- Lambeth Palace
- Festival Hall, the South Bank Centre and the Globe
- Tower of London*
- Maritime Greenwich* and the Millennium Dome
- Bishops Park and Fulham Palace
- Royal Botanic Gardens, Kew*
- Chiswick, Syon and Ham Houses



In addition, there are a vast number of other, less well known, but locally valued assets at risk. In total, TE2100 estimates that there are over 3100 hectares of sites across the Estuary floodplain with heritage value which would be highly sensitive to flooding. One illustrative indicator of worth is perhaps revenue from tourism, which currently stands at around £15 bn per annum.

Sources: Environment Agency flood mapping; The environment and the economy, GHK Consulting, 2006. Photo: www.westminster-abbey.org

* Part of UNESCO world heritage sites

What is at stake? 5: The London Underground



The Underground is a central element of life in London. In addition to its vital transport role – fulfilling nearly 1 billion passenger journeys each year – the “Tube” is famously seen by Londoners as a refuge in time of crisis. However, serious flooding is one crisis in which the Underground would cease to perform either of its roles. With much of the central area of the Tube network below street level, and many of those streets being in the floodplain, the Underground is particularly

vulnerable. There are 15 Underground stations in the Wandsworth to Deptford policy unit alone including Waterloo which is the busiest Tube station on the network, handling 46,000 passengers in each morning peak.

A major flood of the Tube could potentially disable the affected line or lines for an extended period, based on experience of flooding elsewhere (i.e. weeks if not months with no service). Clearly the costs of prolonged Tube closures to London’s economy could be very significant. On one day (7 August 2002), flooding incurred a cost in passenger delays alone of £0.74 m. This figure does not include knock-on impacts on these or other users.

Sources: Passenger/journey numbers: <http://www.tfl.gov.uk/tube/company/facts.asp>; Delay costs from current rainfall-related flooding: Climate change and London’s transport systems, LCCP/ Atkins, Technical report, September 2005. Public domain photo

What is at stake? 6: Surface transport and commuting



Although the London Underground network is particularly vulnerable to increased flood risk in the Thames estuary, low-lying surface transport could also increasingly be affected by flood events, given current defence standards. Estuary-wide transport assets which could be at increased risk include the A13 trunk road, and the London, Tilbury and Southend, and North Kent, railway

lines. Under-Thames road tunnels at Dartford and Blackwall form part of national trunk routes and the costs arising from inundation – in terms of damage, delays and knock-on losses – could be very large.

At a more local level, the Wandsworth to Deptford TE2100 policy unit is a particular area in which transport assets would be vulnerable. This area contains a number of major rail lines, and Waterloo, Charing Cross, London Bridge and Clapham Junction railway stations (the latter reportedly the busiest station in Europe, with some 2000 trains passing through daily). Not all lines are elevated above the floodplain, and stations could be cut off by a major flood.

The costs of this in terms of disruption (if not actual damage) could be very large, given London’s continued reliance on in-commuting.

Sources: Environment Agency flood mapping

What is at stake? 7: Nature conservation in the Estuary



There are scores of important ecological sites at risk of flooding in the Thames Estuary, many protected by national and international designations (e.g. Ramsar sites).

To take just a single example, one of very few ancient landscapes remaining in London is at Rainham Marshes. These medieval marshes right next to the River Thames were

closed to the public for over 100 years and used as a military firing range.

The RSPB acquired the site in 2000 and set about transforming it into an important place for nature and an important visitor site. Now one can expect to see breeding wading birds in spring and summer, and large flocks of wild ducks in winter. Birds of prey and rare birds are regularly seen too. There are also water voles in the ditches and rare dragonflies are a common sight in summer.

Important bird species at Rainham include the Lapwings visiting during the year. Wintering birds are replaced by breeding birds in spring, and other birds that have bred further north pass through in summer and autumn. Also Little Egrets can now be seen here in large numbers throughout the year. The large concentrations of wildfowl and waders regularly attract hunting Peregrines – especially in autumn and winter.

What is at stake? 8: The Port of London



The Port of London (PLA) comprises Tilbury and around 70 specialist wharves from Fulham to Canvey. The wharves are operated independently and handle a vast range of goods. The Port handles over 50 m tonnes of imports and exports (53.8 m tonnes in 2005, only 12% less than in 1964). London remains the largest UK port by traffic for non-fuel goods, and its market share is growing.

Research for the PLA suggests the Port generates over 35,000 full-time jobs and makes a total contribution to the UK economy of £3.4 bn each year. In 2005, the PLA itself had a turnover of nearly £41 m and an operating profit of £1.2 m. For the future, the biggest single development of London as a port could be the building of the London Gateway facility at Shell Haven, extending over nearly 170 hectares, 93 of them reclaimed from the Thames Estuary.

Flood risk, and responses to it, both affect port and shipping operations, and are affected by them. Currently, the operation of flood barriers – particularly the Thames and Barking barriers – can have impacts on the passage of shipping with the potential for knock-on costs. Future flood risk solutions will need to be designed and built with shipping operations in mind.

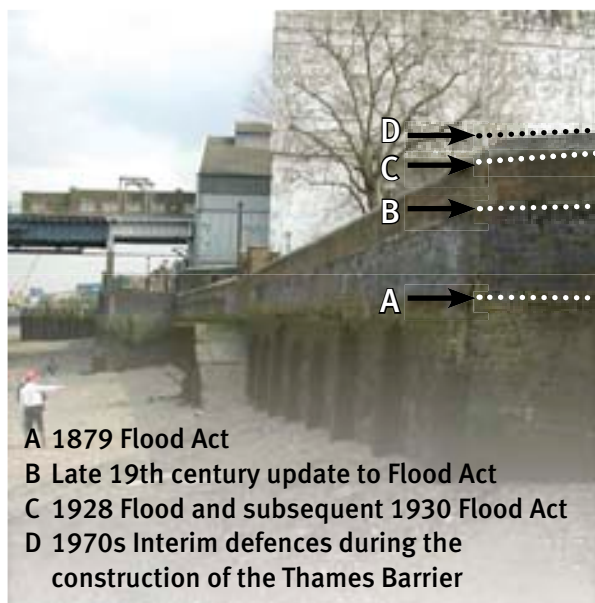
Sources of data and photo: Port of London Authority

What has shaped how we manage tidal floods today?

Managing floods on the Thames estuary is not a recent activity. There were tidal defences on the Thames estuary more than 1500 years ago. These defences protected Anglo-Saxon settlements in Kent and Essex.

In the first century AD, the Romans built their city Londinium on the high ground which is today the ‘square mile’ of the city; well above the five metre contour level which approximately defines the area of tidal flood risk today. But the successful expansion of London over the centuries saw it cover the adjoining marshlands, and as sea levels rose relative to land, the challenge of maintaining tidal defence for our capital city was born.

In the 17th century, Dutch engineers reclaimed Canvey Island and turned its three islands into one. Further upstream, with the construction of the docks, associated wharves and urban development, large areas of marshland on either side of the Estuary were reclaimed for a variety of uses including grazing marsh and agriculture. By the late 19th century, there was very little of the Thames estuary which had not been modified in some way by human intervention. The network of tidal defences required constant attention to keep pace with rising sea levels and the first of the



Response to floods past: river wall at Greenwich

London Flood Acts was passed following a series of damaging floods in London during the 19th century.

There was a major tidal flood in 1928 and an even worse catastrophe in 1953. This was the catalyst for the construction of the Thames Barrier and the associated defence improvements in the 1980s.

The decision to build the Thames Barrier was taken on the advice of Sir Hermann Bondi,

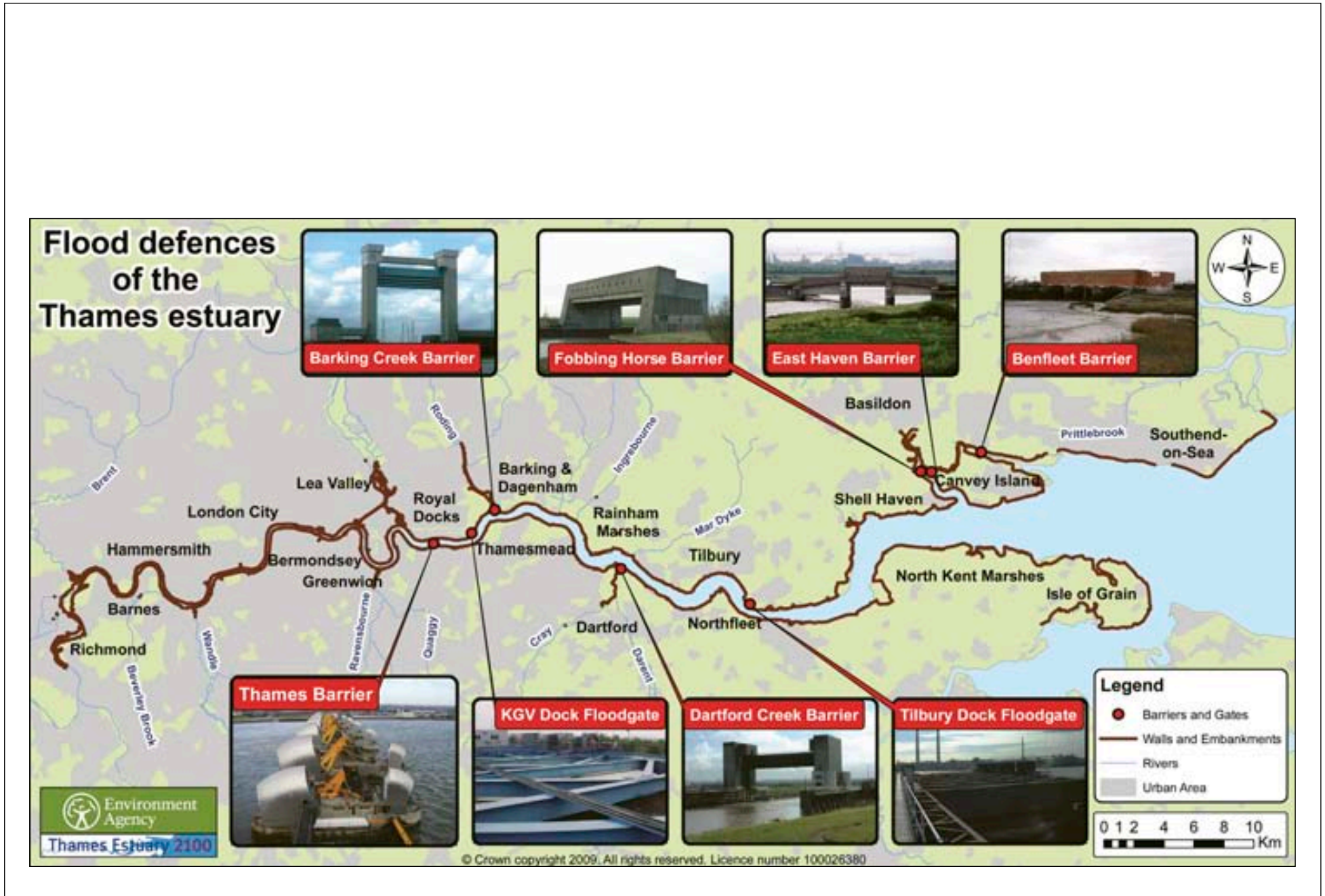
Government Chief Scientific Advisor during the 1960s. This followed the Waverley Committee, which reported in 1954 on the east coast floods, recommending a dual approach of engineering structures backed up with a considered approach to development in the floodplain.

We have been very successful in the first of these recommendations. The Thames Barrier and associated defences have provided confidence to London and the Thames estuary communities for 25 years. But we have been less successful in managing the consequence of flooding. Sir Hermann Bondi’s statement remains as true today as it was 40 years ago.

Through our TE2100 plan we are promoting floodplain management as part of an integrated strategy for living successfully in the Thames tidal flood risk area as recommended by Waverley and Bondi.

“I have no doubt whatever in my mind that such a major surge flood in London would be a disaster of the singular and immense kind... It would be indeed a knock-out blow to the nerve centre of the country...”

H. Bondi, London Flood Barrier. Report to the Ministry of Housing and Local Government 1967.



How tidal flood risk is managed today

Planning for and managing floods is the role of a number of organisations and individuals across the Thames estuary. Everyone has a role to play in managing and reducing flood risk now and in the future. The Thames tidal flood defence system is made up of the Thames Barrier and eight other major flood barriers owned and operated by the Environment Agency. It also includes 36 industrial flood gates, more than 400 smaller movable structures and over 330 km of walls and embankments which are in over 3000 different ownerships.

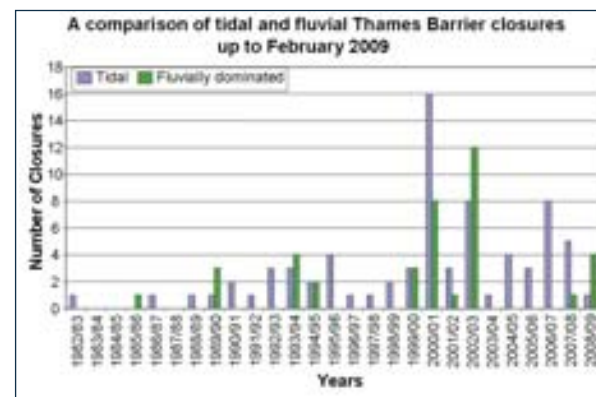


We, the Environment Agency are responsible for delivering sustainable flood and coastal erosion risk management solutions and for overseeing the delivery of local solutions by others. Our job includes:

- understanding and planning for a changing climate;
- flood forecasting, warning and responding to floods;
- maintaining, renewing, improving and operating flood defences;
- overseeing the work on flood defences owned by others;
- providing advice to local authorities on spatial plans and planning applications relating to flood risk.

Regional and local authorities are responsible for ensuring that flood risk is taken into account at all stages of the planning process in order to manage and reduce the consequences of flooding. Working through local and regional resilience forums they lead in:

- planning for flood events by producing flood plans and recovery/continuity plans;
- dealing with the consequences of flooding such as humanitarian assistance, emergency housing and clear up operations;
- providing advice to local communities on what action they can take before, during and after a flood.



25 Years of Thames Barrier closures

Businesses and the community as a whole have an important role in preparing for floods by finding out if they live or work in a flood risk area, signing up for our flood warning service and taking appropriate action to keep their property, employees and family safe. The charity National Flood Forum aims to provide an independent voice for those at flood risk.

The Department for Food and Rural Affairs (Defra) has national policy responsibility for flood and coastal erosion risk management and provides funding through grant in aid to the Environment Agency which also administers grant for capital projects to local authorities.

The challenge

The Thames estuary is a successful compromise of a thriving man-made landscape coexisting with a rich and diverse estuarine environment. However it is a dynamic, ever changing system which through this century will face increasing and new challenges.

Future challenges and changes which have driven us to review current flood risk management activities and prepare us all for the future are:

- climate change
- ageing flood defences
- the physical environment
- socio-economic change
- public and institutional awareness.

Climate change

Climate change presents the greatest challenge in terms of future uncertainty. The tidal impacts include expected rises in mean sea level, peak surge tide level, and wave heights. Of particular concern is uncertainty over the rate of sea level rise. Whilst current rates are low (of the order of 3 mm/year relative to land level) there are regular reports of change to the global climate, the impacts of

which are uncertain³. In addition, freshwater flood flows from tributaries that drain into the Estuary will increase through higher winter rainfall.

Ageing flood defences

As would be expected, much of the current flood management infrastructure, constructed 30 years ago and in some cases more, is gradually deteriorating and will come to the end of its useful life during the period 2030 to 2060. It will require replacement or major repair at a cost of several billion pounds. The rate of deterioration of these structures and their ability to withstand increasing sea levels is therefore a vital factor in our future planning. The riverside of the Estuary and how we use it is also changing and the form and position of our flood defences may also not be suitable for the Estuary today or in the future.

The physical environment

Land levels in the south-east of England are slowly sinking as an after effect of the last ice age when the northern part of the country was covered in a mass of ice. This is a process called isostatic rebound. The result of this, quantified through our studies, is that the land level is going down

relative to sea levels by around 1.5 mm per year. Although this appears a small amount, over the century it can add a significant difference to the protection afforded by the defences. Changes in the morphology of the Estuary can also affect flood levels and the ability of the Estuary to withstand it. Over the centuries the natural river channel has been narrowed as development in London and the Estuary has sought to take advantage of the benefits the river brings, such as river transport for trade. Today the attractiveness of the river as a site for new development continues to put pressure to encroach into the river space.

Socio-economic change

The Foresight Flood Risk project⁴ identified the critical uncertainty that socio-economic development presents to the future of flood risk. Not only has there been extensive development on the Thames estuary floodplains, including throughout central London, but also the potential flood damages per property have risen. The reasons for this include changes in wealth and technology, resulting in a dramatic increase in the value of buildings and contents and their susceptibility to flood damage.

³ For example, A 20th Century acceleration in global sea level rise. Church, J A & White, N J Geophysical Research Letters, 33 L01602, 10.1029/2005GL024826

⁴ Foresight – Future flooding, Scientific summary: Volume II Managing future risks, Team led by E P Evans on behalf of the Office of Science and Technology, April 2004

Chapter 4: The Thames estuary is changing

Public and institutional awareness of flood risk

At present public awareness of flood risk on the Estuary is low. The present low chance of flooding due to the high standard of protection means that the focus of attention has been on keeping the defences in good condition and less attention has been given to public awareness of flood risk and how, through spatial and emergency planning, we might manage the consequences of a tidal flood in the unlikely event it happens. The uncertain future presented by climate change and rising flood risk means it is essential for this situation to change. Also much of the historic development in the floodplain in London and the Estuary has paid little heed to the possibility of a flood, relying wholly upon the defences to manage the risk. The recent Planning Policy Statement 25 on Development and Flood Risk looks to change this focus, and this must now be reflected in future spatial planning. Continued public and institutional confidence in flood risk management arrangements is essential. But all parties must be aware of their own responsibilities and the appropriate precautionary actions. There needs to be clarity on who does what and a more integrated response from those providers and responders involved. This was a primary recommendation of Sir Michael Pitt's review of the summer 2007 floods.



Stormy weather at Leigh-on-Sea

Chapter 4: The Thames estuary is changing

Responding to the changing estuary

In responding to these challenges our aim is to develop a flood management system that does not become a burden for future generations and is adaptable to the changes that we face. It must be maintainable, and it must not threaten the ecological balance of the Thames estuary. Although we are looking to the end of the century, many of the decisions that we take now can affect our ability to adapt in the future. For example, if we are likely to raise, move or adapt defences we must ensure that we provide the space now to allow for that to happen in the future. The Foresight – Future Flooding report concluded that if we failed to start investing in sustainable approaches to flood and coastal risk management, increased flooding was inevitable.

TE2100 and climate change

TE2100 is the first major flood risk management project in the UK to have put climate change adaptation at its core. We have developed methods to test our flood risk measures and options against differing climate change scenarios so that if we face an acceleration in water levels, beyond current predictions, we will know how effective these options will be and whether we would need to change them.



*The Lobster Smack in 1902:
The defences were described at the
time as being “practically invulnerable”*



*The same building in 2000:
The defences, raised following
the 1953 flood and raised further
in the 1980s are now level
with the roof eaves*

The Lobster Smack – 200 years of defence raising at Canvey Island

Chapter 4: The Thames estuary is changing

To inform the development of these scenarios we commissioned scientific research with the Met Office and others to improve our understanding. We know that climate change could lead to increases in sea level, storm surge height and peak river flows but the question is by how much. The studies we have done have helped reduce the uncertainty in what the future might bring.

We have learnt that:

- Sea level rise in the Thames over the next century due to thermal expansion of the oceans, melting glaciers and polar ice is likely to be between 20cm and 90cm.
- There remains a lot of uncertainty over the contribution of polar ice melt to increasing sea level rise. At the extreme, it may cause sea level to rise by a total of up to 2 m (including thermal expansion) – although this is thought to be highly unlikely.
- Climate change is less likely to increase storm surge height and frequency in the North Sea than previously thought.

- Future peak freshwater flows for the Thames, at Kingston for instance, could increase by around 40% by 2080.

Crucially, in terms of our planning for the Thames estuary, this research means that:

- These results give greater certainty that we have been planning for the right potential range of water levels this century, and the current Defra guidance for sea level rise in the Estuary is appropriate.
- Our previous worst-case scenario for increases in maximum water levels can be revised down from +4.2 m to +2.7 m. This worst-case scenario is highly unlikely, but gives us an extreme to test our options against.
- Such a reduction in worst case scenario for this century means that a tide-excluding estuary barrage will not be necessary to manage flood risk this century and can be dropped from our final options.
- We are confident that our plan can cope with a changing climate and we can measure with confidence how much adaptation will be needed for different climate change scenarios.

Our approach and studies have been used to inform other climate change projects such as the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment and the Stern Review. The results of this work will also inform the Marine section of the forthcoming UK Climate Projections 2009 Report (UKCP 09).

Climate change mitigation: The more extreme the climate change scenario, the more costly will be the flood risk management measures to adapt to it. The underlying message is that climate change mitigation makes good economic sense and we all need to try to reduce emissions and reduce our carbon footprint to slow the rate of change that we will experience. This was highlighted in the Stern Review on the Economics of Climate Change (2006). In costing our options we have calculated the greenhouse gas costs. They are a relatively small percentage of the whole cost and there is not a great deal to choose between the options, but it is important to recognise publicly the need for a “carbon footprint-aware” culture.

Without effective mitigation future generations in London and the Thames estuary may have to deal with climate change which exceeds our +2.7 m extreme scenario by 2100.

Introducing the Plan

The TE2100 project was established by the Environment Agency in 2002 to come up with answers to the challenge of long term flood risk management planning for London and the Thames estuary.

It was agreed that a successful TE2100 Plan would be:

1. Technically feasible and adaptable to change
2. Environmentally sustainable
3. Economically justifiable
4. Socially and politically acceptable

TE2100 Strategic aim

To develop a flood management plan for London and the Thames Estuary that is risk based, takes into account existing and future assets, is sustainable, includes the needs of stakeholders and addresses the issues in the context of a changing climate and varying socio-economic conditions that may develop over the next 100 years.

Our recommendations

This Plan will direct the actions that are needed to manage and reduce tidal flood risk over the next 100 years. It is adaptable to a changing climate to ensure that the actions that are taken are the right ones, taken at the right time and will not waste money on over-engineered solutions.

Our key recommendations

1. The TE2100 policies will direct the implementation of actions and future flood management investment. As the climate changes, we will all need change how we manage and live with floods. In some areas there will be hard choices.
2. We are starting from a good position, we have a world class system of flood defences and flood preparedness plans. For the first 25 years of our plan we recommend continuing with how we manage tidal flood risk today through actively maintaining and improving the existing system at an estimated cost of £1.4 bn. We must continue to work closely with implementation partners to direct new vulnerable development away from high flood risk areas and ensure that those living there remain safe today, and in the future.

3. The middle 35 years of our Plan will see expenditure of the order of £3.1 bn with major renewal and replacement of the Thames tidal defences. This will bring opportunities to reshape and renew the riverside. We recommend that multi-agency riverside strategies are developed to inform spatial planning and asset management decisions and investments.

4. Our ten estuary-wide options have been designed to manage rising water levels through this century and achieve the TE2100 policies. We have considered the social, economic and environmental cost and benefits of these options based on conditions today, to come up with two front runners. But we recommend that flood risk is monitored and the Plan reviewed and updated at least every ten years.

Chapter 5: The Thames Estuary 2100 Plan

5. As the climate continues to change and water levels rise, we estimate that around 2050 a decision will be needed on how flood risk continues to be managed. By 2070 we recommend one of our two 'front runner' options is implemented. These are either continuing to upgrade and modify existing flood defences and floodplain management (option 1.4) or constructing a new barrier at Long Reach with associated works (option 3.2). Our estimated cost for the end of the century works is £4.2 bn – noting that the end of the century option may change as a result of a Plan review and changed conditions.

6. TE2100 supporting studies will be maintained and shared with implementation partners to form the basis of a monitoring programme for the TE2100 indicators for change. This will be used to demonstrate progress on TE2100 Plan implementation and to inform the plans of our partners such as strategic flood risk assessments and flood plans.

7. We recommend that 1200 hectares of intertidal habitat is created to replace areas lost due to sea level rise over the period of the TE2100 Plan. We have identified seven sites which have the potential for intertidal habitat creation.

8. We recommend that a Thames estuary land strategy is developed in partnership with decision makers, land owners and managers to safeguard land for future flood risk management and to bring together the various strategic plans and vision statements from across the estuary.

9. Our action plan contains 98 actions which are necessary for successful implementation of the TE2100 Plan. Our action plan is presented at an estuary-wide and local level and divided into three time horizons for decision-making and action.

10. Our action plan will be revised as a result of this consultation and will form the basis of the TE2100 final Plan and its implementation.

The TE2100 action plan will form the basis of continued partnership working with all those involved in flood risk management across the Thames estuary, especially where a multi-agency approach to managing flood risk consequence is needed.

This is how we got there



Our Vision – the TE2100 Objectives

- To manage the risk of flooding to people, and minimise the adverse impacts of flooding to property and the environment;
- To adapt to the challenges that we will face from climate change;
- To support and inform the land use planning process to ensure appropriate, sustainable and resilient development in the tidal Thames floodplain;
- To protect the social, cultural and commercial value of the tidal River Thames, its tidal tributaries and its floodplain;
- To enhance and restore estuarine ecosystems to contribute to biodiversity targets and maximise the environmental benefits of natural floods.

Understanding flood risk and the Estuary

In the early phases of the TE2100 project we collected essential data on habitats, the plants and animals of the Estuary and the sediments to understand how the estuary's natural processes work. With low level helicopter LIDAR⁵ we inspected the defences from the Thames Barrier to the sea. We studied today's flood risk and how it might change in the future and established our vision for future flood risk management. This is described by the TE2100 flood management policies.

TE2100 policies

Our aspirations for sustainable flood risk management for the next 100 years are based on an assessment of how much flood risk management activity we can justify in different parts of the TE2100 Plan area. There are five possible strategic levels of flood risk management available to us. These are defined as policies **P1** through to **P5**. For more information on the flood risk management policies look at our Technical Report chapter 5. The policies set the strategic direction of flood risk management in each part of the Estuary.

This is essential information for planners and those who live and work in these local areas. It is also the starting point for the development of flood management options for the Estuary.

Maintaining confidence

The Thames Barrier will continue to provide flood management to London through most of this century with some modification. Our investigations have confirmed that there is sufficient capacity in the system so major changes in the flood management system will not be needed until 2070 (based on current climate predictions).

However, significant improvements to the current tidal defence system will be needed before 2070 including raising the crest level of most of the flood defences and replacement of a large proportion of the assets as they reach the end of their lives. A comprehensive programme of continuing maintenance and improvements is therefore essential. Our first 25 years of the TE2100 programme includes this essential work.

Thereafter, our Plan will continue to provide confidence to the 1.25 million people who live and work in the London and Thames estuary tidal floodplain, and will provide a shared understanding of flood risk management for our strategic partners and other groups.

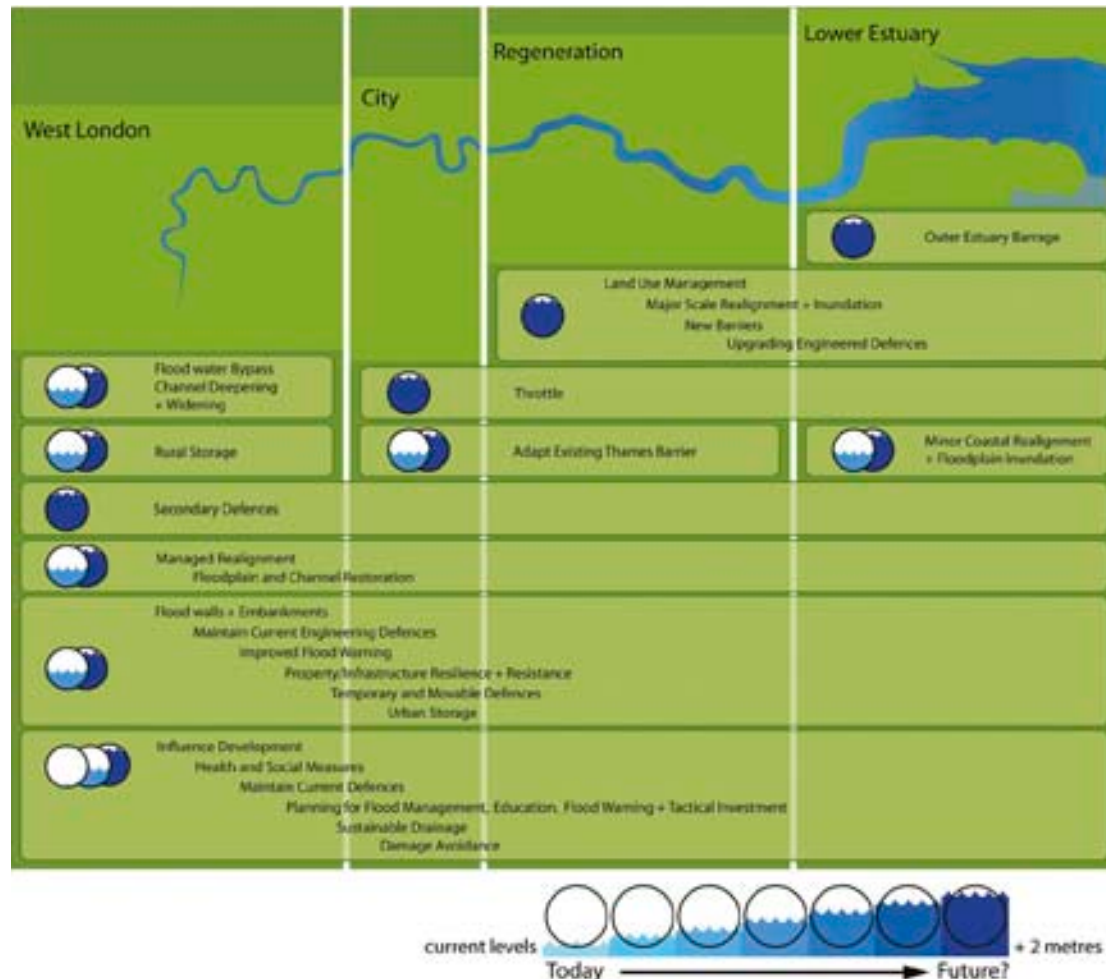
Developing the options and selecting the front runners

In phases 2 and 3 of the project we developed tools, models and techniques to help us develop a range of options to manage flood risk. We studied a wide range of possible options and through our investigations and assessments we identified the most promising options to be investigated further. The diagram overleaf is from our Early Conceptual

⁵ LIDAR (Light Detection and Ranging) a method of obtaining high quality measurements from a distance

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Early conceptual options: our starting point for options development



Options consultation in 2005 showing a summary of the possible options for managing flood risk in the estuary.

What options have been excluded? Following investigation, consultation and appraisal, some of these options have been excluded:

- **Throttle.** This was excluded because our further investigations showed that it was not effective in reducing flood risk.
- **A tide-excluding barrage** was excluded because of the adverse impacts that impounding the estuary would cause, including water quality, morphology and drainage.
- **A Barrier with locks** in the outer estuary (downriver of Canvey Island) was excluded because of cost, environmental impacts and constraints to navigation to the Thames Gateway Port and other port facilities on the estuary.
- **A Barrier in the outer estuary** (downriver of Canvey Island) was excluded because of cost and adverse impacts on the estuary environment and navigation.
- **Improved channel conveyance** from Teddington to Brentford. This was excluded on the grounds of adverse environmental impact and lack of sustainability.

How options reduce flood risk

An option is made up of a combination (or portfolio) of different actions which act together to achieve the recommended policy. This is shown in the Figure below. The green line represents the increasing flood risk, and the horizontal line represents the policy. The red line shows how each portfolio of actions reduces flood risk so that



Managing flood risk using 'portfolios' sequenced through the century

it stays below the policy level. It is therefore necessary to make decisions ahead of when they are needed. Some actions will require a lead in time of 20 years or more.

We have developed four generic options (the red "saw-tooth" line) which can successfully manage flood risk through the century.

These have been further developed to form ten estuary-wide options. We have investigated these options in more detail and tested them for effectiveness and efficiency in delivering our strategic vision. Our ten estuary-wide options are summarised in table 5.1.

Our recommended option: We recommend maintaining and improving the existing system (option 1.4) as the optimum approach for the first 60 years of our Plan, with new arrangements required by 2070 (under current government climate change guidance) for the option which takes us into the 22nd century. At this stage there are two front runners; continue to maintain and improve the existing system (option 1.4) or a new barrier at Long Reach (option 3.2).

Through our action plan (whole estuary – Zone 0), we are seeking your views on these recommendations.



Do you consider that we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?



Find out more about our front runners in Designing an adaptable plan (overleaf) and Chapter 7.

Table 5.1. The TE2100 Estuary-wide options

Option 1. Improve the existing defences

- 1.1. Raise defences when needed
- 1.2. Allow for future adaptation of defences
- 1.3. Raise defences when they are replaced
- 1.4. Optimise defence repair & replacement

Option 2. Tidal flood storage

Four potential sites have been identified which are in the right location to store tidal waters and reduce the level of storm surges. The sites identified are at Erith Marshes, Aveley and Wennington Marshes, Dartford and Crayford Marshes, and Shorne and Higham Marshes.

Option 3. New Barrier

- 3.1. Tilbury Location
- 3.2. Long Reach Location

The new Barrier would be designed to resist the highest surge tides predicted under government climate change guidance.

Option 4. Barrier with locks

- 4.1. Tilbury Location
- 4.2. Long Reach Location
- 4.3. Convert Thames Barrier to a barrier with locks when the operational limit of closures per year is reached.

Sea level rise and pressure on habitats: Valuable habitat is being lost because our defences are preventing it from migrating landwards as sea level rises. Over the 100 year life of our Plan, 1,200 hectares of new habitat will be needed. We have identified seven sites which have the right characteristics for habitat creation, and we are likely to need to use four of these sites. The sites are shown on the estuary-wide option maps in our Action Plan Zone 0. The sites are:

- Grain Marshes
- All Hallows Marshes
- St. Mary's Marsh
- West Canvey Marshes
- Vange Marsh
- Bowers Marsh
- Fobbing Marshes.



Your responses to this part of our action plan will enable us to finalise our habitat creation programme.

Understanding the local issues

Having established estuary-wide options for flood risk management, these must be taken down to local level. There are a number of different choices for this local implementation which must be

designed to optimise flood risk management within each policy unit whilst remaining true to the requirements of the estuary-wide options. There is also a need to include managing flood risk from other local sources of flooding, for example tributaries or urban drainage. Just because these are local issues, it does not mean they are less important. It is the local choices which have the greatest and most immediate impact on the local environment and people.



Our action plan includes our recommendations on how these local issues should be further developed. We are seeking your views to assist us in finalising these recommendations.

Understanding consequences

The pressures of society, the environment and the economy are increasing the risk to those in the floodplains. We need to reduce the consequences of flooding and make the floodplains a safer place. We must take pragmatic measures which take account of the protection already offered by the defences. But the measures must ensure that in the event of failure or overtopping of the defence, existing and new developments are safe. Spatial

planning and emergency preparedness will have an increasing role in flood risk management in the Thames Estuary. We have studied the vulnerability of communities and infrastructure within the Estuary and have a wealth of data to share with emergency planners and other implementation partners.



Our action plan explains these local measures and seeks your views.

Designing an adaptable plan

Dealing with uncertainty: Chapter 4 describes the uncertainty of future change and the challenge this presents to implementation of our Plan. Our TE2100 plan must be adaptable to change and remain fit for purpose throughout its 100 year life. To achieve this, we have identified ten key indicators of the changes which will affect flood risk management. These indicators, or “triggers for change” must be monitored throughout the life of the TE2100 Plan (see table 5.2 opposite). The outputs from this monitoring programme will inform the regular reviews and re appraisal of the Plan. Importantly, they will also trigger decision-making if rapid change occurs in one or more of the indicators.

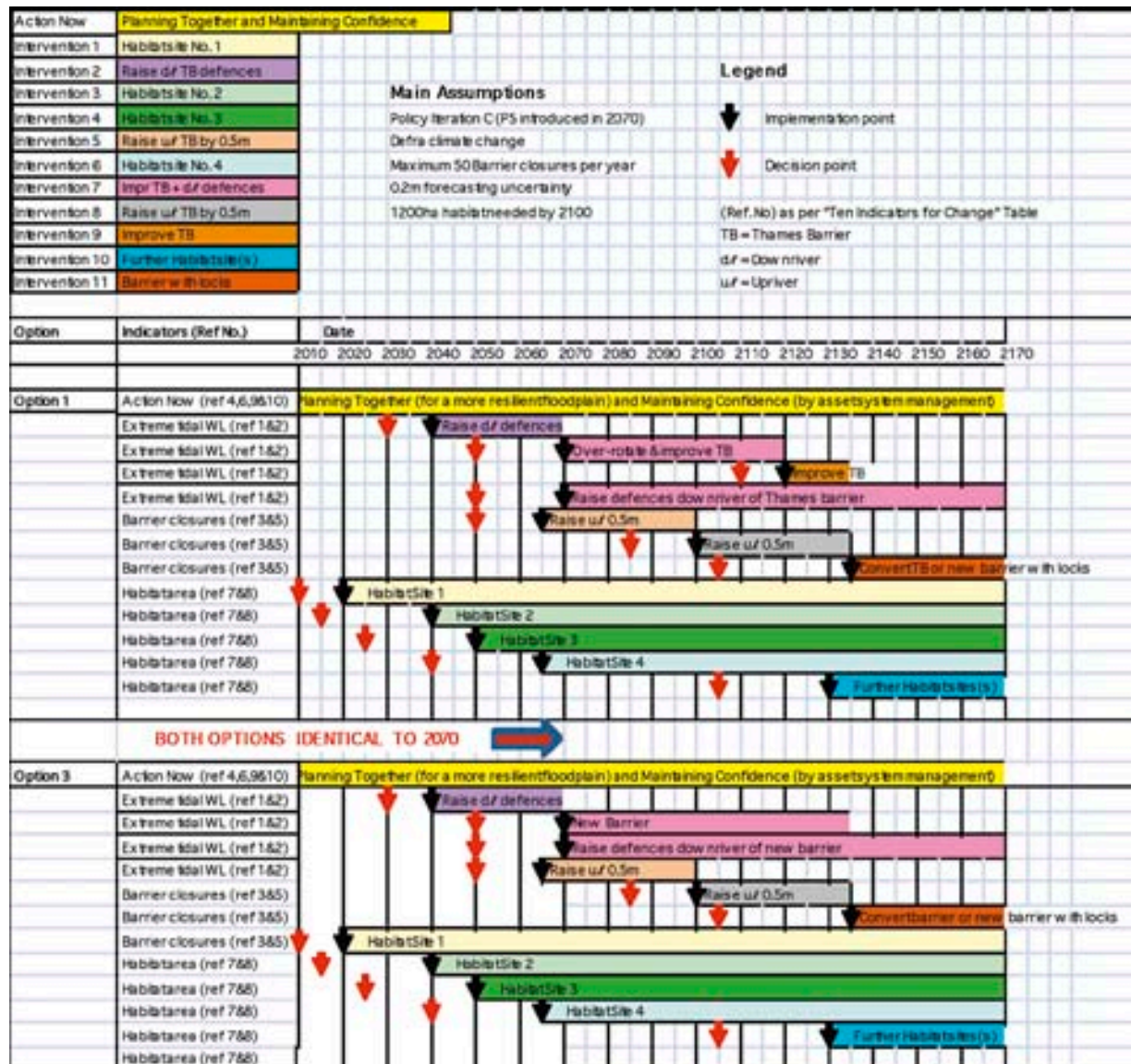
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Table 5.2. Ten indicators for change – and why they are important to TE2100

1	Mean Sea Level	The level to which protection may be required twice a day every day. Mean sea level is the level which determines the number of times per year that a barrier must be closed. This also has a major impact on the area of intertidal habitat in the Estuary.
2	Peak surge tide level	The extreme (but rare) tidal flood levels which will have to be managed. Peak surge tide level also determines the crest level of the defences including the Thames and other barriers.
3	Peak river (fluvial) flood flows	The combined tidal/fluvial flood risk at pressure points in West London and where tributaries meet the estuary.
4	Condition of flood defence structures	How to optimise the repair and renewal of defences for investment programmes getting best value for money whilst ensuring public safety. To ensure that the flood defence system will function as required. Identification of the improvements needed to ensure the integrity of the system.
5	Frequency of closure and reliability of the Thames/ other barriers	How much useful life remains for these important structures, and how efficient they are.
6	Developed area and value/ type of development	People and property at risk. Key social and economic information for flood risk management planning.
7	Extent of erosion/deposition	How stable the morphology of the estuary is and how this affects the ecology of the estuary and the defences.
8	Intertidal habitat area including mudflat and saltmarsh	The health and stability of the intertidal habitat zone, and whether we are complying with EU habitats regulations.
9	Land use planning and development activities	A measure of how well flood risk (i.e. safer floodplains) and opportunities for sustainability (e.g. the creation of green corridors) are being factored into development. Also predicts future needs for society and economics.
10	Public/institutional attitudes to flood risk	Public (hence political) appetite for risk and institutional preparedness to manage risk and to plan for/respond to emergencies.

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Table 5.3. TE2100 Plan options compared through the century



Planning for the long term: To plan effectively to the end of this century, we will be making decisions which affect future generations well into the 22nd century. Table 5.3 illustrates how our two front runners could provide a flood risk management system to the end of this century and beyond.

The indicators for change are shown. These must be monitored to ensure the Plan remains flexible and responds appropriately to change. Table 5.3 also shows how the two front runners recommended in our Plan would be implemented in stages. Some key points to note are:

- the arrows showing implementation date and decision dates;
- both options are identical from 2010 to the year 2070;
- the horizontal bars on the options charts show when each intervention starts and when it ceases to be of value;
- when an intervention ceases to be of value, a new intervention is implemented. But the decision to do this must be made 10, 20 or even more years earlier as shown;
- Table 5.3 shows the timing of interventions for the government current climate change guidance (Defra 06).

There is no way of knowing exactly what London and the Thames Estuary will look like so far in the future, The choice of “end of the century” option will be made around 2050 during a future review of the TE2100 Plan and will be based on the conditions prevailing at the time of the review.

TE2100 – Fit for Purpose over its 100 year life?

We recommend that the TE2100 Plan is reviewed against the 10 indicators for change every 10 years as a minimum – or more frequently if major change is occurs in one or more of the indicators being monitored.

If one or more of the indicators change significantly, this will trigger a movement of the bars on Table 5.3 showing the interventions. This could be likened to the channel volume sliders on a sound mixing desk, the final “mix” being the optimum decisions at each stage throughout the life of the TE2100 Plan.




There are many different ways in which we could respond to changes identified each time the TE2100 Plan is reviewed and updated. Table 5.4 shows the ways in which the TE2100 Plan is adaptable to change.

Table 5.4. How the TE2100 Plan is adaptable

<p>Changes to the timing of new intervention: If rates of change increase, interventions will be brought forward. If the rates of change are slower, then these interventions will be delayed.</p>
<p>Ability to change between options: If the rate of change of a critical factor is significantly different from the expected rate of change, it may be necessary to switch to an alternative option which can cope more efficiently with these new conditions.</p>
<p>Adaptation of engineering responses: Structures should be designed so that they can be adapted to changing circumstances. For example, providing foundations for new defences that can take higher future flood water loadings, or designing barriers and other control structures that can be modified in the future. The initial cost will be higher than responses that do not allow for subsequent adaptation, but this can result in significant savings over the whole life of the structure.</p>
<p>Safeguarding land for future options: Each flood risk management option will require land for new defences, enlarged defences, new barriers, new areas of habitat creation, and in some cases flood storage. Land allocations through the spatial planning system must be guided and informed by the requirements of the TE2100 options to ensure they remain possible.</p>
<p>Adaptation to new infrastructure: New infrastructure on the Thames estuary could have a major impact on flood risk management arrangements. For example, ports such as the proposed London Gateway Port at Shellhaven will require free access for navigation. Also, new transport links could provide the opportunity to combine a new crossing of the estuary with a new barrier. This could be brought forward in the TE2100 Plan if this is justified by the synergies and funding from different groups.</p>

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Three time horizons – three themes for flood risk management

	<p style="text-align: center;">The first 25 years from 2010 to 2034</p> <p style="text-align: center;">“Maintaining confidence and planning together”</p>	<ul style="list-style-type: none"> • Continuing maintenance, operation and essential improvements. • Safeguarding the spaces for future flood management. • TE2100 will have a real influence in the preparation of, and updating of regional and local strategic and spatial plans.
	<p style="text-align: center;">The middle 35 years from 2035 to 2069</p> <p style="text-align: center;">“Renewal and reshaping the riverside”</p>	<ul style="list-style-type: none"> • Many of the existing walls, embankments and smaller barriers will need raising and major refurbishment or replacement in this period. • These major projects provide an opportunity to reshape our riverside environment through working with spatial planners, designers, environmental groups and those who live and work in the Estuary area. • Towards the end of this period, a decision will be made on the century option to be adopted.
	<p style="text-align: center;">To the end of the century from 2070</p> <p style="text-align: center;">“Preparing for, and moving into the 22nd century”</p>	<ul style="list-style-type: none"> • From 2070 (based on government’s current climate change guidance) a major change will be needed and one of our “end of the century” options will be implemented. • This is a long time in the future but your views are important as they will set the basis from which future changes in attitudes are measured.

The supporting evidence

We have built up a comprehensive evidence base of data and results with over 300 studies and investigations. This evidence provides a firm foundation to our TE2100 Plan. It is also a valuable resource for us to share with implementation partners. 📄 To find out more see chapter 11.

Deciding on the Plan

In order to decide on our preferred Plan we have had to understand the impacts of all of our ten estuary-wide options. We have used two key methods – economic appraisal and strategic environmental assessment, to undertake this work which is described in chapter 7 “Deciding on the Plan”.

📄 For more information on appraisal and assessment see chapter 7.

Planning the implementation

Three phases have emerged for implementation of our TE2100 Plan, each having a different objective and theme representing the developing needs of flood risk management in the Thames estuary over the 100 years of the TE2100 Plan:

- Maintaining confidence and planning together” (2010 to 2034);
- Renewal and reshaping the riverside” (2035 to 2069);
- Preparing for, and moving into the 22nd Century” (from 2070).

Our consultation questions are in the short, medium or long term of the action plan. To aid your navigation through the action plan, we have colour coded the text according to the relevant time horizon and position in the Estuary.

A 100-year programme of works has been developed. The detail of the works proposed is contained in our action plan chapters 8 and 9. We have a high degree of confidence in the short- and medium-term programmes which take us up to the end of 2069. From 2070, given government’s current climate change guidance, a major change in the flood risk management system will be required. Our long-term programme, which takes us from 2070 into the 22nd century, has been

based on the options which come out best from our appraisal process measured against today's conditions. Significant changes in climate and other factors over the next 60 years may point to a different recommended option for the end of the century.



Your responses to the long term sections of our action plan will also guide future decision-making.

Building the partnerships


The overall responsibility for flood risk management lies with the Environment Agency but we cannot implement the TE2100 Plan alone. It requires a multi-agency approach to implementing the Plan. For instance, regional and local authorities will play a key part in delivering our recommendations for spatial and emergency planning procedures.



Your response to our action plan will help us build on existing partnerships and create new ones.

The action plan

Our action plan chapters 8 and 9 describes the actions required at local and estuary-wide level by the different people and organisations involved. This is central to our consultation and our questions are designed to seek your responses to our action plan to enable us to finalise our Plan. We are also seeking your views on our long-term plan. This will provide a basis for future decision-making.

But the work of the TE2100 Plan starts once this consultation is completed and we submit the final plan to Government in 2010. The first actions and investments are scheduled to start immediately the plan is agreed. Our programme indicates major expenditure of £1.4 bn in the first 25 years alone – though much of this represents a continuation of what we are doing now. The middle 35 years of our Plan has an estimated cost of £3.1 bn and the final years, to the end of the century, £4.2 bn (depending on the final option selected).  More information about the estimated costs of the options we are recommending and the proposed expenditure is contained within our TE2100 Technical Report. Details of how to get hold of this are in chapter 11.

This is a major investment. We are confident that our decisions are based on the best possible

science and we have worked with and listened to others throughout the development of this Plan. But this is the first time that all the elements of our Plan are presented together. It is now over to you to have your say.



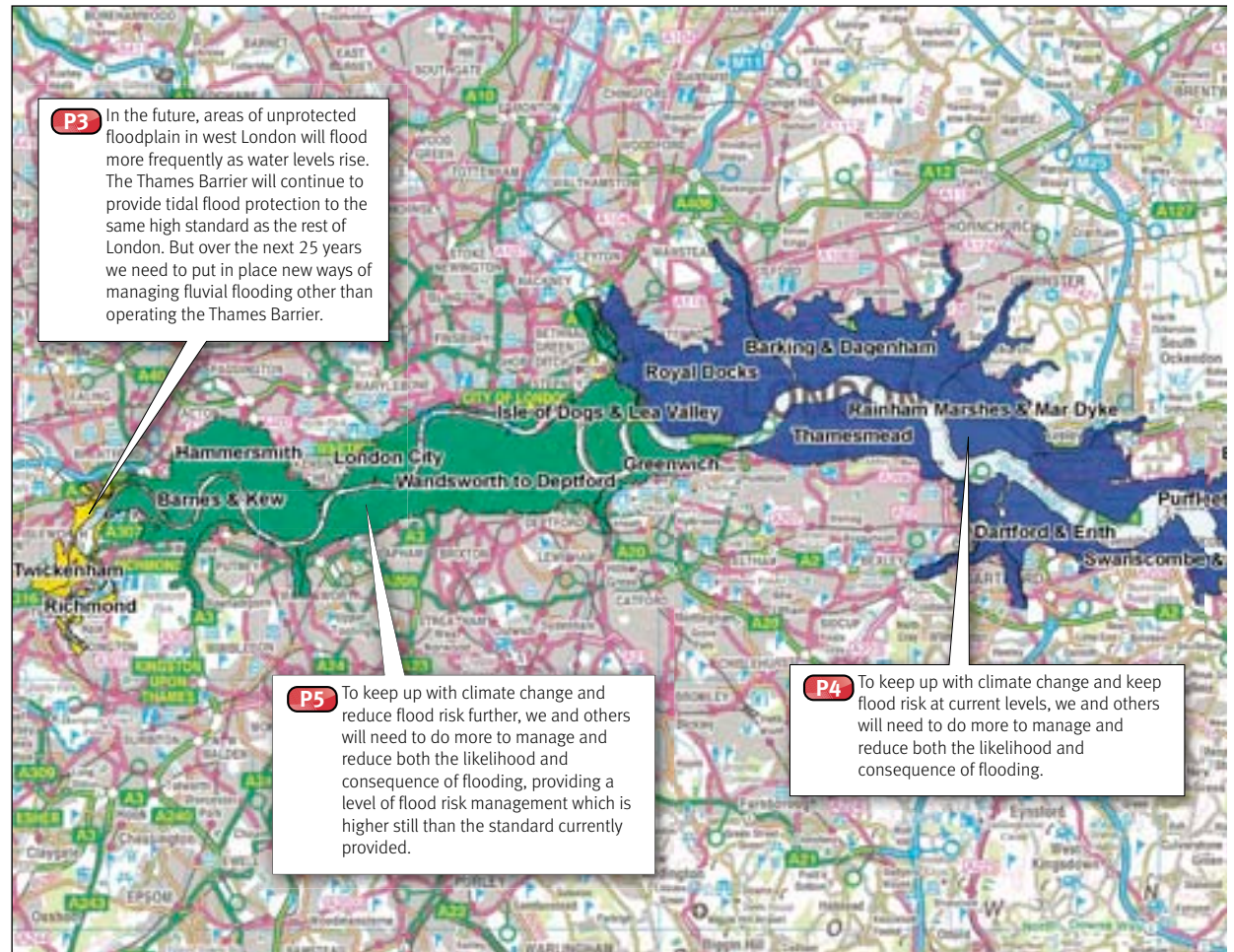
The Thames Barrier – visitors on a technical tour

Introducing the TE2100 policies

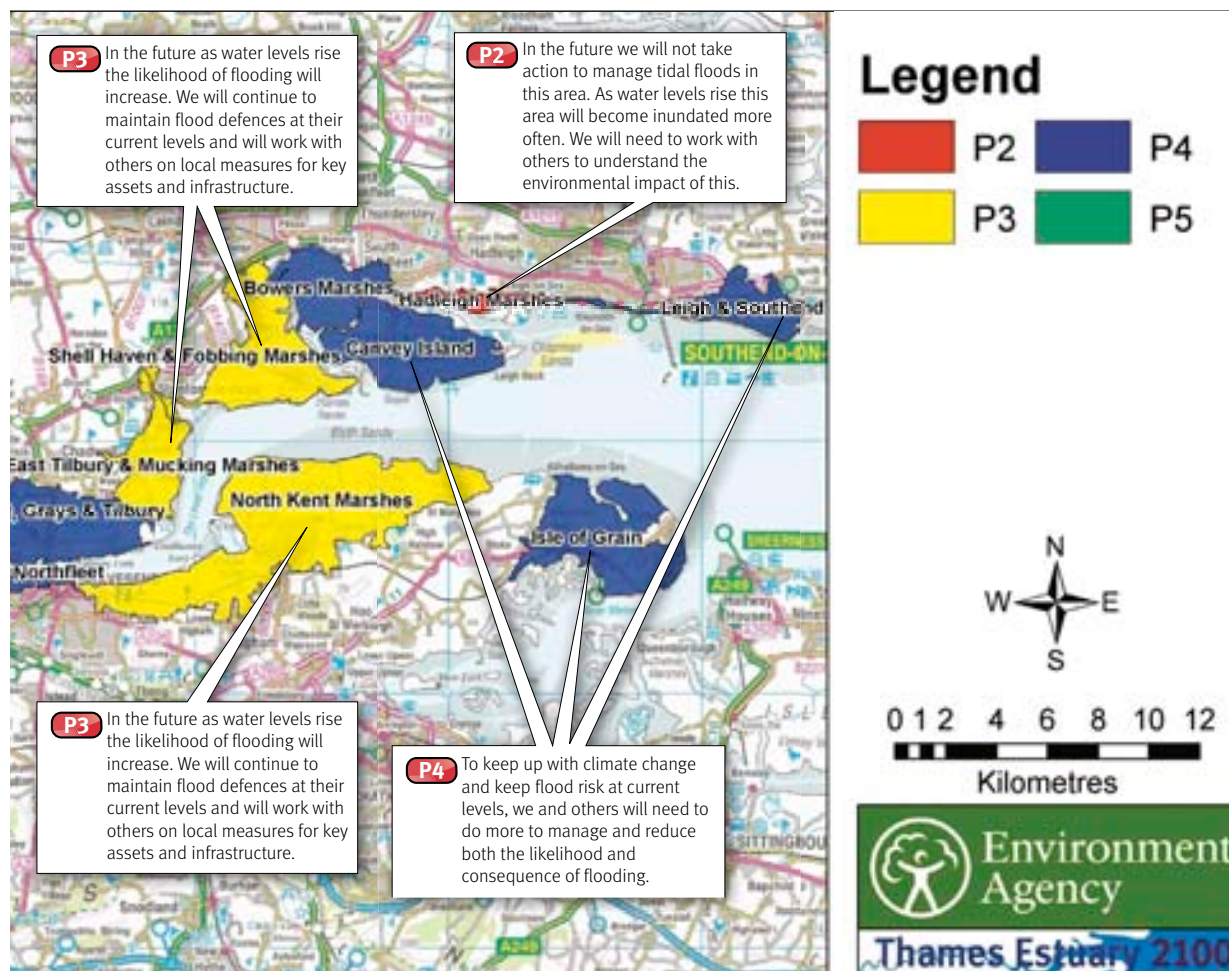
What do the policies mean?

- P1** No active intervention (including flood warning and maintenance). Continue to monitor and advise.
- P2** Reduce existing flood risk management actions (accepting that flood risk will increase over time).
- P3** Continue with existing or alternative actions to manage and **maintain** flood risk at the current level (accepting that the likelihood and/or consequences of a flood will increase over time from this baseline).
- P4** Take further action to **sustain** current scale of flood risk into the future (responding to potential increases in flood risk from urban development, land use change, and climate change).
- P5** Take further action to **reduce** the risk of flooding (now and/or in the future).

The TE2100 policies: This map shows the strategic flood risk management approach for the Thames Estuary recommended in the TE2100 Plan. We have divided the Estuary into 23 geographical areas, known as the policy units. Each policy unit has been assessed to determine the appropriate level of flood risk management.



Chapter 6: The shape of future flood risk management



P3 In the future as water levels rise the likelihood of flooding will increase. We will continue to maintain flood defences at their current levels and will work with others on local measures for key assets and infrastructure.

P2 In the future we will not take action to manage tidal floods in this area. As water levels rise this area will become inundated more often. We will need to work with others to understand the environmental impact of this.

P3 In the future as water levels rise the likelihood of flooding will increase. We will continue to maintain flood defences at their current levels and will work with others on local measures for key assets and infrastructure.

P4 To keep up with climate change and keep flood risk at current levels, we and others will need to do more to manage and reduce both the likelihood and consequence of flooding.

Moving from vision to reality: The first stage was to assess the level of flood risk management activity we can justify in different parts of the TE2100 Plan area. This is described by the policies which are the starting point for developing the TE2100 programme of activities at estuary-wide and local scale. The policies also provide us with a single framework for considering different options and assist with prioritisation of flood risk management activities.

The policies indicate the level of flood risk management which is justified by the people, the value of property and the other assets being protected in that area. The policies set the strategic direction of flood risk management in each part of the Estuary. This is defined by one of five available policies **P1** to **P5** as shown in the table.

Policy appraisal: The social, economic and environmental value of each policy unit has been assessed through a formal process to allocate a flood risk management policy. The same process is used throughout England and Wales to ensure a nationally consistent approach to flood risk – and a level playing field when it comes to allocation of scarce resources for flood risk management. Policy **P1** was used as one of the baselines for the appraisal but has not been selected for any of the TE2100 policy units. 📍 This is explained in our TE2100 Technical Report.

Understanding impacts and making decisions

To help make decisions on which are the best flood risk management options and policies for the estuary communities and environment we have used a number of assessment and appraisal methodologies. These are designed to:


- assess what strategic flood management approach, or policy, can be justified in a local area;
- assess the impacts any individual future flood management option might have;
- appraise how potential impacts of any flood management option compares with other options.

The results of the policy assessment and appraisal can be found in chapter 6. The assessment and appraisal of flood management options used the following methods:

- **Economic appraisal** (also known as cost-benefit analysis) attempts to estimate the costs and benefits to society (the nation) of options using monetary terms;
- **Strategic Environmental Assessment (SEA)** assesses the environmental and social impacts of flood management options and how they conform to environmental legislation.

Our Plan brings the two processes together to determine the best course of action, based on current information.

Economic appraisal (cost-benefit analysis)

This is accepted best practice within flood risk management planning, and the approach is consistent with Defra’s⁶ Flood and Coastal Defence Project Appraisal Guidance series and the Policy Statement on Appraisal (July 2008) issued as a result of the Making Space for Water strategy. A key aspect of this approach is the need for greater consideration of social and environmental impacts within appraisal. TE2100 has been at the cutting edge of emerging new methods (Multi-Criteria Analysis) to factor in society and the environment in flood risk management appraisal, in addition to the traditional focus on protecting against property damage from flooding.  For more information, see the TE2100 Technical Report.

As such, although called “economic appraisal”, our approach also seeks to place value on the environmental and social impacts and benefits of our flood risk management options. It remains an economic approach however to the extent that these wider impacts are expressed in terms of

⁶ Government’s Department for Environment, Food and Rural Affairs (Defra)

Table 7.1. Impact categories assessed in the appraisal

Economic
Property
Key infrastructure
Agricultural land use
Navigation
Transport
Indirect impacts on business
Environmental
Physical habitats and biodiversity
Water quality and quantity
Natural processes
Other environmental
Landscape
Historical environment
Social
Recreation
Safety and security
Sense of community
Technical
Technical risk

money values – the “worth to society” as expressed in a monetary terms. In addition to the estimated costs of an option the types of impacts assessed as part of the economic appraisal are as follows:

- Factoring in social and environmental outcomes can change the view of which options have the biggest benefits compared to the more traditional cost-benefit analysis.
- The result of the flood risk management options economic appraisal.
- Assessing the ratio of benefits to costs for all of the options considered in this stage of the Plan lead to two “front runners” being determined:
 - ...Optimised maintenance and enhancement of the existing system with modifications made to the Thames Barrier by 2070, and further adapting the structure to become a barrier with locks or “open” barrage after 2135.
 - ...Optimised maintenance and enhancement of the existing system to 2070 and building a new barrier at Long Reach by 2070; (converting to a barrier with locks or “open” barrage after 2135).

For the period up to 2070, maintaining and enhancing the current system is strongly preferred, regardless of the “end-of century” approach

selected thereafter. Uncertainty in the assessment post-2070, and the absence of an immediate need to decide on the preferred strategy beyond that point, mean that a single preferred “end of century” option is not being promoted at this time.

Strategic environmental assessment

Strategic environmental assessment (SEA) is a systematic process of evaluating the potential consequences of a plan before it is approved, and it is legally required for TE2100. SEA involves collecting and presenting baseline information relating to the Plan; identifying alternatives to the Plan and their effects; predicting the significant environmental effects of the Plan and proposing mitigation measures for these effects; preparing an Environmental Report that documents the above information; consulting the public and authorities with environmental responsibilities; and monitoring significant environmental effects of implementing the Plan.

We have carried out the SEA at the same time as developing and drafting our TE2100 Plan. It has helped us develop and assess strategic alternatives and identify opportunities for policy amendments and environmental mitigation, while shaping our early thoughts on the content of the Plan.

We have considered the impacts of our various TE2100 Plan options. 🗨️ This is reported in the supporting SEA Environmental Report.

Impact mitigation and enhancement

We have identified in our Environmental Report several ways in which we can minimise adverse effects of the flood risk management options and enhance positive ones. Some are relevant to all of the options and some to specific options only.

Examples of these mitigation actions relevant to all options include:

- **Construction** – during the construction of any options, every effort should be made to transport construction materials by river where possible, and residents should be consulted and warned in advance of planned works.
- **Floodplain management** – we need to consider flood warning, emergency planning, spatial planning and building design, including secondary defences, as appropriate. Vulnerable populations may require extra assistance to improve the effectiveness of flood warning or emergency planning.

- **Environmental enhancement** – in terms of environmental mitigation, by managing realignment areas and enhancing existing habitat on the floodplain we can provide an important habitat for fish, birds and invertebrates. Economic benefits to the estuary could be provided from improving both recreational and commercial fisheries.

There are more details of mitigating the effects of specific options in our Environmental Report.

Habitats Regulations Assessment (Appropriate Assessment)

Under the Habitats Directive we need to make an Appropriate Assessment to determine whether the TE2100 Plan will impact upon the integrity of designated habitat sites in the Thames Estuary. Our four-stage process is outlined below:

Stage 1: Clarify whether the Plan is ‘necessary’ for the site management

The TE2100 Plan is not necessary for managing the designated sites in the Thames.

Stage 2: Assessment of likely significant effect

Sea level rise could see the loss of up to 1200 ha of designated intertidal habitat in the Thames Estuary Plan area over the next century.

This has been identified through the Greater Thames Coastal Habitat Management Plan (CHaMP). In recommending maintenance and improvement of the fixed defences, the TE2100 Plan is likely to have significant negative effect alone, and in combination, on the:

- Medway Estuary and Marshes SPA/Ramsar site
- Thames Estuary and Marshes SPA/Ramsar site
- Holehaven Creek proposed SPA
- Benfleet and Southend SPA/Ramsar site
- Foulness (Mid-Essex Coast Phase 5) SPA/Ramsar/SAC

The primary reason for this is that continuing with the current line of defences will mean that these sites are likely to suffer from coastal squeeze – where the inter-tidal habitat is squeezed out between the line of defences and rising sea levels.

Stage 3: Adverse effect assessment procedure

Discussions with Natural England on this stage are underway. Investigations to date suggest there is likely to be an adverse effect on site integrity as a result of the Plan on the:

- Medway Estuary and Marshes SPA/Ramsar site
- Benfleet and Southend SPA/Ramsar site
- Thames Estuary and Marshes SPA/Ramsar site
- Holehaven Creek proposed SPA

Stage 4: Alternatives

We have considered and consulted on a wide range of alternatives before arriving at the range of options contained in the Consultation Plan. If at this stage no alternative solutions are identified, Imperative Reasons for Overriding Public Interest (IROPI) tests will be applied and a joint case from the Environment Agency and Natural England will be submitted to the Secretary of State.

In anticipation that the Appropriate Assessment cannot conclude there will be no adverse effect, we have identified in the TE2100 Plan opportunities for 1600 ha for potential intertidal habitat creation and 1400 ha for potential freshwater habitat creation. These are identified within our action plan (Chapters 8 & 9). Following EC guidance and in agreement with Natural England, the new habitat areas are as near as possible to those adversely affected; are suitable in terms of ecological features; and should be ready in time to provide the functions they are intended to compensate for.

SEA and HRA: Conclusions

The conclusion of the SEA and HRA (Appropriate Assessment) process is that the environmentally-preferred option is to upgrade and maintain the existing system of defences (option 1.4). Barrier options are likely to infringe environmental legislation.

Bringing the economic appraisal and SEA together

In summary, the economic appraisal has identified **Improving the existing defences** (option 1.4) and a **New barrier at Long Reach** (option 3.2) as “front runners” for the period beyond 2070, with Improving the existing system (option 1.4) being preferred before then.

The SEA/HRA process has concluded that Improving the existing system – optimising repair and replacement (option 1.4) is the environmentally preferred option both pre- and post-2070.

This suggests that the overall preference would be for Improving the existing system (option 1.4), however, current information suggests that a new Barrier at Long Reach (option 3.2) might be the better economic option by a small margin post-2070.



The TE2100 action zones

Our action plan sets out our recommendations estuary-wide and in each of the TE2100 policy units. There are 23 policy units in our Plan area, so to avoid repetition we have grouped together those with similar characteristics and requiring a similar type and range of actions. There are eight of these local action zones and an estuary-wide zone:

Action zone 0 – estuary-wide

Action zone 1 – west London

Action zone 2 – central London

Action zone 3 – east London

Action zone 4 – east London downstream of Thames Barrier

Action zone 5 – middle Estuary

Action zone 6 – lower Estuary Marshes






Action zone 7 – lower Estuary, urban/industrial and marshland

Action zone 8 – Seaside/fishermen’s frontage

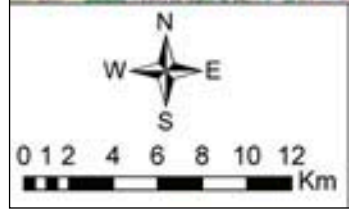
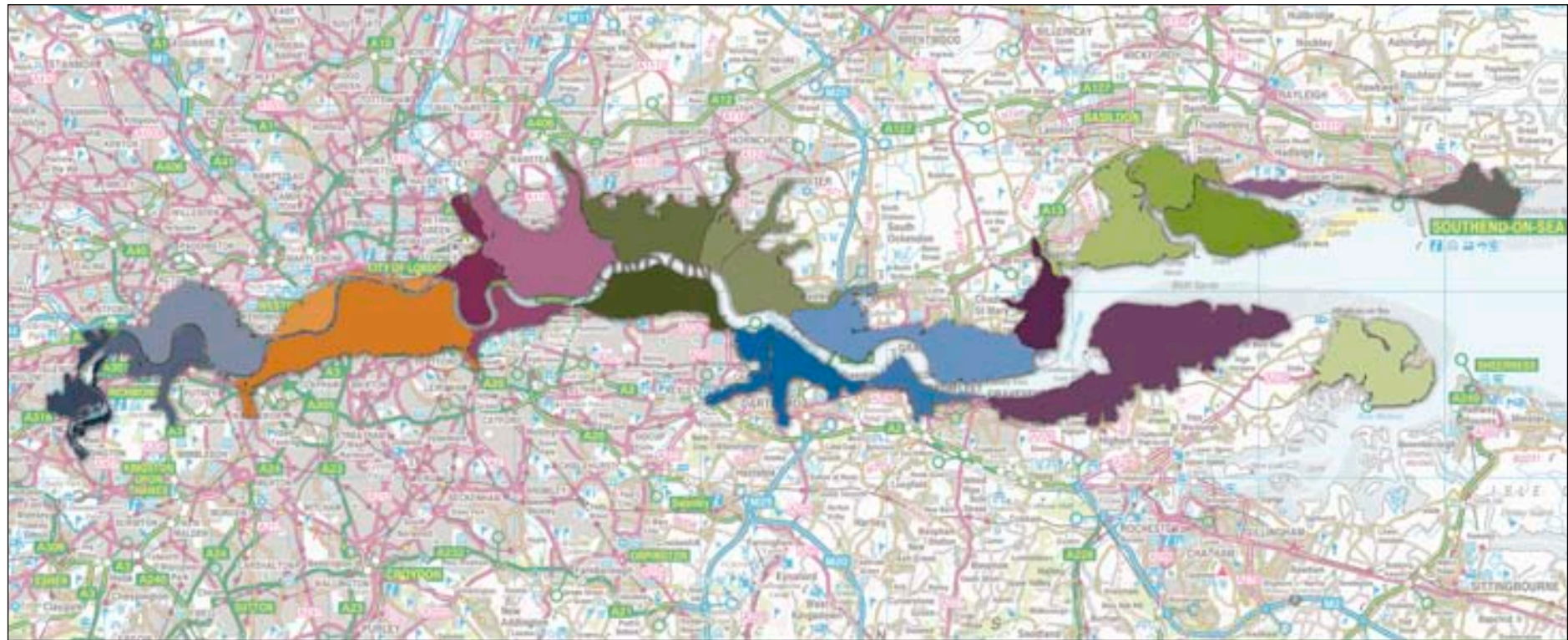
There is a description explaining the features of each policy unit and our action plan for each zone which shows:

- what actions are required;
- who will undertake these actions;
- how this will be done;
- how your response can help us finalise the TE2100 Plan.



-  Do you agree with our assessment of the policy units?
-  Do you consider that we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?
-  Do you agree with the actions identified in our action plans and the timing of those actions?
-  Do you agree with the mechanisms we have set out to deliver the action plans?
-  Have we identified the right partner organisations to deliver our action plans and are you, or your organisation, able to contribute to these actions?

Chapter 8: Introducing the action plan



Thames Estuary 2100 Action Zones

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An overview of the action zones



Action zone 1



Action zone 2



Action zone 3

Action zone 0 – estuary-wide

(This action zone covers the estuary-wide options which affect to a greater or lesser degree, all 23 of the policy units)

This action zone covers the whole Estuary and our estuary-wide options are presented here for consultation. These estuary-wide options provide the strategic framework for flood risk management for the TE2100 Plan area for 100 years. Further information on what this means at local level is described in the action plan tables for zones 1 to 8.



Action zone 4

Action zone 1 – west London

(Richmond, Twickenham, Barnes & Kew and Hammersmith)

These four policy units are in West London. Whilst the area is heavily urbanised, they all have large open spaces and important recreation and amenity areas. Richmond and Twickenham both have a significant fluvial flood risk from the Thames. Richmond and Twickenham policy units have been given by TE2100 a **P3** flood risk management policy and we recommend a **P5** policy for Barnes & Kew and Hammersmith policy units. These policies are further described in the action plan and are outlined in chapter 6.

Action zone 2 – central London

(Wandsworth to Deptford and London City)

These two policy units cover the section of the Thames that passes through central London. TE2100 gives both policy units a **P5** flood risk management policy.

Action zone 3 – east London

(Greenwich, Isle of Dogs & Lea Valley and Royal Docks)

These three policy units cover much of the regeneration area in East London. Development at Canary Wharf on the Isle of Dogs continues, and there are major developments planned in the Greenwich and Royal Docks policy units. TE2100 gives Greenwich and Isle of Dogs & Lea Valley a **P5** flood risk management policy and Royal Docks a **P4**.

Action zone 4 – east London downstream of Thames Barrier

(Barking & Dagenham, Rainham Marshes & Mar Dyke and Thamesmead)

These three policy units cover the Estuary from Woolwich to Erith. Common features include new residential development, major industrial areas and open marshes. TE2100 gives all these policy units a **P4** flood risk management policy.



Action zone 5



Action zone 7



Action zone 6



Action zone 8

Action zone 5 – middle Estuary

(Dartford & Erith, Swanscombe & Northfleet and Purfleet, Grays & Tilbury)

These three policy units cover the Estuary from Erith to Gravesend. Common features include port activity, new development sites, industry and open marshes. TE2100 gives all these policy units a **P4** flood risk management policy.

Action zone 6 – lower Estuary Marshes

(East Tilbury & Mucking Marshes, North Kent Marshes and Hadleigh Marshes)

These three policy units are all in the lower Estuary. They are predominantly areas of open grazing marshes. TE2100 gives East Tilbury and North Kent Marshes a **P3** flood risk management policy and Hadleigh Marshes a **P2**. This means that flood risk is likely to increase in these policy units.

Action zone 7 – lower Estuary, urban/industrial and marshland

(Canvey Island, Bowers Marshes, Shell Haven & Fobbing Marshes and Isle of Grain)

These four policy units cover a wide range of land uses, including a major residential area (Canvey Island), major industrial areas (Shell Haven/ Coryton and Isle of Grain East), and areas of freshwater marsh. Canvey Island, Bowers Marshes and Shell Haven & Fobbing Marshes are linked together because they have a common flood risk management system. TE2100 gives Canvey Island, the Isle of Grain and Bowers Marshes a **P4** flood risk management policy and Shell Haven & Fobbing Marshes a **P3** with secondary defence arrangements at key sites.

Action zone 8 – Seaside/fishermen's frontage

(Leigh-on-Sea and Southend-on-Sea)

This single policy unit has a very different character to the rest of the Estuary and is therefore treated separately. Southend-on-Sea is a seaside resort and Leigh has a strong fishing tradition. The policy unit has a long frontage and a narrow floodplain. TE2100 gives it a **P4** flood risk management policy.

Action zones

Action zone 0 – estuary-wide

■ Estuary-wide option 1 (improve existing system)	50
■ Estuary-wide option 2 (tidal flood storage)	51
■ Estuary-wide option 3 (new barriers).....	52
■ Estuary-wide option 4 (new barrier with locks)	54

Action zone 1 – west London

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■ Twickenham	72
■ Barnes & Kew	74
■ Hammersmith.....	76

Action zone 2 – central London

■ Wandsworth to Deptford	90
■ London City	94

Action zone 3 – east London

■ Isle of Dogs & Lea Valley.....	106
■ Greenwich.....	109
■ Royal Docks.....	112

Action zone 4 – east London downstream of Thames Barrier

■ Thamesmead	126
■ Barking & Dagenham	129
■ Rainham Marshes & Mar Dyke	132

Action zone 5 – middle Estuary

■ Dartford & Erith	146
■ Swanscombe & Northfleet	148
■ Purfleet, Grays & Tilbury.....	150

Action zone 6 – lower Estuary Marshes

■ East Tilbury & Mucking Marshes	162
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■ Hadleigh Marshes.....	166

Action zone 7 – lower Estuary, urban/industrial and marshland

■ Canvey Island.....	176
■ Bowers Marshes.....	179
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■ Isle of Grain	185

Action zone 8 – Seaside/fishermen’s frontage

■ Leigh-on-Sea & Southend-on-Sea	200
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Action plan for zone 0 – table A.0.

14 actions identified

The estuary-wide options

- Estuary-wide option 1 (improve existing system)
- Estuary-wide option 2 (tidal flood storage)
- Estuary-wide option 3 (new barrier)
- Estuary-wide option 4 (new barrier with locks)

Table A.0. describes the 14 actions for zone 0 – (estuary-wide) which have been identified through the TE2100 plan. The actions are described under the following headings:

- TE2100 recommended actions (and whether or not costs for this have been included in the TE2100 plan)
- Implementation partners
- How this will be achieved
- How your response can help us finalise the TE2100 plan



Do you consider that we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?



Do you agree with the actions identified in our action plans and the timing of those actions?



Do you agree with the mechanisms we have set out to deliver the action plans?



Have we identified the right partner organisations to deliver our action plans and are you, or your organisation, able to contribute to these actions?

Chapter 9: TE2100 action plan: **action zone 0** – estuary-wide

Estuary-wide option 1
(improve existing system)

Estuary-wide option 2
(tidal flood storage)

Estuary-wide option 3
(new barrier)

Estuary-wide option 4
(new barrier with locks)

The TE2100 estuary-wide options

We have devised ten estuary-wide options and tested them for effectiveness and efficiency in delivering our strategic vision, and a rolling

programme of construction work and related activities has been defined from 2010 to 2069 the main options and the “do minimum” Policy **P3** are summarised below.

The estuary-wide option	What it means
Policy P3 . Maintain the current level of flood risk management	Continuing current flood risk management activity.
Option 1: Improve the existing defences 1.1 Raise defences when needed 1.2 Allow for future adaptation of defences 1.3 Raise defences when they are replaced 1.4 Optimise defence repair & replacement	Four different sub-options were considered, involving different maintenance schedules, and different ways of deciding when and by how much walls should be raised. Our appraisal indicates that option 1.4 is the preferred option until 2070.
Option 2: Tidal flood storage Four potential sites have been identified which are in the right location to store tidal waters and reduce the level of storm surges. The sites identified are at Erith Marshes, Aveley and Wennington Marshes, Dartford and Crayford Marshes, and Shorne and Higham Marshes.	Storing tidal waters during very large surge tides would help to reduce extreme water levels at the Thames Barrier. This could delay by several decades the date when the Thames Barrier would have to be replaced or improved. Our appraisal and technical investigations do not favour this option at present but it remains in our palette of end of the century options for future review.
Option 3: New barrier 3.1 Tilbury location 3.2 Long Reach location Barriers would be designed to resist the highest surge tides predicted under the Defra climate change scenario.	Both options assume that the barrier can be closed only a certain number of times per year, so there would still be a need for defence raising upstream.

(continued)

The estuary-wide option	What it means
<p>Option 4: Barrier with locks</p> <p>4.1 Tilbury location 4.2 Long Reach location 4.3 Barrier with locks at Thames Barrier (when closures/year approach their limit)</p>	<p>A barrier with locks allows ships to pass through large openings in the same way as a new barrier during periods when the barrier is open, but also allows ships to pass through locks when the barrier is closed. A barrier with locks is designed to be ‘fail-safe’ and can be closed as frequently as necessary without losing its reliability. This is the most expensive option.</p>

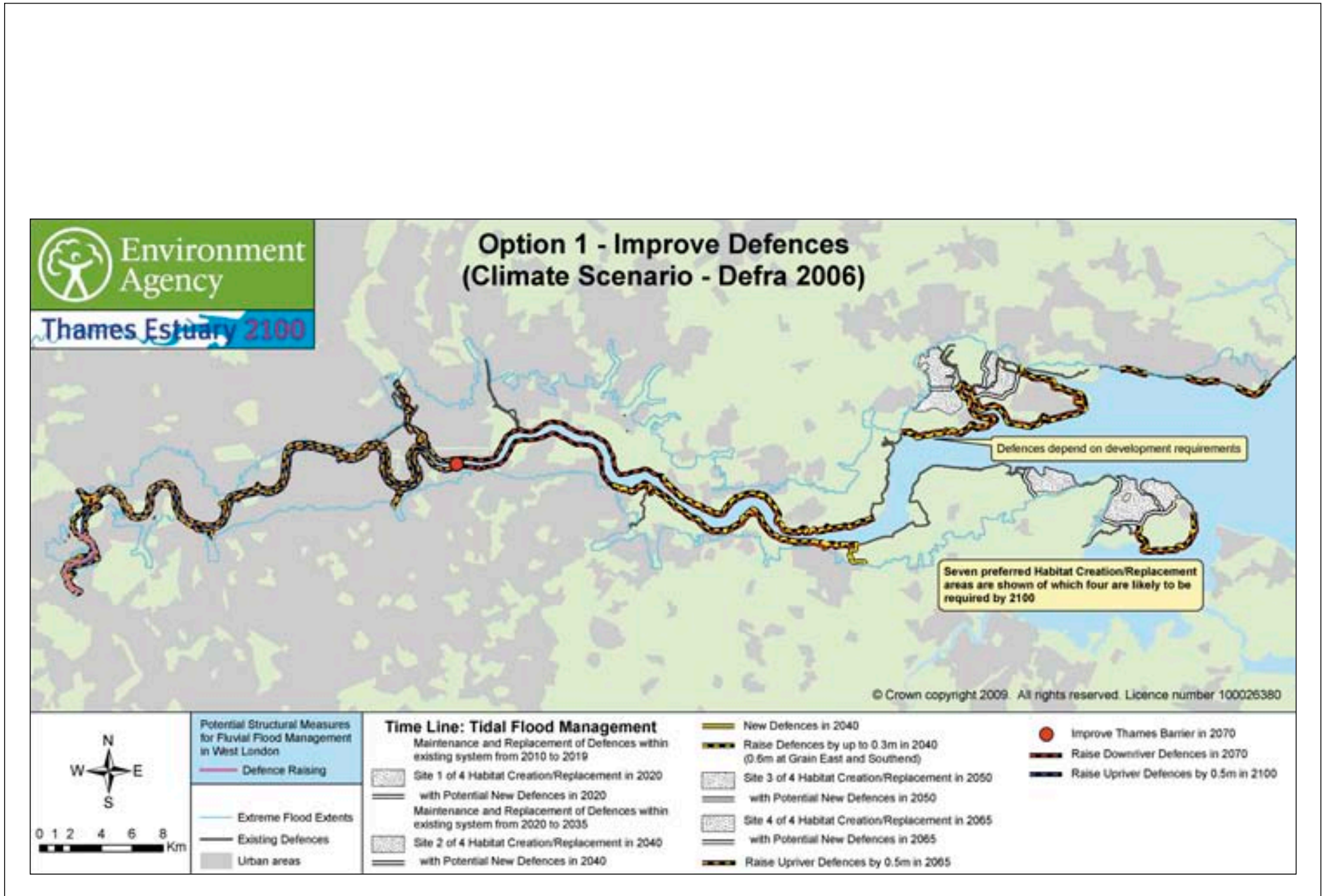


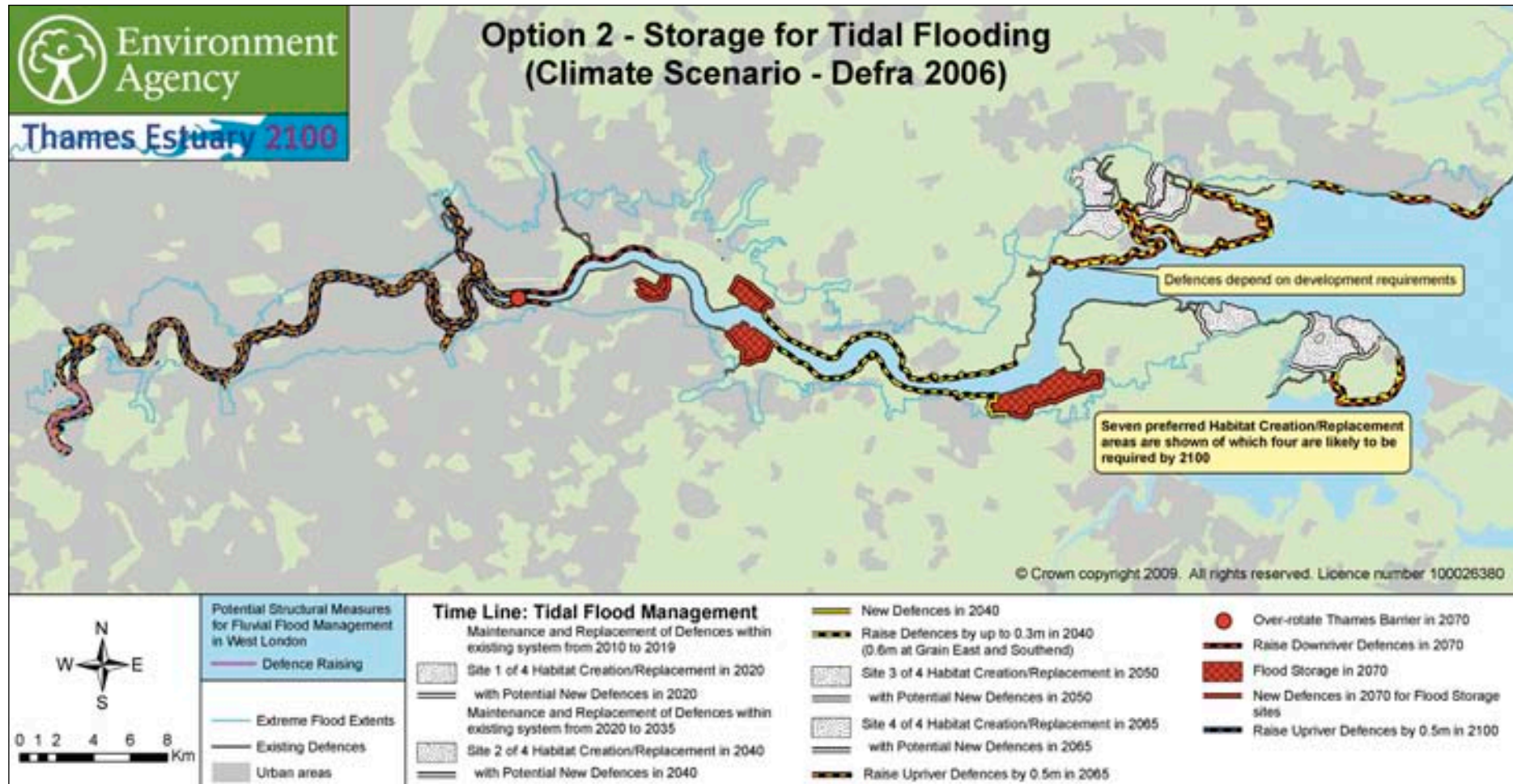
Our appraisal shows that option 1.4 is the optimum approach for the first 60 years of the Plan under government’s current guidance on climate change.



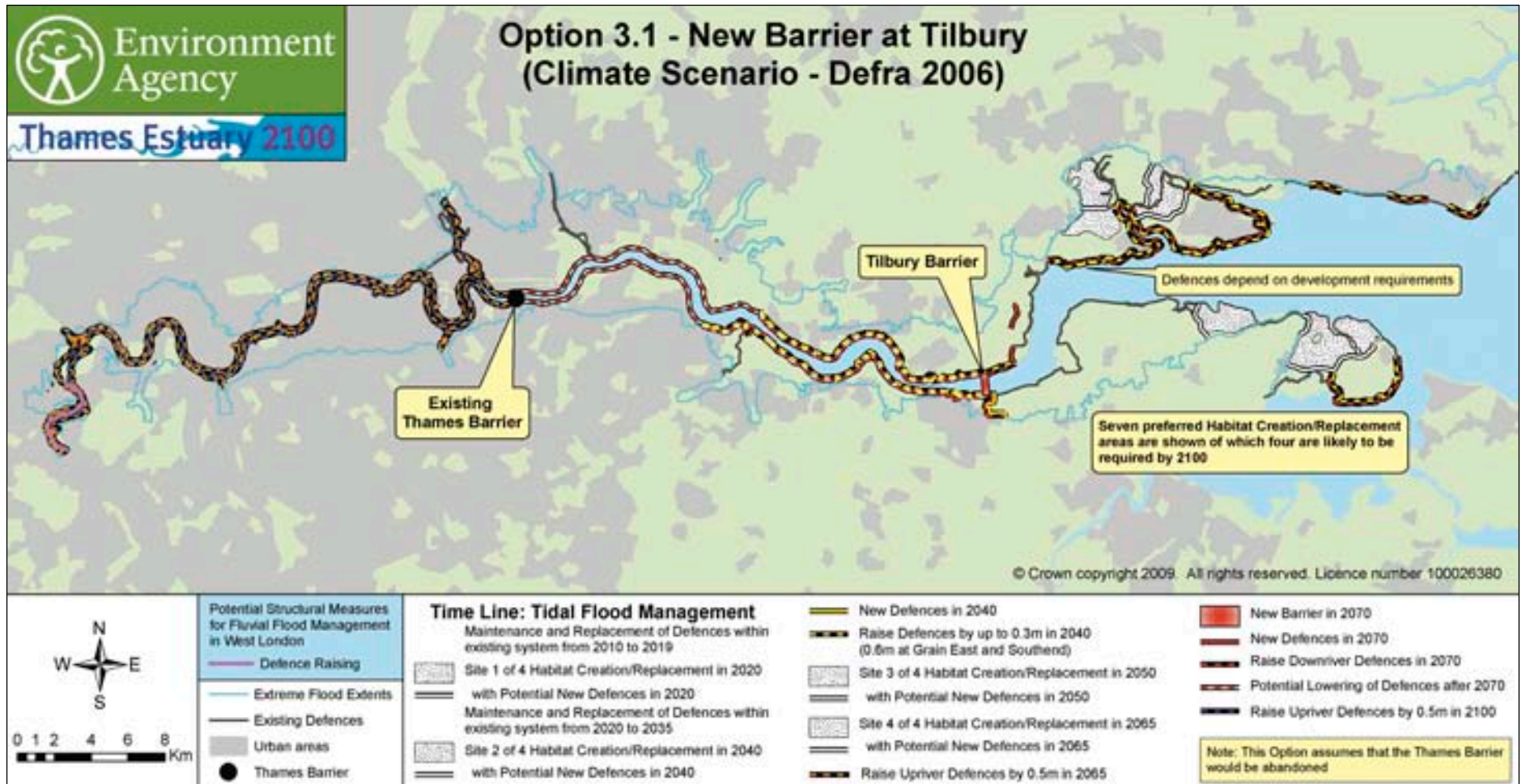
From the year 2070, our appraisal shows that options 1.4 and 3.2 are the two front-runners for managing tidal flood risk up to the end of this century and into the 22nd century.

Chapter 9: TE2100 action plan: **action zone 0** – estuary-wide

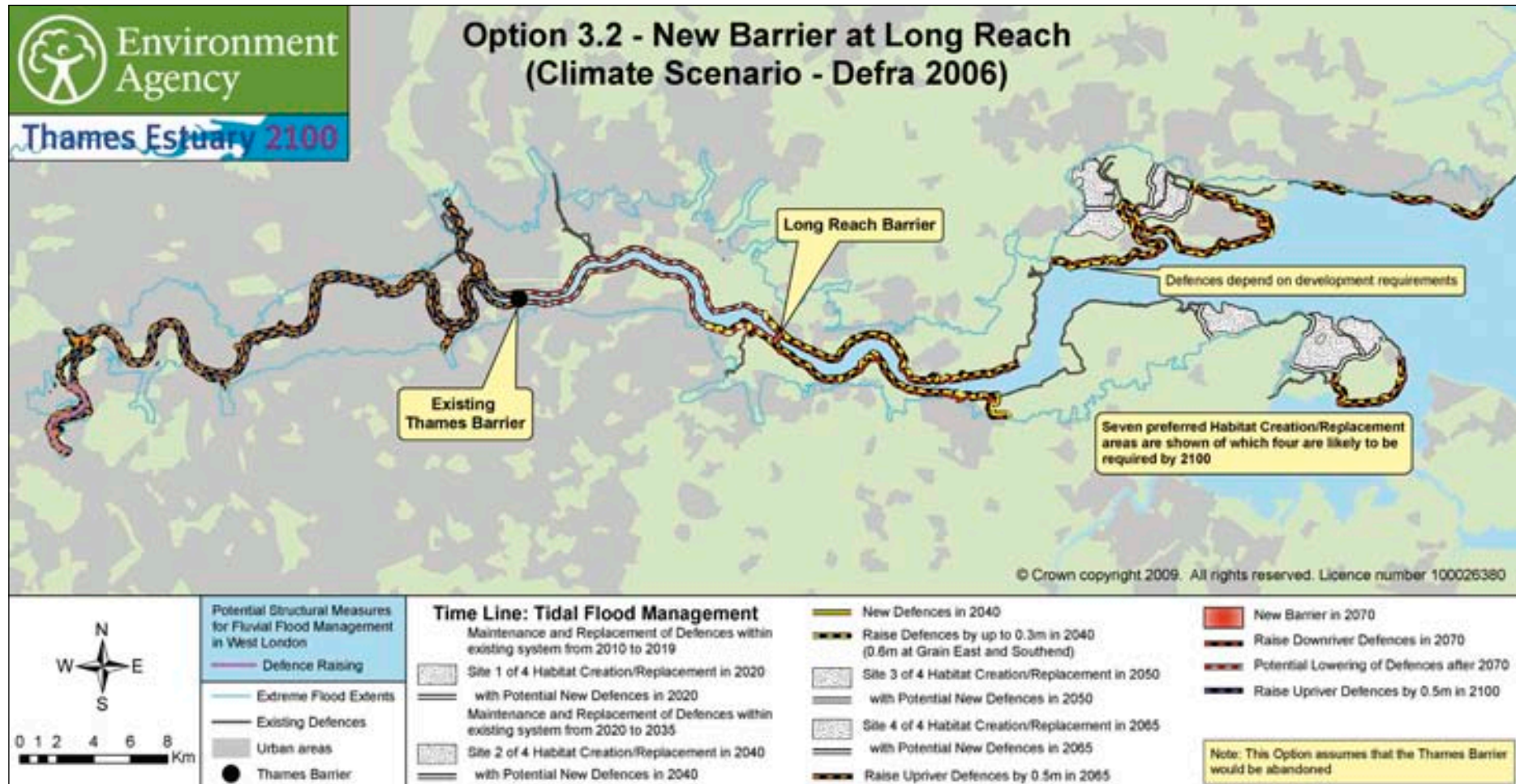




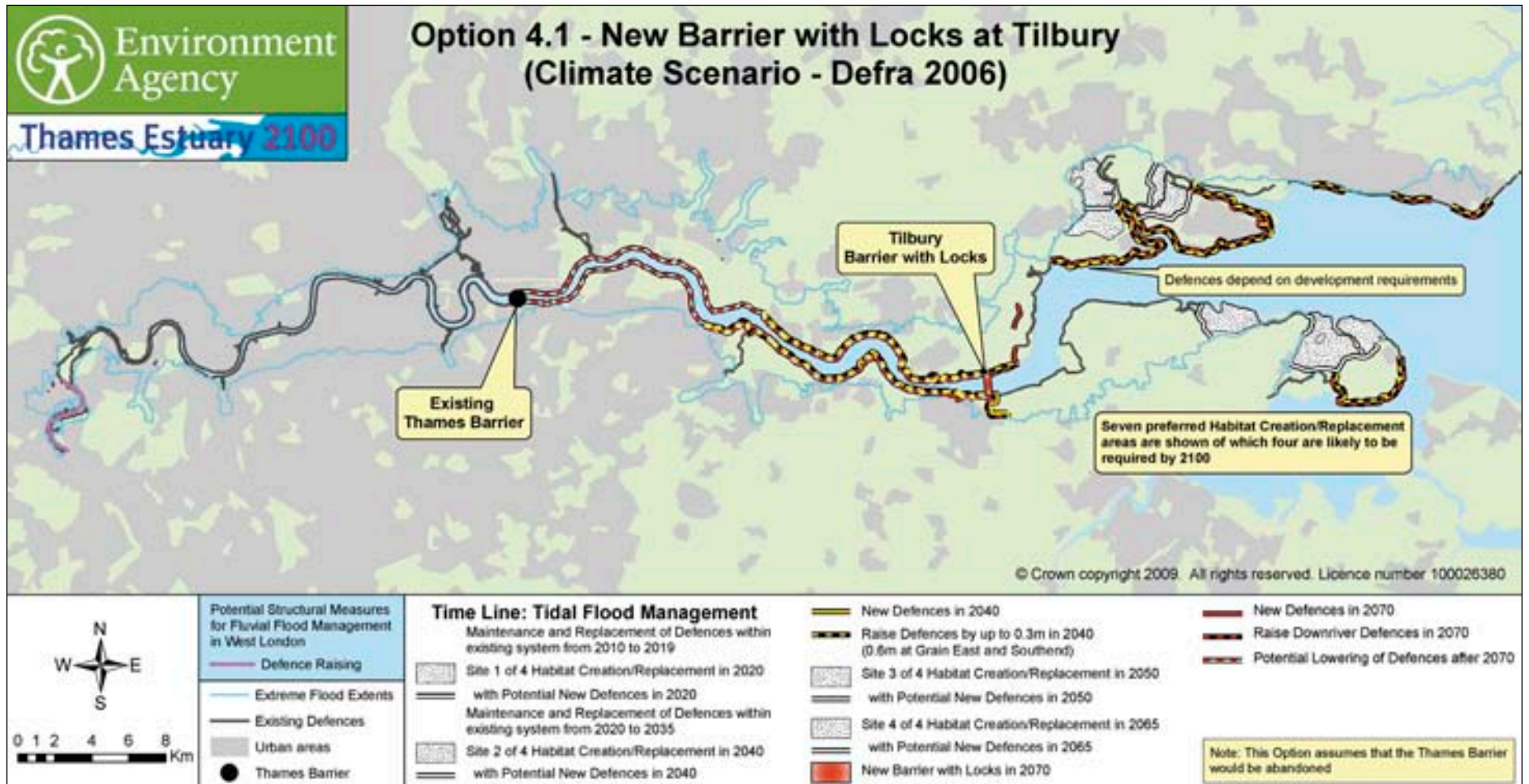
Estuary-wide option 2 (tidal flood storage)



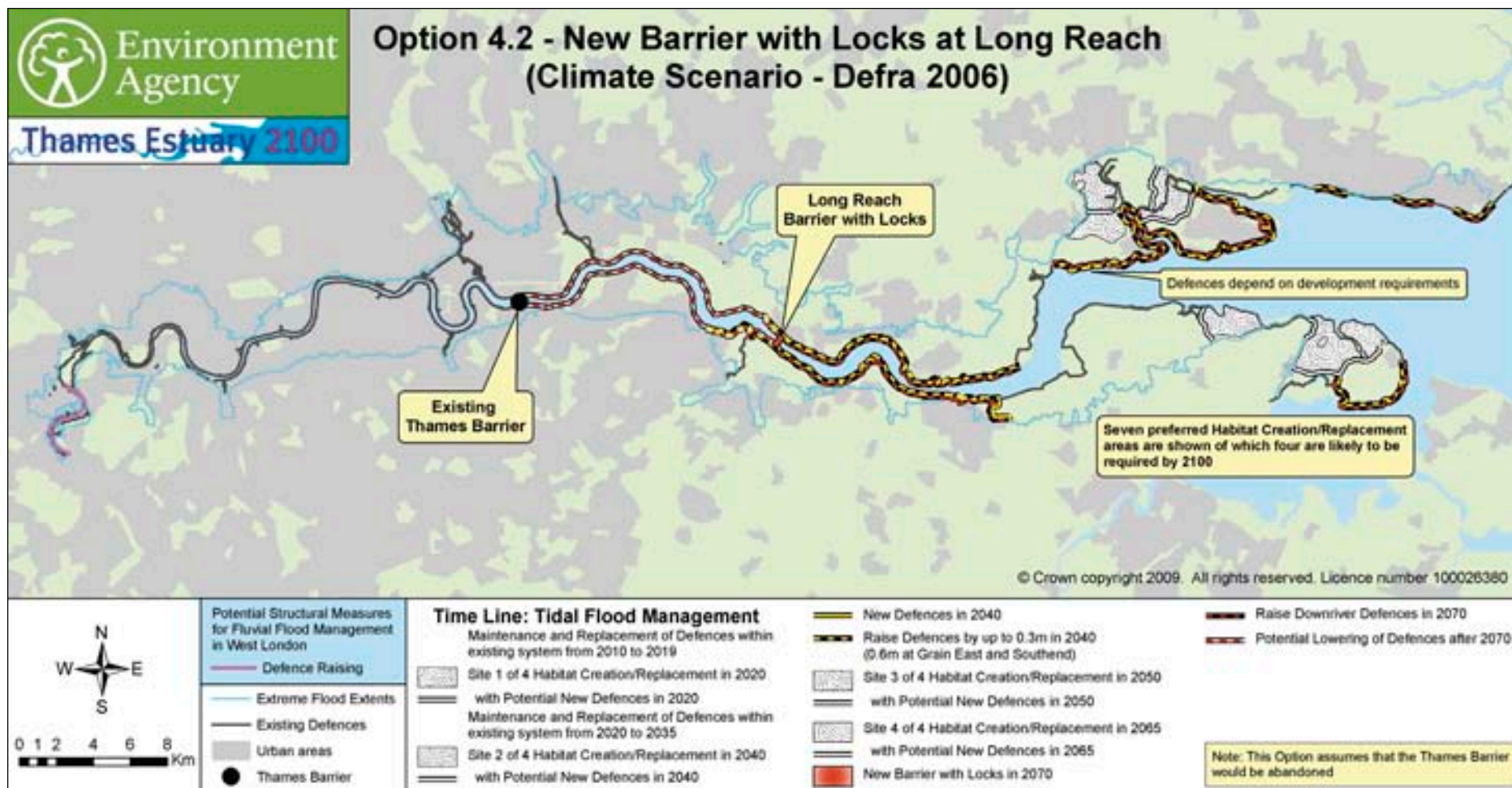
Estuary-wide option 3 (new barrier)



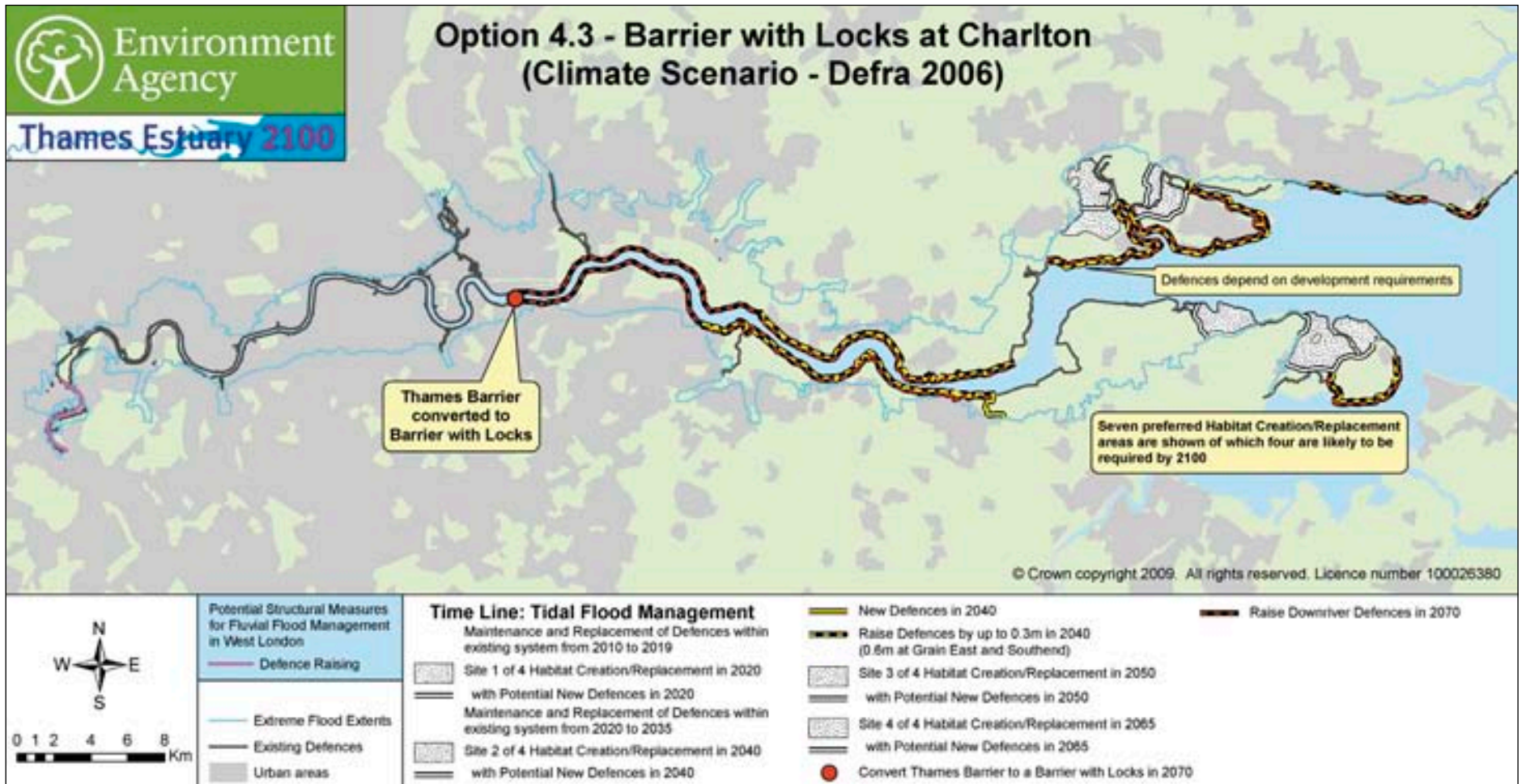
Estuary-wide option 3 (new barrier)



Estuary-wide option 4 (new barrier with locks)



Estuary-wide option 4 (new barrier with locks)




Estuary-wide option 4 (new barrier with locks)

Table A.0. – estuary-wide options

- Option 1
Improve existing system
- Option 2
Tidal flood storage
- Option 3
New barrier (two locations)
- Option 4
New barrier with locks

[Note that all dates are based on government’s current guidance on climate change – the TE2100 plan will be reviewed and updated if these predictions change]

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.O.1. Maintain and improve or replace defences (option 1.4.).</p> <p>Our appraisal shows this is the optimum approach for the first 25 years of the Plan from 2010 to 2034. It will involve continued maintenance and improvement of the defences. Option 1.4 (Optimise defence repair & replacement) is shown to be 10% less expensive than the other sub-options:</p> <ul style="list-style-type: none"> 1.1 Raise defences when needed 1.2 Allow for future adaptation of defences 1.3 Raise defences when they are replaced 1.4 Optimise defence repair & replacement. <p>Opportunities being sought for partnerships and environmental improvements. See local plans.</p> <p><i>(Cost included in TE2100 plan)</i></p>	<p>Environment Agency</p> <p>Riparian owners with responsibility for their defences</p> <p>Landowners adjacent to the defences</p> <p>Regional and local authorities</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset System Management teams will promote these schemes. However, the method of improving the defences is different from the present day approach. It involves greater maintenance and repair work in addition to replacement. Promotion of schemes through the capital programme may not be appropriate for maintenance and repair, and a different way of working may be required.</p>	<p>This is the work which the Environment Agency does now. We will continue with our programme of maintenance and replacement but we are looking for ways of working better and more effectively.</p> <p>We are also seeking opportunities and partnerships to deliver environmental and recreational enhancements which will create a better place.</p> <p>We would welcome any comments that you or your organisation can provide which assist us in these aims. You can respond here with comments relating to the whole Estuary, or if you have specific comments relating to the area where you live or work, you can respond to the local action plan tables.</p> <p style="text-align: right;">(continued)</p>



Chapter 9: TE2100 action plan: **action zone 0** – estuary-wide


Estuary-wide option 1
(improve existing system)

Estuary-wide option 2
(tidal flood storage)

Estuary-wide option 3
(new barrier)

Estuary-wide option 4
(new barrier with locks)

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	A.0.1. (continued)			We are interested in your views about how defences will be raised. Option 1.4 assumes that they will be raised when required and not when replaced. This differs from the present practice of raising at replacement. If defences are not raised at replacement, the foundations for new defences should be strong enough to take future raising. This will mean more larger initial constructions, which have built in adaptability for future raising.
	 <p>A.0.2. To maintain, operate, modify and improve the Thames Barrier and other active defences for the first 25 years of the Plan from 2010 to 2034.</p> <p>Includes the Thames Barrier but also:</p> <ul style="list-style-type: none"> • KGV dock gate and Gallions sluice • Barking Barrier • Dartford Barrier • Tilbury Docks Flood Gate • Fobbing Horse Barrier • East Haven Barrier • Benfleet Barrier • 36 major industrial floodgates • 480 minor frontage gates and moveable defences. <p><i>(Cost included in TE2100 plan)</i></p>	<p>Environment Agency</p> <p>Riparian owners with responsibility for their defences</p> <p>Landowners adjacent to the defences</p> <p>Regional and local authorities</p>	<p>We will continue to operate, maintain, modify and improve the Thames Barrier and other active defences.</p> <p>For active defences owned and operated by others we will oversee their operation and maintenance.</p> <p>We will promote schemes through capital programme and they will form part of strategic and investment plans.</p>	<p>This is the work which the Environment Agency does now. We will continue with our programme of operations, maintenance and replacement but we are looking for ways of working better and more effectively.</p> <p>We are also seeking opportunities and partnerships to deliver environmental and recreational enhancements which will create a better place.</p> <p>We would welcome any comments that you or your organisation can provide which assist us in these aims. We are particularly interested to learn more about your views on the other barriers which operate in concert with the Thames Barrier.</p>

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.0.3. Habitat Creation site 1 of 4</p> <p>In 2020 the first of four intertidal habitat creation sites will be implemented.</p> <p>Valuable habitat is being lost because our defences are preventing it from migrating landwards as sea level rises and over the 100-year life of our Plan, 1200 hectares of new habitat will be needed. We have identified seven sites which have the right characteristics for habitat creation. The location of the sites are shown on the estuary-wide option maps. The sites are:</p> <ul style="list-style-type: none"> • Grain Marshes • All hallows Marshes • St Mary’s Marsh • West Canvey Marshes • Vange Marsh • Bowers Marsh • Fobbing Marshes. <p>By 2020 new freshwater habitat will be needed to compensate for the loss of designated freshwater and grazing marsh interest features as a result of potential loss as a result of intertidal habitat creation. The following sites have been identified as having the potential to support the interest features that could be lost, either through enhancement of existing features or creation of new habitat:</p> <ul style="list-style-type: none"> • Vange and North Fobbing Marshes • Dartford Marshes East 	<p>Environment Agency</p> <p>Natural England</p> <p>Landowners</p> <p>Local Authorities</p> <p>Public and local interest groups</p> <p>RSPB</p> <p>Wildlife Trusts</p>	<p>Planning and groundworks will commence 10 years before implementation of the managed realignment. This preliminary work includes construction of a new line of defence to protect people and properties from the risk of flooding from the new intertidal zone.</p> <p>It also includes, in some cases, recharging the land levels so that the correct habitat develops. It may take up to 10 years after the realignment is implemented before the habitat is fully established at the site.</p> <p>We will be looking for partnership arrangements to manage these sites and get the best for the natural environment, for the local population and for visitors.</p>	<p>We would like to hear your views on our 2020 habitat creation proposal. If your views cover all the sites, or are generally about habitat creation, then please respond to this action (A.0.3.). If you have views about specific sites, please respond to the relevant local action plan in the tables that follow.</p> <p>It is important that we use this consultation to have a proper and effective airing of information and views regarding any land use change. In the Environment Agency, we see habitat creation as a positive step towards the goal of sustainability and supporting the habitats and species that make the Thames estuary internationally important. As managers of flood defences we also have an obligation to maintain the ecological integrity of internationally designated habitats where it is determined our defences are having a detrimental effect. This habitat must be replaced.</p> <p>There will be no increased tidal flood risk to the public as a result of the intertidal habitat creation schemes as they will always include a new defence construction on the landward side of the new habitat to protect people and property. This provides major opportunities for improving the reliability of the defence system. It also provides opportunities for enhancements for recreation, key infrastructure, visitors centres and other facilities. In order to finalise our plans, we need to hear what you think – in general terms, or at a local level.</p> <p style="text-align: right;">(continued)</p>



Chapter 9: TE2100 action plan: **action zone 0** – estuary-wide



Estuary-wide option 1
(improve existing system)

Estuary-wide option 2
(tidal flood storage)

Estuary-wide option 3
(new barrier)

Estuary-wide option 4
(new barrier with locks)

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.0.3. (continued)</p> <ul style="list-style-type: none"> • Shorne Marshes West • Aveley, Wennington and Rainham Marshes • Ingrebourne River • Dartford and Crayford Marshes • South Fobbing Marshes • Cliffe Marshes • Pitsea Marshes • Cooling Marshes • Tilbury Marshes and West Tilbury Marshes • Hadleigh Marsh East • High Halstow • Higham Marshes • Aveley Bay/Wennington Creek. <p><i>(Cost of new intertidal habitat included in TE2100 plan, cost of new freshwater habitat not included in TE2100 plan)</i></p>			
	<p>A.0.4.</p> <p>To maintain and improve or replace defences (option 1.4).</p> <p>Our appraisal shows this is the optimum approach for the 35 years of the Plan from 2035 to 2069. It will involve continued maintenance, operation and improvement of the defences. Option 1.4 (Optimise defence repair & replacement) is shown to be 10% less expensive than the other sub-options (see A.0.1. above).</p> <p><i>(Cost included in TE2100 plan)</i></p>	<p>Environment Agency</p> <p>Riparian owners with responsibility for their defences</p> <p>Landowners adjacent to the defences</p> <p>Regional and local authorities</p>	<p>The period 2035 to 2069 includes raising of both upriver and downriver defences.</p> <p>There will also be a major programme of rebuilding and refurbishment of the defences as they come to the end of their useful lives.</p> <p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p>	<p>These works will happen between 2035 and 2059 so they may not affect you directly. Our aims remain as A.0.1. above, but during this period, many of the defences will have come to the end of their lives. This provides many opportunities for creating a better place and planning for a better riverside environment.</p> <p>If you have views which would help us shape the future riverside environment, then please respond to this action (A.0.4.).</p> <p>If you have views about specific sites, please respond to the relevant local action plan in the tables that follow.</p>

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.0.5. To maintain, operate, modify and improve the Thames Barrier and other active defences during the 35 year period of the Plan from 2035 to 2069.</p> <p>Includes the Thames Barrier but also:</p> <ul style="list-style-type: none"> • KGV dock gate and Gallions sluice • Barking Barrier • Dartford Barrier • Tilbury Docks Flood Gate • Fobbing Horse Barrier • East Haven Barrier • Benfleet Barrier • 36 major industrial floodgates • 480 minor frontage gates and moveable defences. <p><i>(Cost included in TE2100 plan)</i></p>	<p>Environment Agency</p> <p>Riparian owners with responsibility for their defences</p> <p>Landowners adjacent to the defences</p>	<p>We will continue to operate, maintain, modify and improve the Thames Barrier and other active defences.</p> <p>Removal of the some of the existing active defences in the Estuary could restore parts of the floodplain to a more natural system.</p> <p>Where necessary passive defences could be implemented to provide an appropriate level of risk management to property at risk.</p> <p>For active defences owned and operated by others we will oversee their operation and maintenance.</p> <p>We will promote schemes through capital programme and they will form part of strategic and investment plans.</p>	<p>Even if you and/or your organisation are not planning this far ahead, your views and any additional information you can provide will be of interest to us for future planning.</p> <p>Restoring natural function to the floodplain by removing structures supports the provision of an appropriate and sustainable flood risk management system and aligns with the Government’s making space for water strategy.</p>
	<p>A.0.6. Habitat Creation – site 2, 3, and 4.</p>	<p>Environment Agency</p> <p>Natural England</p> <p>Local Authorities</p> <p>Landowners</p>	<p>Monitoring and review will be required to confirm actual loss of intertidal habitat compared to that which was projected. Adjustment may need to be made to planned replacement activities.</p>	<p>We would like to hear your views on our 2040, 2050 and 2065 habitat creation proposals. If your views cover all the sites, or are generally about habitat creation, then please respond to this action A.0.6.</p> <p style="text-align: right;">(continued)</p>



Chapter 9: TE2100 action plan: **action zone 0** – estuary-wide




Estuary-wide option 1
(improve existing system)

Estuary-wide option 2
(tidal flood storage)

Estuary-wide option 3
(new barrier)

Estuary-wide option 4
(new barrier with locks)

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.0.6. (continued)</p> <p>In this period the remaining habitat creation sites will be implemented in 2040, 2050 and 2065. Further sites will be realigned to make up the necessary 1200 hectares of intertidal habitat creation required this century.</p> <p>Site options shown on the estuary-wide option maps are:</p> <ul style="list-style-type: none"> • Grain Marshes • All hallows Marshes • St Mary’s Marsh • West Canvey Marshes • Vange Marsh • Bowers Marsh • Fobbing Marshes. <p><i>(Cost included in TE2100 plan)</i></p>	<p>Public and local interest groups</p> <p>RSPB</p> <p>Wildlife Trusts</p>	<p>Intertidal Habitat creation will require compensation freshwater habitat creation.</p> <p>See A.0.3. for additional considerations.</p>	<p>If you have views about specific sites, please respond to the relevant local action plan in the tables that follow.</p> <p>See A.0.3. for additional considerations.</p>
	<p>A.0.7.</p> <p>To implement “end of the century” option from 2070.</p> <p>From the year 2070, our appraisal shows that options 1.4 and 3.2 are the two front-runners for managing tidal flood risk up to the end of this century and into the 22nd century.</p>	<p>Environment Agency</p> <p>Defra</p> <p>Natural England</p> <p>Landowners</p> <p>Other partners</p>	<p>We will promote the schemes which make up our end of the century options in consultation with Government, and other partners.</p> <p>There are major opportunities for reshaping the Estuary landscape and character as part of these works.</p>	<p>We would like your views on our two front-runners. These are:</p> <p>Option 1.4 – Maintain and improve existing system, optimising maintenance and reconstruction activities.</p> <p>Option 3.2 – A new barrier at Long Reach.</p> <p>Both options include defence raising downriver of the Thames Barrier (option 1.4) and the new barrier (option 3.2).</p> <p>Do you feel we have selected the best long-term options, and is it clear why we have recommended the two front-runners?</p> <p style="text-align: right;">(continued)</p>

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.0.7. (continued)</p> <p>For the purposes of costing the Plan, option 3.2 (New Barrier at Long Reach) has been used as this performed marginally better in our economic appraisal. Our strategic environmental assessment (SEA) indicated that there was little between the options but barriers were least preferable because they caused more damage to natural processes and habitat.</p> <p><i>(Cost of option 3.2 included in TE2100 plan)</i></p>		The TE2100 10-yearly update will include a review of Action A.0.7. and recommend further whether the end of the century recommendations remain or whether they have changed.	
	<p>A.0.8.</p> <p>To maintain, operate, modify and improve the Thames Barrier or new Barrier and other active defences from the year 2070.</p> <p><i>(Cost of option 3.2 included in TE2100 plan)</i></p>	<p>Environment Agency</p> <p>Riparian owners with responsibility for their defences</p> <p>Landowners adjacent to the defences</p>	<p>The nature of these works will depend on options adopted in 2070.</p> <p>The TE2100 10-yearly review will update the long-term programme with the latest recommendations.</p>	If you have views about the long-term future of the barriers and other movable defences, please share them with us now so we can use this in future appraisal reviews.
	<p>A.0.9.</p> <p>End of the century choices</p> <p>We have developed ten choices:</p> <p>Option 1: Improve the existing defences</p> <p>1.1 Raise defences when needed</p> <p>1.2 Allow for future adaptation of defences</p> <p>1.3 Raise defences when they are replaced</p>	<p>Environment Agency</p> <p>All stakeholders</p>	We have identified two front-runners (see A.0.7.) but the choice of end of the century option will not be made until 2050 or 2060 under government's current climate change guidance. Flood risk management considerations alone do not justify these 2070 options being brought forward.	<p>The selection of option for 2070 will be made following a series of 10-yearly reviews of the TE2100 plan. You may feel there is no point in giving your views on something which will not happen for 60 years or more – especially as we have already stated which are the front-runners. But the environment and society will change over the next 60 years and we need to be able to measure these changes in our 10-yearly reviews of the TE2100 plan. This consultation provides an opportunity for you to have your views recorded and presented as part of an ongoing vision statement to those who follow us</p> <p>60 to 100 years from now. (continued)</p>


Chapter 9: TE2100 action plan: **action zone 0** – estuary-wide


Estuary-wide option 1
(improve existing system)

Estuary-wide option 2
(tidal flood storage)

Estuary-wide option 3
(new barrier)

Estuary-wide option 4
(new barrier with locks)

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.0.9. (continued)</p> <p>1.4 Optimise defence repair & replacement</p> <p>Option 2: Tidal flood storage Six potential sites have been identified which are in the right location to store tidal waters and reduce the level of storm surges. The sites identified are at Erith Marshes, Aveley and Wennington Marshes, Dartford and Crayford Marshes, and Shorne and Higham Marshes.</p> <p>Option 3: New barrier 3.1 Tilbury location 3.2 Long Reach Location</p> <p>Option 4: Barrier with locks 4.1 Tilbury location 4.2 Long Reach location 4.3 Barrier with locks at Thames Barrier (when closures/year approach their limit)</p> <p><i>(Cost of option 3.2 included in TE2100 plan but this will be reviewed at subsequent appraisals)</i></p>		<p>There may be external factors such as funding from other major infrastructure projects which justify a review of the TE2100 appraisal – our adaptable plan (see chapter 12) allows for this.</p> <p>For further information, please see the estuary-wide options maps.</p> <p>This action also includes the maintenance and management of the fixed defences from the year 2070 to the end of the Plan.</p>	<p>We are particularly interested to know your views on the following:</p> <p>Option 1: Maintain and improve existing system Do you think it is better to do the minimum to keep the infrastructure going (option 1.1), to spend more to make defences adaptable (option 1.2), to spend even more to anticipate future improvements (option 1.3) or to optimise defence maintenance, repair and replacement – which is cheaper but more difficult to manage (option 1.4)?</p> <p>Option 2: Tidal flood storage Do you have any general views on this option? Do you have views on the advantages and disadvantages of particular sites? (We will be gathering information on the local issues through our local action tables.)</p> <p>Option 3: New barrier Do you have any general views on this option? Do you have views on the two locations, Tilbury and Long Reach? (We will be gathering information on the local issues through our local action tables.)</p> <p>Option 4: New barrier with locks (or “open” barrage) Do you have any general views on this option? Do you have views on the three locations, Tilbury, Long Reach and at the current Thames Barrier site? (We will be gathering information on the local issues through our local action tables.)</p>

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.0.10. Development of a land strategy for the Thames estuary.</p> <p>We recommend the development of a Land strategy for the Thames estuary to support the TE2100 plan. This land strategy will have four purposes:</p> <ul style="list-style-type: none"> • To safeguard land which may be needed for future flood risk management purposes. • To co-ordinate the planning and ensure that we get the best out of the habitat creation schemes. • Many of our defences are needed to prevent contaminant from leaching into the river and these areas are not useful for other purposes. There is a need to establish a programme of remedial works with the key objective of removing the constraints to flood risk management (and other uses) caused by the contamination. • To bring together the various strategic plans and vision statements in the Estuary. 	<p>Environment Agency</p> <p>Defra, Natural England</p> <p>National Farmers' Union (NFU)</p> <p>Thames Gateway Parklands Vision</p> <p>Greater London Authority (GLA), East of England Regional Assembly (EERA), South East England Regional Authority (SEERA)</p> <p>The Thames Landscape Strategies</p> <p>Thames Estuary Partnership</p> <p>Other strategic planners</p> <p>Landowners and other interest groups</p>	<p>Details for the production of the Thames estuary land strategy will be included in the TE2100 implementation blueprint to be prepared in 2009.</p> <p>The document will recognise the following strategic plans and vision statements:</p> <p>Parklands Vision</p> <p>The GLA London Plan's Blue Ribbon Network</p> <p>The Thames Landscape Strategies</p> <p>Thames Estuary Partnership's Thames Strategy East</p> <p>Our flood and coastal risk management plans for the Thames estuary</p> <p>Other strategic plans</p>	<p>We cannot know what institutional arrangements there will be as we approach the 22nd century, but our TE2100 vision imagines an environment where the Thames estuary is increasingly enjoyed and respected by the people who live and work there and those who visit. We believe that this land strategy will communicate this vision for the Estuary and assist in its integration into existing and future plans and programmes.</p> <p>Your views on this document will help us shape and develop it.</p> <p>What should it contain? Who should use it? Any other views of you and/or your organisation will help us in preparing proposals for this document. It is important because it will form an ongoing vision statement to those who follow us 60 to 100 years from now as well as providing practical advice for today's managers of the Thames estuary environment.</p>



Chapter 9: TE2100 action plan: **action zone 0** – estuary-wide

Estuary-wide option 1
(improve existing system)



Estuary-wide option 2
(tidal flood storage)

Estuary-wide option 3
(new barrier)

Estuary-wide option 4
(new barrier with locks)

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.0.11. Agree partnership arrangements for floodplain management – now to the end of the century.</p> <p>Many floodplain management actions are already taken by Government, emergency services, utility providers and others. Our studies show how stronger partnerships, improved co-ordination and investment in priority areas can significantly improve safety and reduce damages. We have tested new actions and identified potential investment in specific policy units to inform local delivery plans.</p>	Environment Agency Regional & Local Authorities Emergency Services Utility Providers	<p>Our Planning Liaison and Development Control staff support strategic planning and applications with advice and flood risk information.</p> <p>Our Flood Incident Management staff support emergency planning through local resilience fora.</p> <p>Regional & local authorities preparing Flood Plans and Local Development Frameworks supported by sustainability frameworks.</p> <p>Utility providers planning resilient infrastructure and retrofitting where necessary.</p>	<p>We are looking for ways of working more effectively and improving efficiency by strengthening our partnerships.</p> <p>We would welcome any comments that you or your organisation can provide which assist us in these aims. You can respond here with comments relating to the whole estuary, or if you have specific comments relating to the area where you live or work, you can respond to the local action plan tables.</p>
	 <p>A.0.12. To monitor and maintain the TE2100 plan for the first 25 years from 2010 to 2034.</p>	Environment Agency Met office Defra Natural England	<p>Monitor key indicators from 2010 to 2034.</p> <p>Oversee strategic implementation of actions including annual audit of action plan.</p> <p>Review and update TE2100 plan in 2020 and 2030.</p>	

Chapter 9: TE2100 action plan: **action zone 0** – estuary-wide

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 plan
	<p>A.0.13. To monitor and maintain the TE2100 plan for the middle 35 years from 2035 to 2069.</p>	<p>Environment Agency Met office Defra Natural England</p>	<p>Establish monitoring systems for key indicators (working with other Environment Agency regions and the Met Office).</p> <p>Oversee strategic implementation of actions including annual audit of action plan.</p> <p>Monitor key indicators from 2035 to 2069.</p> <p>Review and update TE2100 plan in 2030, 2040, 2050 and 2060.</p>	
	<p>A.0.14. To monitor and maintain the TE2100 plan from 2070 to the end of the century.</p>	<p>Environment Agency Met office Defra Natural England</p>	<p>Monitor key indicators from 2070 to the end of the life of the TE2100 Plan.</p> <p>Oversee strategic implementation of actions including annual audit of action plan.</p> <p>Review and update TE2100 plan in 2070, 2080, 2090 and 2100.</p>	

Estuary-wide option 1
(improve existing system)

Estuary-wide option 2
(tidal flood storage)

Estuary-wide option 3
(new barrier)

Estuary-wide option 4
(new barrier with locks)

Estuary-wide
option 1
(improve
existing
system)

Estuary-wide
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(tidal flood
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option 3
(new barrier)

Estuary-wide
option 4
(new barrier
with locks)

Chapter 9: TE2100 action plan: **action zone 0** – estuary-wide



TE2100 action plan: action zone 1 – west London

Action plan for zone 1 – table A.1.

12 actions identified

Description of the policy units

- Richmond
- Twickenham
- Barnes & Kew
- Hammersmith

Table A.1. describes the 12 actions for Zone 1 – west London which have been identified through the TE2100 Plan. The actions are described under the following headings:

- TE2100 recommended actions (and whether or not costs for this have been included in the TE2100 Plan)
- Implementation partners
- How this will be achieved
- How your response can help us finalise the TE2100 Plan



Do you consider we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?



Do you agree with the actions identified in the action plan and the timing of those actions?



Do you agree with the mechanisms we have set out to deliver the actions plan?



Have we identified the right partner organisations to deliver the action plan and are you, or your organisation, able to contribute to these actions?

Policy unit – Richmond



Richmond riverside

Policy: Our recommended flood risk management policy for Richmond is policy **P3**, to continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline), working with others on local measures for key assets and infrastructure.

Description

The Richmond policy unit consists of a relatively narrow floodplain along the Thames, much of which floods regularly and is occupied by parks and gardens. The amount of property at risk is small but there are some historic and important sites including Ham House and part of Kew Gardens. There are two schools and three electricity substations in the flood risk area.

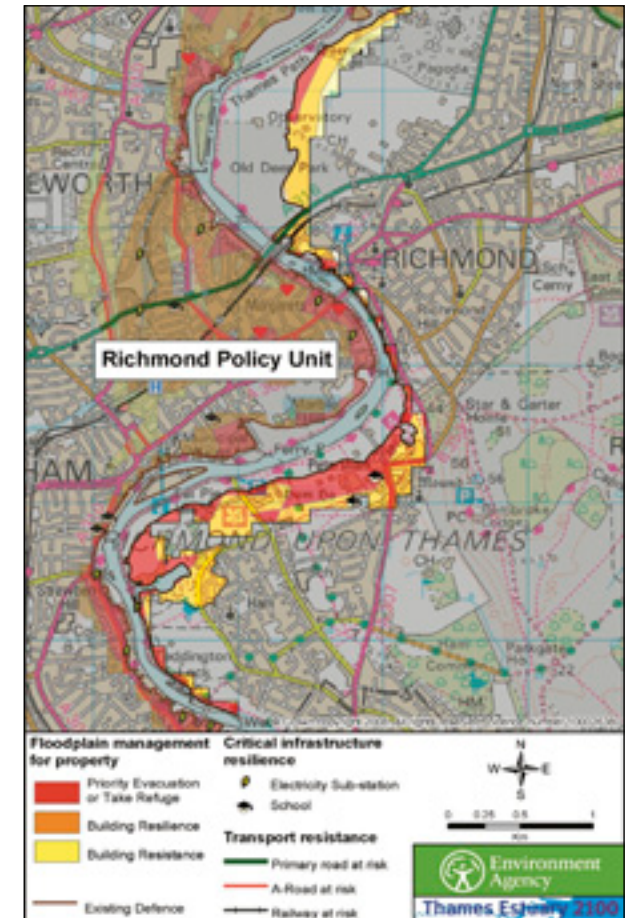
The developed floodplain is narrow and therefore the benefits of improving defences are limited. This policy unit is a very environmentally sensitive area, where defence improvements should enhance the landscape and not have adverse impacts. The area is covered by the Thames Landscape Strategy Hampton to Kew, which includes a vision for managing and improving the landscape including better public access to the river. There is public access along the riverside for the full length of the frontage, much of which is in the park areas.

Sources of flooding

- Tidal from the Thames upriver of the Thames Barrier (probability of 0.1% per annum, barrier controlled); flood depths up to 2 m if the Thames Barrier failed.
- Fluvial and tidal/fluvial from the Thames (probability >1% per annum; flood depths up to 3 m).
- Local drainage.

Existing flood risk management system

- The Thames Barrier, to control tidal water levels.
- The Thames Barrier is also used to reduce fluvial flood levels.
- Secondary tidal defences along the Thames frontage.
- Flood forecasting and warning.



At risk in Richmond policy unit

TE2100 action plan: action zone 1 – west London

There are no fluvial flood defences but existing tidal defences provide some protection against fluvial flooding downriver of Teddington. There are some undefended areas between the defences and the Estuary.

Policy context

This policy unit lies within the Thames CFMP area, and also the area covered by the Thames Landscape Strategy (Hampton to Kew). Some development is planned in Richmond but the impact on the floodplain would be small.

Vision

Our vision for the Richmond policy unit is to provide flood risk management within the constraints of a **P3** policy, that enhances the landscape and amenity of the area, and involves local communities, businesses and agencies in flood risk management. Suggested requirements are for improved and new defences where public access and views of the Estuary are maintained and enhanced.

Local issues and choices

The Richmond policy unit is the narrow strip of floodplain running along the eastern bank of the Thames from Teddington, past the Old Deer Park to

the edge of Kew Gardens. There is a risk of fluvial flooding in Richmond from the tidal Thames.

At present, the Thames Barrier is closed to reduce fluvial flood risk. But climate change will increase the number of closures required to protect against rising tides. With increased and more intense rainfall, fluvial flood risk will also increase. The Thames Barrier will be less and less available to assist with managing this fluvial flood risk as it is conserved for tidal flood risk management – the purpose for which it was designed. (The particular constraint is the annual number of closures for the Barrier, as this must be limited to reduce the risk of failure and ensure readiness of the Thames Barrier for tidal surge flood conditions.)



The Thames Barrier will continue to provide a high standard of protection against tidal flood conditions, but over the next 25 years its use for fluvial flood risk management will be gradually reduced. Choices for managing this risk are given in action plan table A.1.

For the Richmond policy unit this means that we have 25 years to plan and put in place alternative measures for managing freshwater flood risk. This means that vulnerable areas, such as undefended islands, will have to rely upon floodplain management measures in the future with localised defences to protect specific properties where this can be justified. Floodplain management measures include resistance and resilience of properties and increased reliance on flood warning and community flood management strategies. An opportunity for wetland habitat restoration has been identified in the action plan table (A.1.).



Do you understand our assessment for the Richmond policy unit?



Do you agree with it?

Policy unit – Twickenham

Policy: Our recommended flood risk management policy for Twickenham is policy **P3**, to continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline), working with others on local measures for key assets and infrastructure.

Description

The Twickenham policy unit has a relatively narrow floodplain along the Thames, although there is a large tidal/fluvial floodplain area on the River Crane and a smaller area on the River Brent. The flood risk areas are mainly residential but also contain parks and gardens including Syon House and Marble Hill Park. There are six schools, four care homes, 12 electricity sub stations, a hospital and major arterial routes and railway lines in the flood risk area. This is an environmentally sensitive area, where flood defence improvements should be designed to enhance the landscape and minimise adverse impacts. The area is covered by the Thames Landscape Strategy Hampton to Kew, which includes a vision for managing and improving the landscape including better public access to the river. There is public access to the riverside in parts of the policy unit, but other areas are privately owned.

Sources of flooding

These are the same as for the Richmond policy unit, but in addition there are the following sources of flood risk:

- Fluvial from the River Crane, exacerbated by backing up from the Thames (probability >1% per annum, flood depths up to 2 m). The River Crane has an extensive floodplain in the tidal/fluvial interaction zone.
- Fluvial and tidal/fluvial from the River Brent (probability 1% per annum, flood depths up to 2 m).
- Fluvial and tidal/fluvial from the Duke of Northumberland's River. The flood risk is believed to be small.
- Local drainage.
- Groundwater flooding from superficial strata, possibly connected to Thames levels.

Existing flood risk management system

- The Thames Barrier, to control tidal water levels.
- The Thames Barrier is also used to reduce fluvial flood levels.
- Secondary tidal flood defences along the Thames frontage and the lower Brent.



At risk in Twickenham policy unit

- The Crane gates that prevent high water levels in the Thames entering the River Crane. They are only effective when Crane flows are relatively low. When fluvial flows on the River Crane are high, the gates open even if the Thames water level is high.
- Local fluvial defences on the River Crane.
- Flood forecasting and warning.



Teddington

There are no formal fluvial flood defences on the Thames. The existing tidal defences do however provide some protection against fluvial flooding downriver of Teddington. The current estimated standard of protection provided by these defences at Teddington is 3% per annum (1:30). There are some poorly defended areas including areas between the defences and the Estuary, and Eel Pie Island. Flood warning arrangements for these areas include warning signs and lights.

Policy context

The Twickenham policy unit lies within the Thames CFMP area. It is also in the area covered by the Thames Landscape Strategy (Hampton to Kew). Some development is planned in Twickenham but the impact on the floodplain would be small.

Vision

Our vision for this policy unit is to provide flood risk management within the constraints of a **P3** policy, that enhances the landscape and amenity of the area, and involves local communities and businesses and agencies in flood risk management.

Local issues and choices

There is a risk of fluvial flooding in Twickenham from the tidal Thames. Choices for managing this risk are given in the action plan table A.1. As for the Richmond policy unit, at present, the Thames Barrier is closed to reduce fluvial flood risk. However, this use will be significantly reduced in order to conserve the barrier for tidal flood risk management. This means that vulnerable areas, for example undefended islands such as Eel Pie Island, will have to increasingly rely upon floodplain management and localised defence measures in the future over the next 25 years.

Measures will also be required for tributary flooding, particularly from the River Crane which has an extensive fluvial floodplain in the fluvial/tidal interaction zone (table A.1.). This will be affected by lack of space for new defences.

Floodplain management may also be required for groundwater flooding. This has not been investigated by TE2100 and it is included in our action plan.



Do you understand our assessment for the Twickenham policy unit?



Do you agree with it?

Policy unit – Barnes & Kew

Policy: The recommended flood risk management policy for Barnes & Kew is policy **P5**, to take further action to reduce flood risk beyond that required to keep pace with climate change.

Description

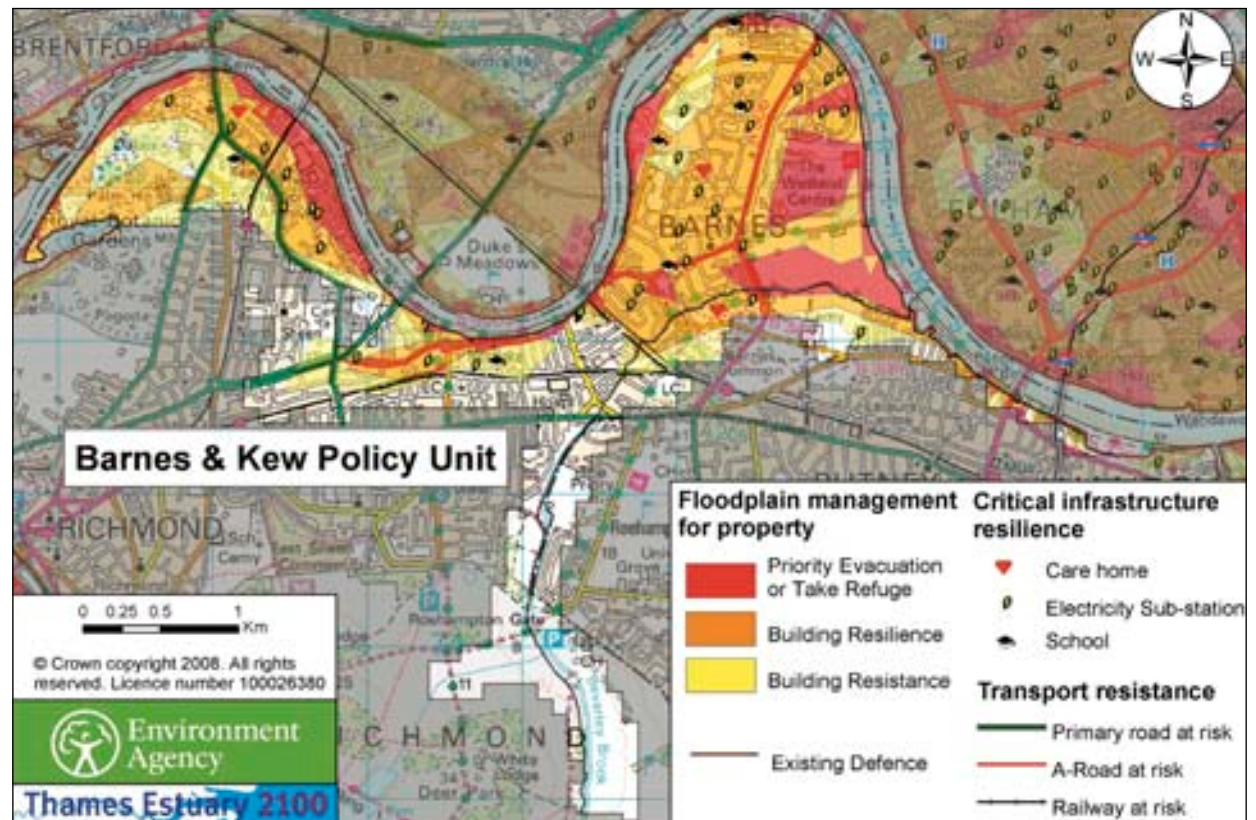
The Barnes & Kew policy unit contains large residential areas, schools and offices. It also has several large open areas including the Kew Gardens World Heritage Site, Barnes Wetlands Centre and playing fields. There is public access to the whole frontage. There are two care homes, seven schools and 29 electricity substations in the flood risk area which also has the major arterial routes leading to three Thames bridges.

Sources of flooding

These are the same as for Richmond plus fluvial flooding from Beverley Brook (probability about 10% per annum) and a risk of groundwater flooding from superficial strata, possibly connected to high water levels in the Thames.

Existing flood risk management system

- The Thames Barrier, to control tidal water levels.
- Secondary tidal flood defences along the Thames frontage.
- Beverley Brook flapped outfall.



At risk in the Barnes & Kew policy unit

- Beverley Brook bypass culverts, that provide relief from fluvial flooding.
- Known combined sewer overflows (CSOs) for urban drainage flood mitigation.
- Flood forecasting and warning.



Mortlake. Downstream of Chiswick Bridge

Policy context

The Barnes & Kew policy unit lies within the Thames CFMP area. It is also in the reach covered by the Thames Strategy Kew to Chelsea, which gives clear guidance on where and how the Estuary frontage could be improved. Some development is planned but the sites are generally small, and the impact on the floodplain would also be small.

Vision


As with Barnes & Kew our vision for this policy unit is to enhance the already attractive environment in this area by providing defence improvements that are designed in a sensitive way and blend with the surroundings. Where defences are raised, it will be important to ensure that the impacts on views are minimised. The vision also includes greater local and institutional awareness of the flood risk, and this should influence emergency planning, land use planning and new development.


Local issues and choices

There is a possibility that defence raising for tidal flood risk management may not be acceptable in all areas because of the adverse impact on the riverside. An alternative approach would be a combination of local secondary defences to protect parts of the floodplain, and floodplain management to reduce the impacts of flooding to existing properties and other assets. However, when considering this approach it must be remembered that flooding could occur several times per year and the annual frequency will increase. It should only be adopted when there is a good local appreciation and acceptance of the risk of living with flooding. In this policy unit, a **P5** policy is recommended. This means that

there is justification to improve the level of flood risk management beyond that required to keep pace with climate change.

Accretion of the river bed is occurring at Barnes and Putney. This may provide opportunities to improve the ecological capacity and appearance of these frontages. There is a risk of fluvial flooding from Beverley Brook which is exacerbated by high water levels in the Thames. There are two diversion culverts, although these are also affected by tide lock from high levels in the Thames. Responses to manage tidally influenced fluvial flood risk on Beverley Brook are set out in table A.1. Floodplain management may also be required for groundwater flooding. This has not been investigated by TE2100 and it is included in our action plan.

 Do you understand our assessment for the Barnes and Kew policy unit?

 Do you agree with it?

Policy unit – Hammersmith

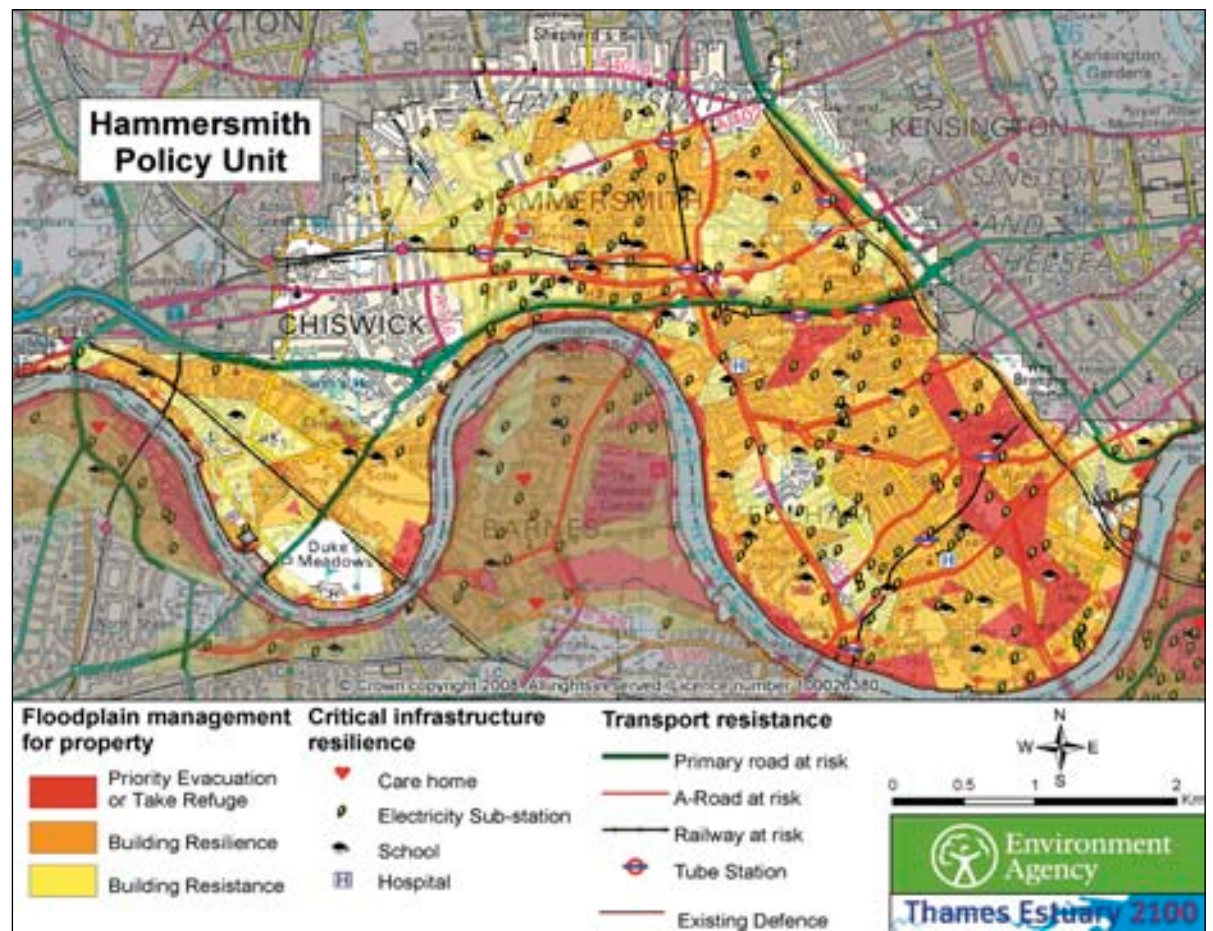
Policy: The selected policy for Hammersmith policy unit is policy **P5** to take further action to reduce flood risk.

Description

Hammersmith is a large and highly developed policy unit with extensive and established residential areas. The estuary frontage is a mixture of public parks, public walkways, roads and private areas. Thus access to the Estuary is currently not continuous. The underground network at Hammersmith and environs is particularly vulnerable with 10 underground stations in the flood risk zone. There are also 34 schools, six care homes, over 100 electricity substations and two major hospitals in the flood risk area.

Sources of flooding

- Tidal from the Thames upriver of the Thames Barrier (probability 0.1% per annum or less frequent, barrier controlled), flood depths up to 2 m if the Thames Barrier failed.
- Fluvial from the Thames upriver of the Thames Barrier (probability 0.1% per annum or less frequent).
- There is a risk of flooding from pluvial and urban drainage sources.



At risk in Hammersmith policy unit

- There is a potential for groundwater flooding from superficial strata when levels in the Thames are high, particularly in the future when defence levels have been raised in line with our **P5** policy.

Existing flood risk management system

- The Thames Barrier, to control tidal water levels.
- Secondary tidal flood defences along the Thames frontage.
- Eight CSOs for urban drainage flood mitigation.
- Flood forecasting and warning.



Hammersmith Bridge

Policy context

The Hammersmith policy unit lies within the Thames CFMP area. It is also in the reach covered by the Thames Strategy Kew to Chelsea, which gives clear guidance on where and how the Estuary frontage could be improved. There are locations where development is planned on or near the Estuary frontage. These provide opportunities to enhance the frontage and the defences.

Vision

Our vision for the Hammersmith policy unit is to enhance the already attractive environment in this area by providing defence improvements that are designed in a sensitive way and blend with the surroundings whilst achieving our recommended policy **P5**. The vision also includes greater local and institutional awareness of the flood risk, and this should influence emergency planning, land use planning and new development.

Local issues and choices

Where policy **P5** applies, a higher standard of protection is needed. This will be provided by the Thames Barrier for tidal flood risk for the foreseeable future. There is a possibility that defence raising for tidal flood risk management



View from Hammersmith Bridge

may not be acceptable in all areas because of the adverse impact on the riverside. An alternative approach would be a combination of defence realignment and floodplain management to reduce the impacts of flooding to existing properties and other assets located between the realigned defence and the Estuary. However, when considering this approach it must be remembered that flooding could occur several times per year and that the annual frequency will increase.

Fluvial flooding from the Thames is unlikely to be a problem for the Hammersmith policy unit because fluvial flood levels would not overtop the defences. There is a risk of flooding from pluvial (rainfall) and urban drainage sources. These have only been investigated at a high level, and mitigation measures have not been developed in detail. Further investigation into this local flood risk forms part of our action plan (see table A.1.). Mitigation measures could include improvement of drainage outfalls and flood resilience in affected areas.

There is a potential for groundwater flooding from superficial strata when levels in the Thames are high, particularly in the future when defences are raised. This has not been investigated by TE2100 and investigation and development of mitigation measures is included as an action in our action plan (see table A.1.).

Accretion of the river bed is occurring at Fulham. This may provide opportunities to improve the ecological capacity and appearance of this frontage. Erosion of the river bed is occurring on the frontage at Chiswick, and it may be necessary to set the defence line back when the defences are upgraded to avoid erosion damage to the defences.



Do you understand our assessment for the Hammersmith policy unit?



Do you agree with it?


TE2100 action plan: action zone 1 – west London

Table A.1. – Policy units

Richmond Twickenham Barnes & Kew Hammersmith

P3
P3
P5
P5

[Note that all dates are based on government's current guidance on climate change – the TE2100 Plan will be reviewed and updated if these predictions change]




	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.1.1. To agree a programme for planning and putting in place within 25 years, alternative measures for managing fluvial flood risk in the west London tidal area.</p> <p>[The Thames Barrier will continue to provide tidal flood protection to the same high standard as the rest of London. The Thames Barrier will also continue to be deployed for fluvial floods which trigger barrier closure but within 25 years it will no longer be sustainable to use the Thames Barrier to assist with lower order fluvial flood events – particularly for protection for of islands and other undefended areas]</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency</p> <p>Greater London Authority (GLA)</p> <p>West London Boroughs:</p> <ul style="list-style-type: none"> • LB Richmond on Thames • LB Hammersmith & Fulham • LB Hounslow • LB Wandsworth • LB Kensington & Chelsea <p>Local Resilience Forum</p>	<p>We will discuss with London Boroughs to agree the strategic scope of measures required.</p> <p>We will promote projects to achieve the agreed measures in partnership with local authority emergency and spatial planners and the GLA.</p> <p>Engagement of public, business and interests groups to raise awareness and increase support for adaptation.</p> <p>In line with the findings of the Thames CFMP, we recommend long-term adaptation of the urban environment in these floodplains.</p>	<p>Implementation partners: We would like you to tell us about your plans for managing development in the tidal/fluvial floodplains. Your core objectives may already support this action. If they don't, will this be included in your plans next time they are updated? This information will guide the development of our implementation blueprint during 2009 and improve arrangements for partnership working.</p> <p>Landowners, the public, businesses and other interested groups: By the year 2034, we may no longer be able to use the Thames Barrier for the frequent, but lower order, fluvial flood events although it will continue to provide a good level of protection against tidal and higher order fluvial flood events. Alternative ways of managing fluvial flood risk will be needed. This will mean adapting some buildings and public spaces which currently have a low standard of protection against fluvial flood. It is important that the public and businesses have confidence in, and are supportive of this approach.</p> <p style="text-align: right;">(continued)</p>

Twickenham



Barnes & Kew

Hammersmith



TE2100 action plan: **action zone 1 – west London**

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	A.1.1 (continued)		This will be very challenging, will require a high degree of partnership and commitment – and will be more difficult than simply maintaining what is already in place.	Each area in west London has different requirements so it is important that the right programme is developed for your area.
	A.1.2. TE2100 Plan informs the development and revision of local authority strategic flood risk assessments (SFRAs) and flood plans. <i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i>	Environment Agency West London Boroughs: <ul style="list-style-type: none"> • LB Richmond on Thames • LB Hammersmith & Fulham • LB Hounslow • LB Wandsworth • LB Kensington & Chelsea Local Resilience Forum	TE2100 information is provided to local authorities preparing flood plans and emergency capability testing. Local authority flood plans are developed with an understanding of TE2100 recommendations and data. A stakeholder engagement programme to ensure the public, businesses and other groups understand, are involved in and supportive of the flood plans.	Implementation partners: Do your flood plans include the findings and recommendations from TE2100? Do you have enough information from us to develop your flood plans so that they can be informed by TE2100? Your response will guide the development of our implementation blueprint during 2009 and improve arrangements for partnership working. Landowners, the public, business and other interested groups: The Thames tidal defences are robust and well managed. But should there be a failure of a defence or an extreme event which overtops the defences, large areas of west London would be at risk. The flood plans will set out arrangements for managing this sort of emergency. Your response on the TE2100 proposals will be shared with Agencies responsible for preparing the flood plans.
	A.1.3. To agree a programme to provide localised flood protection and resilience for vulnerable key sites in west London zone – particularly in the Hammersmith policy unit.	Environment Agency <ul style="list-style-type: none"> • LB Richmond on Thames • LB Hammersmith & Fulham 	We will discuss with our implementation partners to agree strategic scope of measures required.	Implementation partners: Are you aware of the risks and particular vulnerability of the Hammersmith or other west London policy unit? Do you have arrangements in place to investigate the scope of works required for the properties/areas in which you have an interest? (continued)



TE2100 action plan: action zone 1 – west London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.1.3. (continued)</p> <p>[Note: In Hammersmith policy unit there are ten Underground stations in the flood risk zone. There are also 34 schools, six care homes, over 100 electricity sub stations and two major hospitals. Underground areas including basements are particularly vulnerable and will require evacuation plans]</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<ul style="list-style-type: none"> • LB Hounslow • LB Wandsworth • LB Kensington & Chelsea <p>Local Resilience Forum</p> <p>Transport for London</p> <p>London Underground</p> <p>NHS Trusts</p> <p>EDF Energy</p> <p>Other site owners</p>	<p>Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.</p> <p>All site owners supportive of approach and confidence maintained. Local floodplain management measures in place or planned within 25 years.</p>	<p>Can the Environment Agency assist with this through implementation of action A.1.3?</p> <p>Landowners, the public, business and other interested groups:</p> <p>We would be interested to hear your views to assist us in planning the implementation of action A.1.3. particularly if you live, work or have interests in this area.</p>
	<p>A.1.4.</p> <p>To agree a programme of managing flooding from other sources in the defended tidal floodplain.</p> <p>In the west London zone there is potentially a high risk of pluvial and urban drainage flooding, particularly in areas where the urban drainage system has relatively low capacity and/or is prone to tide locking.</p> <p>There is also fluvial flood risk from the Beverley Brook, the Duke of Northumberland's River and the River Crane.</p>	<p>Environment Agency</p> <p>Local authority (spatial and emergency planning)</p> <p>GLA</p> <p>Landowners</p> <p>Thames Landscape Strategy Hampton to Kew</p> <p>Thames Strategy Kew to Chelsea</p>	<p>We will discuss with our implementation partners to agree strategic scope of measures required.</p> <p>Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.</p> <p>All site owners must be supportive of approach and confidence of public and users maintained.</p>	<p>Implementation partners:</p> <p>Are you aware of the risks and particular vulnerability of people and property to flooding from sources other than tidal? Do you have arrangements in place for initiating the discussion concerning scope of works required for the properties/areas in which you have an interest? Can the Environment Agency assist with this through implementation of action A.1.4?</p> <p>Landowners, the public, business and other interested groups:</p> <p>We would be interested to hear your views to assist us in planning the implementation of this action A.1.4., particularly if you live, work or have interests in this area and are concerned about flooding from sources other than tidal. (continued)</p>



TE2100 action plan: **action zone 1** – west London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.1.4. (continued)</p> <p>Choices for local flood risk management have not been designed or addressed in detail in TE2100 but this is identified as an action in the Plan.</p> <p><i>(Cost of implementing this action is not included in TE2100 Plan, but TE2100 data, information and recommendations are available to support the successful implementation of the action)</i></p>		<p>Local measures for management of flooding from other sources to be in place or planned within 25 years.</p> <p>This action will form part of an updated local delivery plan which is linked to our Thames CFMP and long-term investment strategy (LTIS).</p>	<p>This includes pluvial and urban drainage and fluvial flooding from the River Crane, the Duke of Northumberland's River and the Beverley Brook.</p> <p>Our TE2100 Technical Report and local choices documents for the policy units provide further information on these matters and the choices which are available to assist with problems. If you would like further information on this, please contact the TE2100 project team.</p>
	<p>A.1.5.</p> <p>To agree a programme for floodplain restoration and management.</p> <p>Work with Thames Landscape Strategy – Hampton to Kew on the development and feasibility of the London's lost floodplains project to restore and manage floodplains to reduce flood risk and benefit the use of floodplains for people and wildlife.</p>	<p>Environment Agency</p> <p>Richmond Borough Council</p> <p>National Trust</p> <p>GLA</p> <p>Thames Landscape Strategy Hampton to Kew</p> <p>Thames Strategy Kew to Chelsea</p>	<p>TE2100 and the Lower Thames Strategy to inform the development of the London's lost floodplains project managed by the Thames Landscape Strategy – Hampton to Kew.</p> <p>The TE2100 plan ensures that an appropriate level of flood risk management for people and property will continue to be provided.</p>	<p>Implementation partners:</p> <p>Your views and any additional information you can provide will be collated together with other local delivery data and passed to the Environment Agency team who will be implementing the local delivery which includes the programme defined through action A.1.5.</p> <p>Landowners, the public, business and other interested groups:</p> <p>This work could happen in the first 25 years of our Plan. We would be interested to hear your views to assist us in planning the implementation of this action A.1.5. – particularly if you live, work or have interests in this area.</p>

TE2100 action plan: **action zone 1** – west London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
 First 25 years	<p>A.1.6. To agree partnership arrangements and principles to ensure that new development in west London tidal risk area is safe, and flood risk management is factored into the planning process at all levels for the first 25 years from 2010 to 2034.</p> <p>There is need for greater clarity over methods and procedures for safety in new development behind defences. Environment Agency and local authority staff are providing advice to developers and responding to difficult Planning applications.</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency GLA</p> <p>Local authority (spatial and emergency planning)</p> <ul style="list-style-type: none"> • LB Richmond on Thames • LB Hammersmith & Fulham • LB Hounslow • LB Wandsworth • LB Kensington & Chelsea <p>Developers</p>	<p>TE2100 Plan and associated information informs developing Local Development Frameworks (LDFs) and future updates of existing LDFs.</p> <p>Application of PPS25 for new development and encourage adoption of property-level protection and resilience.</p> <p>Guidance for local authorities and our staff for planning applications to reflect the complexities of the west London defended tidal/ fluvial floodplain.</p>	<p>Implementation partners: Are your LDFs supported by sustainability appraisals that include local tidal flood risk and the implications of climate change? If not, does the TE2100 Plan provide you with the information you need to do this? If guidance is produced on interpretation of PPS25 in a defended area, what sort of information would be most helpful to you? Would you be able to assist the Environment Agency in preparing this guidance?</p> <p>Landowners, the public, business and other interested groups: We would be interested to hear your views to assist us in planning the implementation of this action A.1.6. particularly if you have had experience (good or bad) of dealing with us and other authorities over planning and building by the river and in the west London tidal/ fluvial floodplain.</p>
 Middle 35 years	<p>A.1.7. To review and maintain partnership arrangements and principles from 2035 to 2069.</p> <p>As A.1.6. above</p>	<p>As A.1.6. above</p>	<p>Guidance updated to reflect changing needs. The TE2100 10-yearly update to include review of action A.1.6. and recommend further action.</p>	<p>We cannot know what institutional arrangements will be in place during this period or what pressures there will be on the environment. We do know that for west London to continue to thrive, flood risk management must continue to be integrated into the spatial planning process. If you would like to help shape the development of these arrangements then please let us have your views.</p>


TE2100 action plan: **action zone 1** – west London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.1.8.</p> <p>To review and maintain partnership arrangements and principles from 2070 and into the 22nd century.</p> <p>As A.1.7. above</p>	As A.1.6. above	TE2100 10-yearly update to include review of action A.1.6. and recommend further action. Guidance is updated to reflect changing needs.	Flood risk management continues to be integrated into the spatial planning process into the 22nd century – see above.
	<p>A.1.9.</p> <p>To maintain, enhance and replace the river defence walls and active structures through west London over the first 25 years of the Plan from 2010 to 2034.</p> <p>[Note: This is a continuation of our current activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Landowners</p> <p>Developers and local authority planning teams</p> <p>Thames Landscape Strategy Hampton to Kew</p> <p>Thames Strategy Kew to Chelsea</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset System Management teams will promote these schemes. However, the method of improving the defences is different from the present day approach. It involves greater maintenance and repair work in addition to replacement. Promotion of schemes through the capital programme may not be appropriate for maintenance and repair, and a different way of working may be required.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>This is the work which the Environment Agency does now. We will continue with our programme of operations, maintenance and replacement but we are looking for ways of working better and more effectively.</p> <p>We are also seeking opportunities for environmental and recreational enhancements which will create a better place, and for partnerships which will help us achieve this.</p> <p>We would welcome any comments that you or your organisation can provide which assist us in these aims.</p>

TE2100 action plan: **action zone 1** – west London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.1.10. To operate, maintain and enhance the defence walls and active structures through west London during the 35 year period of the Plan from 2035 to 2069.</p> <p>[Note: Continuing our activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Landowners</p> <p>Developers and local authority planning teams</p> <p>Thames Landscape Strategy Hampton to Kew</p> <p>Thames Strategy Kew to Chelsea</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>We will promote schemes through capital programme and they will form part of strategic and investment plans – subject to replacement/repair working arrangements as A.1.9. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>Our aims remain as A.1.9. above, but during this period, there will be a major programme of rebuilding and refurbishment of the river walls and defences through west London. This provides many opportunities for creating a better place and to plan for a better riverside environment. If you would like to help shape the future environment in this area, then please let us have your views. During this period we will be preparing for the “end of the century” wall works – see A.1.11. below and any decisions made as part of Action A.1.11. must recognise that there may be major changes from 2065.</p>

TE2100 action plan: **action zone 1** – west London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.1.11. To implement a programme of defence raising through west London in the years leading up to 2069.</p> <p>These are the TE2100 “end of the century” measures of raising of defence levels in west London to provide continuing tidal flood risk management for all options except a downriver barrier with locks which will not require defence raising through west London. Combination of defences raised on the existing line and some new defences on a new alignment to enhance sensitive environments would be possible for end of the century options 1, 2 and 3). There are areas where the defences could be set back, and flooding of riverside paths and park areas could be accepted. Option 4 would not require the defences to be raised in west London.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Landowners</p> <p>Local Authorities</p> <p>Developers</p> <p>The public</p> <p>Local interest groups</p> <p>GLA</p> <p>Floodplain users</p>	<p>The timing of defence raising will depend on the rate of sea level rise, but a maximum raise of 1 m is envisaged.</p> <p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>We will promote schemes through capital programme.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p> <p>The TE2100 10-yearly update will include a review of action A.1.11. and recommend further whether the end of the century recommendations have changed.</p>	<p>2065 is a long way ahead but a decision needs to be made on the TE2100 “end of the century” option. This will enable us to finalise our Plan. The end of the century options (see estuary-wide action plan – action zone 0) affect conditions in west London.</p> <p>Options 1, 2 and 3 would mean we would need a wall raising through west London in 2065. Option 4 (a barrier with locks – or “open” barrage) would mean that the walls could stay at the current levels. This may seem like the best option for west London, but it is the most expensive one and it would cause significant damage to the Estuary environment in the vicinity of the new structure.</p> <p>It is not currently one of our front-runners identified through the appraisal process. But we will not be finalising our Plan until the responses from this consultation have been collated and assessed.</p> <p>So if you have views about the value of west London’s riverside and the effect of raising the walls by as much as a metre, please share them with us in submitting your response to this action (A.1.11.).</p> <p>We will make recommendations based on conditions now, in 2009, but the final decision on the end of the century options will not be taken until 2040 or 2050.</p> <p>It is important to send us your views because the responses we receive during this consultation will set the baseline for establishing public attitudes to the west London riverside environment. This “2009 snapshot” of west London stakeholder views will form a starting point for measurement of public attitudes in the future.</p>

TE2100 action plan: **action zone 1** – west London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.1.12. To maintain and enhance the river defence walls and active structures through west London post-2070 and into the 22nd century.</p> <p>Whether or not defences are raised, all defences will still require ongoing maintenance, repair and replacement (and hence engineering works) and this has been allowed for in our Plan investment profile.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Landowners</p> <p>Developers and local authority planning teams</p> <p>Thames Landscape Strategy Hampton to Kew</p> <p>Thames Strategy Kew to Chelsea</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>We will promote schemes through capital programme and they will form part of strategic and investment plans – subject to replacement/repair working arrangements as A.1.9. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>We cannot know what institutional arrangements there will be as we approach the 22nd century, but our TE2100 vision imagines an environment where the west London riverside is increasingly enjoyed and respected by the people who live and work there and those who visit. This means that the actions established in A.1.9. and A.1.10. will be continued by whoever is looking after our environment at that time. If you have views about the long-term future management of west London's riverside, we would like to hear them.</p> <p>This consultation provides an opportunity for you to have these views recorded and presented as part of an ongoing vision statement to those who follow us 60 to 100 years from now.</p>

TE2100 action plan: **action zone 1** – west London



TE2100 action plan: action zone 2 – central London

Action plan for zone 2 – table A.2.

10 actions identified

Description of the policy units

- Wandsworth to Deptford
- London City

Table A.2. describes the 10 actions for Zone 2 – central London which have been identified through the TE2100 Plan. The actions are described under the following headings:

- TE2100 recommended actions (and whether or not costs for this have been included in the TE2100 Plan)
- Implementation partners
- How this will be achieved
- How your response can help us finalise the TE2100 Plan.



Do you consider that we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?



Do you agree with the actions identified in our action plans and the timing of those actions?



Do you agree with the mechanisms we have set out to deliver the action plans?



Have we identified the right partner organisations to deliver our action plans and are you, or your organisation, able to contribute to these actions?

Policy unit – Wandsworth to Deptford

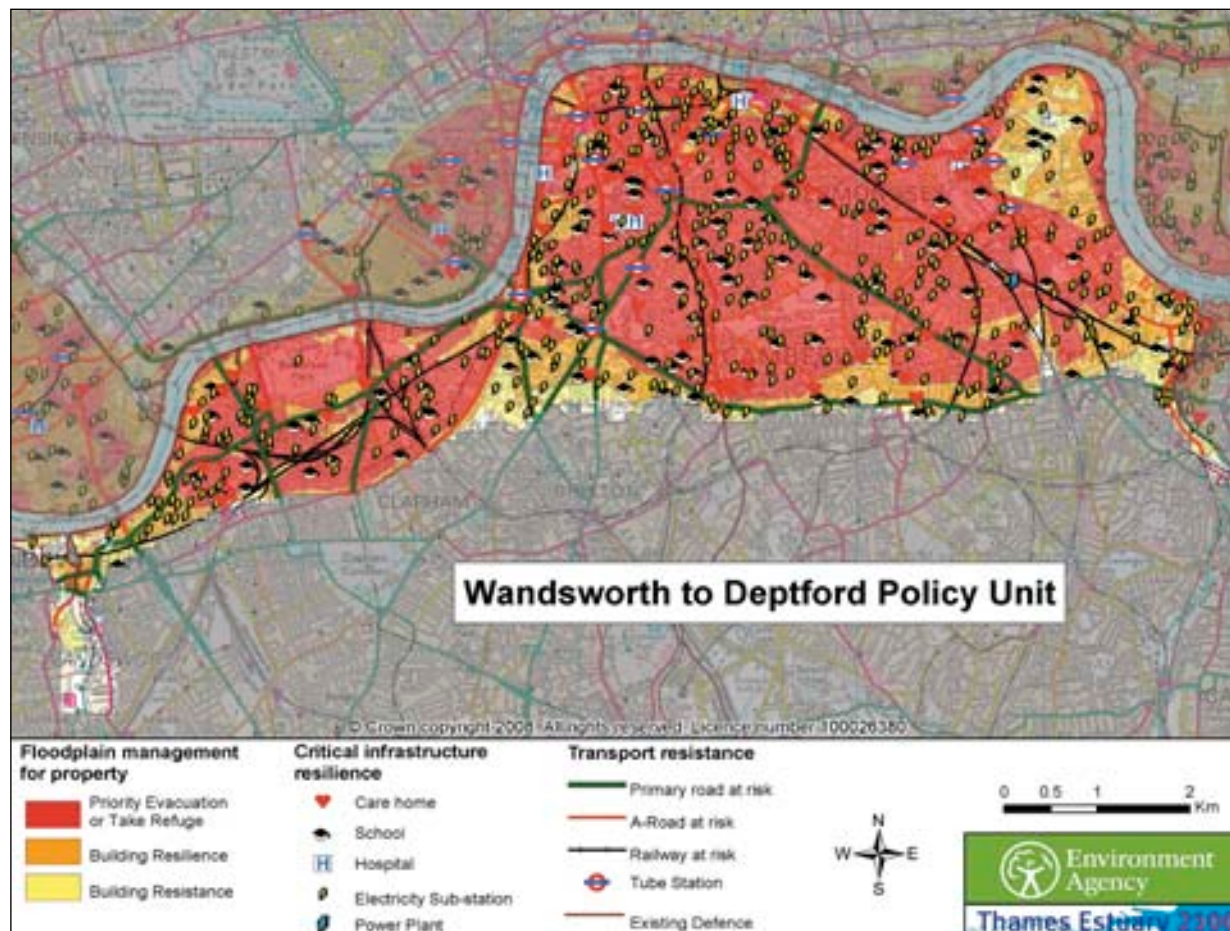
Policy: The selected policy for Wandsworth to Deptford is policy **P5** to take further action to reduce flood risk.

Description

Wandsworth to Deptford has the largest developed area of any of the TE2100 policy units. It is almost continuously developed and includes major urban centres, residential areas, industry, commerce, and some of London’s main transport terminals. It is also a very established area and redevelopments are generally relatively small sites compared with the areas of major regeneration further downriver. It includes a large number of old riverside warehouses, but the redevelopment of these frontages is largely complete.

There are 10 underground stations and three major railway termini in the tidal flood risk area. There are also 32 care homes, 93 schools, three hospitals and over 200 electricity substations potentially at risk. This makes the Wandsworth to Deptford policy unit one of the most vulnerable in the TE2100 area to flood risk in the event of a failure or overtopping of the defences.

The ground level in much of the policy unit is low at 2 m AOD (above ordnance datum) or less, whereas the level on the Thames frontage is



At risk in Wandsworth to Deptford policy unit

TE2100 action plan: action zone 2 – central London

generally higher (typically 3 m AOD or more). Thus there would be great difficulty evacuating floodwater should flooding occur. There is continuous riverside public access from Tower Bridge to Vauxhall.

Many parts of the Wandsworth to Deptford policy unit are particularly vulnerable to flooding because they are low-lying and contain a very large residential and business population. There is also the potential for extensive pluvial (heavy, prolonged rainfall) and urban drainage flooding.

Sources of flooding

- Tidal from the Thames upriver of the Thames Barrier (probability 0.1% per annum or less frequent, barrier controlled) but potential flood depths up to 4 m if the Thames Barrier failed.
- Fluvial from the River Wandle (probability 3% per annum).
- There is also a risk of flooding from pluvial (heavy rainfall) and urban drainage sources. This could potentially be very serious, bearing in mind the size of the Wandsworth to Deptford policy unit and the fact that there are large low-lying areas that would be difficult to drain.
- Groundwater flooding from superficial strata, possibly connected to Thames levels.



The Embankment

Existing flood risk management system

- The Thames Barrier, to control tidal water levels.
- Secondary tidal flood defences along the Thames frontage and the lower reach of the River Wandle.
- 11 combined sewer overflows (CSOs) for urban drainage flood mitigation.
- Flood forecasting and warning.

Note that the River Ravensbourne which borders this policy unit is covered in the Greenwich policy unit.

Policy context

The Wandsworth to Deptford policy unit lies within the Thames CFMP (Catchment Flood Management Plan) area. The western part of the unit is also in the reach covered by the Thames Strategy Kew to Chelsea, which gives clear guidance on where and how the Estuary frontage could be improved.

There are locations where development is planned on or near the Estuary frontage. These development projects provide opportunities to enhance the frontage and the defences.

Vision

Our vision for the Wandsworth to Deptford policy unit is to provide an environment that has a lower flood risk than now (because of the concentration of people and property at risk) and where flood defences are integrated into the landscape.

The policy unit is very diverse and the ways in which the landscape could be enhanced vary. There is also a need to raise awareness of the flood risk as the consequences of flooding would be severe. Flood risk should be taken into account in land use planning and new development.

Local issues and choices

Suggested local choices are essentially the same as for west London except that tidal defences on

TE2100 action plan: **action zone 2** – central London

the lower reach of the River Wandle will require raising for estuary-wide options – and there is ample justification to do this. Local choices to manage local sources of flooding are particular to this policy unit and are described below.

Flood risk management Policy **P5** applies in this policy unit so a higher standard of protection is justified. This will be provided by the Thames Barrier for tidal flood risk for the foreseeable future. Fluvial flooding from the Thames is unlikely to be a problem for this policy unit because fluvial flood levels would not overtop the defences – although there may be a problem with fluvial and pluvial flooding occurring behind the tidal defences.

There is a possibility that there are opportunities for setting back defences and improving the riverside amenity and habitats. A combination of defence realignment and floodplain management could reduce the impacts of flooding to existing properties and other assets located in the floodable areas on the river side of realigned defences, like the approach used around the Tate Modern at Bankside.

However, when considering this approach it must be remembered that although set-back defences



The Southbank

would improve the riverside environment, flooding could occur several times per year and the annual frequency will increase. It is important that the public and businesses are aware of these issues when responding to this consultation.

Accretion of the river bed is occurring at Deptford, Rotherhithe and Lambeth. This may provide opportunities to improve the ecological capacity and appearance of these frontages.

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Deptford Creek five years ago

Erosion of the river bed is occurring at Southwark and Battersea. It may be necessary to set the defence line back when the defences are upgraded to avoid erosion damage to the defences.

Measures will also be needed to provide flood protection for the docks if the defences are raised, possibly by incorporating a flood gate into the dock gates.

The Wandsworth to Deptford policy unit is a very large, flat and low-lying area. It has a high potential for pluvial (from intense or prolonged rainfall) and urban drainage flooding in much of the area. Pluvial flooding will be exacerbated by shortcomings in the urban drainage system.

In addition, there is the potential for groundwater flooding via permeable superficial deposits that connect the Estuary with the floodplain.

These sources of flooding have only been investigated at a strategic level. Further work would be needed to develop mitigation options, and management of local flood risk will be considered during consultation. This is contained in our action plan.



Do you understand our assessment for the Wandsworth to Deptford policy unit?



Do you agree with it?

Policy unit – London City

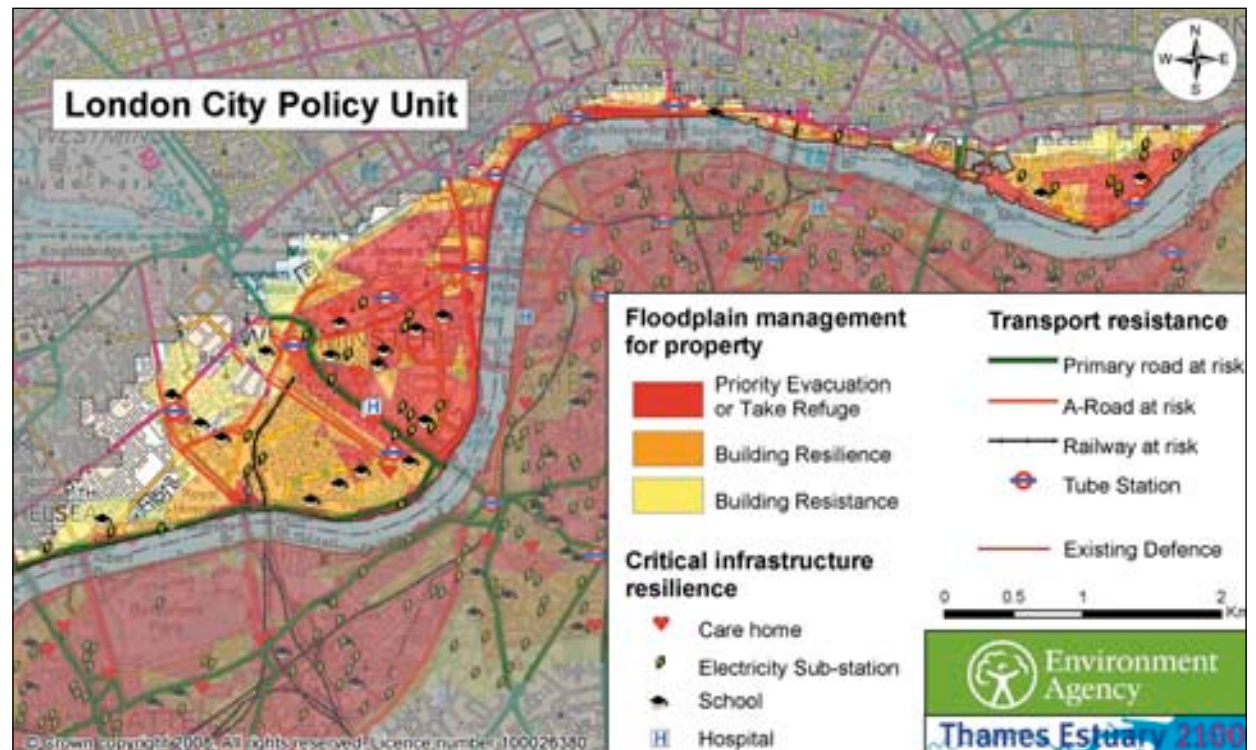
Policy: The selected policy for London City is policy **P5** to take further action to reduce flood risk.

Description

London City policy unit includes much of Westminster, part of Wapping and a narrow strip along the north bank of the Thames between Charing Cross and London Bridge. The policy unit includes two World Heritage Sites (Palace of Westminster and the Tower of London) and many other historic buildings. It is also a very established area, with limited redevelopment opportunities. Much of the transformation of the old warehouses to new uses is complete and the river frontage already has some established public open spaces.

Although it covers a relatively small area, the London City policy unit contains a high number of vulnerable sites in addition to the seat of government and the heritage sites noted above. Within the policy unit there also are eight underground stations, 19 schools, 29 electricity substations and a hospital.

Public access for much of the frontage is via footpaths adjacent to main roads. Further east in the old warehouse areas, there are buildings on the river frontage and access routes are set back.



At risk in London City policy unit

There are defences along the river frontage, some of which are incorporated into buildings.

Sources of flooding

- Tidal from the Thames upriver of the Thames Barrier (probability 0.1% per annum or less frequent, barrier controlled), flood depths up to 3 m if the Thames Barrier failed.
- There is a risk of flooding from pluvial and urban drainage sources, particularly in the Westminster area.



HMS Belfast

- Groundwater flooding from superficial strata, possibly connected to Thames water levels.

Existing flood risk management system

- The Thames Barrier, to control tidal water levels.
- Secondary tidal flood defences along the Thames frontage.
- 22 combined sewer overflows (CSOs) for urban drainage flood mitigation.
- Flood forecasting and warning.

Policy context

The policy unit lies within the Thames CFMP area.

There are locations where development is planned on or near the Estuary frontage. These provide opportunities to enhance the frontage and the defences.

Vision

Our vision for the London City policy unit is to provide an environment that has low flood risk and where flood defences are integrated into the environment. This policy unit contains some of the most important public areas in London, and the appearance of defences and maintaining views is of paramount importance. There is also a need to raise awareness of the flood risk for residents, commuters and tourists.

Local issues and choices

Where flood risk management policy **P5** applies, a higher standard of protection is needed. This will be provided by the Thames Barrier for tidal flood risk for the foreseeable future. Fluvial flooding from the Thames is unlikely to be a problem for this policy unit because fluvial flood levels would not overtop the defences – although there may be fluvial/pluvial flood risk from behind the tidal defences.

There is a possibility that defence raising for tidal flood risk management may not be acceptable in all areas because of the adverse impact on the riverside. Wherever possible, opportunities should be taken to set the defences back into the urban landscape – recognising that the areas to the riverside of the defences would be inundated by the tide from time to time. The Tate Modern on the south bank of the river is an example of where this has been successfully achieved through a development project. The riverside environment is greatly improved, safety is maintained and the defences are easier to maintain.

Accretion of the river bed is occurring at Wapping and Westminster. This may provide opportunities to improve the ecological capacity and appearance of these frontages.



Palace of Westminster

There is a risk of pluvial and urban drainage in the Westminster part of this policy unit. Flooding from the urban drainage system could potentially result from sewer capacity, pump station failure and tide-locking of outfalls.

Whilst generic mitigation responses have been identified for flooding from local sources, these have not been designed or assessed in any detail. Management of this local flood risk will be considered during the consultation.



Do you understand our assessment for the London City policy unit?



Do you agree with it?

There are long lengths of eroding foreshore at Shadwell, Blackfriars, Pimlico and Chelsea. It may be necessary to set the defence line back when the defences are upgraded to avoid erosion damage to the defences.


Measures will be needed to provide flood protection for the dock entrances if the defences are raised, possibly by incorporating a flood gate into the dock gates.

TE2100 action plan: **action zone 2** – central London


Table A.2. – Policy units

■ Wandsworth to Deptford **P5** ■ London City **P5**


[Note that all dates are based on government's current guidance on climate change – the TE2100 Plan will be reviewed and updated if these predictions change]

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.2.1. TE2100 Plan informs the development and revision of local authority strategic flood risk assessments (SFRAs) and flood plans.</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency</p> <p>London Boroughs in action zone 2:</p> <ul style="list-style-type: none"> • LB Wandsworth • LB Southwark • LB Lambeth • LB Lewisham • LB Kensington & Chelsea • LB Tower Hamlets <p>Westminster City Council</p> <p>City of London</p> <p>Central London Local Resilience Forum</p>	<p>TE2100 information is provided to local authorities preparing flood plans to ensure robust capability testing.</p> <p>TE2100 information is provided to London Resilience Forum to inform Community Risk Registers and support exercises.</p> <p>Local authority flood plans are developed with an understanding of TE2100 recommendations and data.</p> <p>A community engagement programme to ensure the public, businesses and other groups understand, are involved in and support the flood plans.</p>	<p>Implementation partners: Do your flood plans include the findings and recommendations from TE2100? Do you have enough information from us to develop your flood plans so that they are informed by TE2100? Your response will guide the development of our implementation blueprint during 2009 and improve arrangements for partnership working.</p> <p>Landowners, the public, business and other interested groups: The Thames Barrier provides very reliable protection to central London against surge tides and when the Thames Barrier is not closed, the river walls provide protection to low-lying areas. But should there be a failure of a defence or an extreme event which overtops the defences, low-lying areas of central London would flood as shown on the policy unit “at risk” maps. Flood plans will set out arrangements for managing this sort of emergency. If you have views on this, please let us know and we will share them with the Authorities responsible for preparing the flood plans.</p>

TE2100 action plan: action zone 2 – central London




	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.2.2. To agree a programme to provide local flood protection, resilience and emergency plans for vulnerable key sites in the Wandsworth to Deptford policy unit.</p> <p>[Note: There are ten underground stations and three major railway termini in the tidal flood risk area. There are also 32 care homes, 93 schools, three hospitals and over 200 electricity sub stations potentially at risk. This makes the Wandsworth to Deptford policy unit one of the most vulnerable in the TE2100 area in the event of a failure or overtopping of the defences.</p> <p>Underground stations are particularly vulnerable in central London as the network will flood and will require evacuation plans and emergency measures]</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency</p> <ul style="list-style-type: none"> • LB Wandsworth • LB Southwark • LB Lambeth • LB Lewisham <p>Central London Local Resilience Forum</p> <p>Transport for London</p> <p>Rail Service Providers</p> <p>NHS Trusts</p> <p>Board of Education</p> <p>EDF Energy</p> <p>Thames Water</p> <p>Other site owners</p>	<p>We will discuss with our implementation partners to agree strategic scope of measures required.</p> <p>Agreement between implementation partners on the strategic approach for protection or reliance of assets, timescale and roles and responsibilities.</p> <p>All site owners supportive of approach and confidence maintained.</p> <p>Floodplain management measures in place or planned within 25 years, refer to flood risk in our policy unit maps for our view of vulnerable assets.</p>	<p>Implementation partners: Are you aware of the risks and particular vulnerability of the Wandsworth to Deptford policy unit? Do you agree with our assessment of the vulnerable assets in the central London action zone? Do you have arrangements in place for the scope of works required for the properties/areas in which you have an interest? Can the Environment Agency assist with this through implementation of action A.2.2?</p> <p>Landowners, the public, business and other interested groups: We would be interested to hear your views to assist us in planning the implementation of action A.2.2. particularly if you live, work or have interests in this area.</p>

TE2100 action plan: **action zone 2** – central London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.2.3. To agree partnership arrangements and principles to ensure that new development in the central London tidal risk area is safe, and that where possible applies PPS25 to actually reduce the consequence of flood risk – particularly in the Wandsworth to Deptford policy unit because of it's vulnerability.</p> <p>For flood risk management to be factored into the planning process at all levels for the first 25 years from 2010 to 2034. There is need for greater clarity over methods and procedures for safety in new development behind defences. Environment Agency and local authority staff are providing advice to developers and responding to difficult planning applications.</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency GLA & LDA Spatial and emergency planners</p> <ul style="list-style-type: none"> • LB Wandsworth • LB Southwark • LB Lambeth • LB Lewisham • LB Kensington & Chelsea • LB Tower Hamlets <p>Westminster City Council City of London Developers & Architects</p>	<p>TE2100 Plan and information informs London Plan and Local Development Frameworks (LDFs) and future revisions.</p> <p>Local authorities and our planning staff require guidance for applying the principles of PPS25⁷ to the complexities of central London's defended tidal floodplain.</p> <p>We will work with implementation partners and CLG to develop guidance for development in London defended tidal floodplain.</p>	<p>Implementation partners: Are your LDFs supported by sustainability appraisals that include local tidal flood risk and the implications of climate change? If not, does the TE2100 Plan provide you with the information you need to do this? If guidance is produced to provide interpretation of PPS25 in a defended area, what sort of information would be most helpful to you? Would you be able to assist the Environment Agency in preparing the guidance – and would it be useful to you?</p> <p>Landowners, the public, business and other interested groups: We would be interested to hear your views to assist us in planning the implementation of this action A.2.3. particularly if you have had experience (good or bad) of dealing with us and other authorities over planning and building by the river and in the central London tidal floodplain.</p>



⁷ Planning Policy Statement No. 25 Development and Flood Risk (CLG 2006)

TE2100 action plan: **action zone 2** – central London


	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.2.4.</p> <p>To review and maintain from 2035 to 2069 the partnership arrangements and principles for development and flood risk management established in the first 25 years of our Plan.</p>	As above	Guidance is updated to reflect changing needs. The TE2100 10-yearly update to include review of action A.2.3. and recommend any changes or developments.	We cannot know what institutional arrangements will be in place during this period or what pressures there will be on the environment. We do know that for central London to continue to thrive, flood risk management must continue to be integrated into the spatial planning process. If you would like to help shape the development of these arrangements then please let us have your views.
	<p>A.2.5.</p> <p>To review and maintain from 2070 and into the 22nd century the partnership arrangements and principles for development and flood risk management established in the middle years of the Plan.</p>	As above	TE2100 10-yearly update to include review of action A.2.4. and recommend further action. Guidance is updated to reflect changing needs.	Flood risk management continues to be integrated into the spatial planning process into the 22nd century. If you have views on how the relationship between spatial planning and flood risk management should be developing in central London as we prepare for the 22nd century, then please respond to this action A.2.5.
	<p>A.2.6.</p> <p>To maintain, enhance or replace, the river defence walls and active structures through central London over the first 25 years of the Plan from 2010 to 2034.</p> <p>[Note: This is a continuation of our current activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p>	<p>Environment Agency</p> <ul style="list-style-type: none"> • LB Wandsworth • LB Southwark • LB Lambeth • LB Lewisham • LB Kensington & Chelsea • LB Tower Hamlets <p>Westminster City Council City of London</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset System Management teams will promote these schemes. However, the method of improving the defences is different from the present day approach. It involves greater maintenance and repair work in addition to replacement.</p>	<p>This is the work which the Environment Agency does now. We will continue with our programme of operations, maintenance and replacement but we are looking for ways of working better and more effectively.</p> <p>We are also seeking opportunities for environmental and recreational enhancements which will create a better place, and for partnerships which will help us achieve this.</p> <p>We would welcome any comments that you or your organisation can provide which assist us in these aims.</p>

(continued)



TE2100 action plan: **action zone 2 – central London**

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.2.6. (continued) <i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Landowners Developers GLA Thames Estuary Partnership</p>	<p>Promotion of schemes through the capital programme may not be appropriate for maintenance and repair, and a different way of working may be required.</p>	<p>Our TE2100 Technical Report and local choices documents for the policy units provide our assessment of the choices which are available in central London in the short term. If you would like to comment on these in more detail, please contact the project team.</p>
	<p>A.2.7. To maintain, enhance or replace the defence walls and active structures through central London during the 30 year period of the Plan from 2035 to 2069.</p> <p>[Note: Continuing our activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <ul style="list-style-type: none"> • LB Wandsworth • LB Southwark • LB Lambeth • LB Lewisham • LB Kensington & Chelsea • LB Tower Hamlets <p>Westminster City Council City of London</p> <p>Landowners Developers GLA Thames Estuary Partnership</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset Systems Management teams will promote schemes through capital programme and they will form part of strategic and investment plans – subject to replacement/repair working arrangements as A.2.6. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>Our aims remain as A.2.6. above, but during this period, there will be a major programme of rebuilding and refurbishment of the river walls and defences through central London. This provides many opportunities for creating a better place and to plan for a better riverside environment. If you would like to help shape the future environment in this area, then please let us have your views.</p> <p>During this period we will be preparing for the “end of the century” wall works – see A.2.8. below and any decisions made as part of Action A.2.7. must recognise that there may be major changes from 2065.</p> <p>Our TE2100 Technical Report and local choices documents for the policy units provide our assessment of the choices which are available in central London in the medium term (2035 to 2069). If you would like to comment on these in more detail, please contact the project team.</p>

TE2100 action plan: **action zone 2** – central London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.2.8. To implement a programme of defence raising through central London in 2065.</p> <p>These are the TE2100 “end of the century” measures of raising defence levels in central London to provide continuing tidal flood risk management for all options (except a downriver barrier with locks which will not require defence raising through central London).</p> <p>Combination of defences raised on the existing line and some new defences on a new alignment to enhance sensitive environments would be possible for “end of the century” options 1, 2 and 3). There are areas where the defences could be set back, and periodic flooding of riverside paths and public open space areas could be acceptable as creating a safe, but more natural riverside environment. These enhancements to the city landscape could be incorporated into new developments.</p> <p>Option 4 would not require the defences to be raised in central London.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Landowners</p> <p>The eight central London local authorities</p> <p>Developers</p> <p>The public</p> <p>Local interest groups</p> <p>GLA</p> <p>Thames Estuary Partnership</p> <p>Floodplain users</p>	<p>The timing of defence raising will depend on the rate of sea level rise, but a maximum raise of 1 m is envisaged.</p> <p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>We will promote schemes through capital programme.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p> <p>The TE2100 10-yearly update will include a review of Action A.2.8. and recommend further whether the end of the century recommendations have changed.</p>	<p>2065 is a long way ahead but a decision needs to be made on the TE2100 “end of the century” option. This will enable us to finalise our Plan. The end of the century options (see estuary-wide action plan – action zone 0) affect options required in central London.</p> <p>Options 1, 2, and 3 would mean we would need a wall raising through central London in 2065. Option 4 (a barrier with locks – or “open” barrage) would mean that the walls could stay at the current levels.</p> <p>However, this is the most expensive option and it would cause significant damage to the Estuary environment. It is not currently one of our front-runners identified through the appraisal process.</p> <p>So if you have views about the value of central London’s riverside and the effect of raising the walls by as much as a metre, please share them with us in submitting your response to this action (A.2.8.).</p> <p>We will make recommendations based on conditions now, in 2009, but the final decision of “end of the century” option is likely to be made between 2050 and 2060, and the front-runners may or may not change.</p> <p>It is important to send us your views because the responses we receive during this consultation will set the baseline for establishing public attitudes to the central London riverside environment. This “2009 snapshot” of central London stakeholder views will form a starting point for measurement of public attitudes in the future.</p>

TE2100 action plan: **action zone 2** – central London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
 Up to 2100	<p>A.2.9. To maintain, improve and enhance the river defence walls and active structures through central London post 2070 and into the 22nd century.</p> <p>Whether or not defences are raised, all defences will still require ongoing maintenance, repair and replacement (and hence engineering works) and this has been allowed for in our Plan investment profile.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Landowners</p> <p>Developers</p> <p>The eight central London local authority planning teams</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>We will promote schemes through capital programme and they will form part of strategic and investment plans – subject to replacement/repair working arrangements as A.2.6. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>We cannot know what institutional arrangements there will be as we approach the 22nd century, but our TE2100 vision imagines an environment where the central London riverside complements the cityscape and is increasingly enjoyed and respected by the people who live and work there and those who visit. This means that the actions established in A.2.6. and A.2.7. will be continued by whoever is looking after our environment at that time.</p> <p>If you have views about the long-term future management of central London’s riverside, we would like to hear them.</p> <p>This consultation provides an opportunity for you to have these views recorded and presented as part of an ongoing vision statement to those who follow us 60 to 100 years from now.</p>
 First 25 years	<p>A.2.10. To agree a programme of managing flooding from other sources in the defended tidal floodplain.</p> <p>Large areas of central London zone are low-lying, and there is potentially a high risk of pluvial and urban drainage flooding, particularly in areas where the urban drainage system has relatively low capacity and/or is prone to tide locking.</p>	<p>Environment Agency</p> <p>Land Owners</p> <p>GLA</p> <p>London Boroughs in action zone 2</p> <ul style="list-style-type: none"> • LB Wandsworth • LB Southwark • LB Lambeth • LB Lewisham 	<p>We will discuss with our implementation partners to agree strategic scope of measures required.</p> <p>Work with GLA and others to develop a Strategic Surface Water Management Plan for London.</p>	<p>Implementation partners: Are you aware of the risks and particular vulnerability of people and property to flooding from sources other than tidal? Do you have arrangements in place for initiating the discussion concerning scope of works required for the properties/areas in which you have an interest? Can the Environment Agency assist with this through implementation of action A.2.10?</p> <p style="text-align: right;">(continued)</p>

TE2100 action plan: **action zone 2** – central London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.2.10. (continued)</p> <p>There is also fluvial flood risk from the River Wandle. Choices for local flood risk management have not been designed or addressed in detail in TE2100 but this is identified as an action in the Plan.</p> <p><i>(Cost of implementing this action is not included in TE2100 Plan, but TE2100 data, information and recommendations are available to support the successful implementation of the action)</i></p>	<ul style="list-style-type: none"> • LB Kensington & Chelsea • LB Tower Hamlets <p>Westminster City Council</p> <p>City of London</p>	<p>All site owners must be supportive of approach and confidence of public and users maintained. Local measures for management of flooding from other sources to be in place or planned within 25 years.</p>	<p>Landowners, the public, business and other interested groups:</p> <p>We would be interested to hear your views to assist us in planning the implementation of this action A.2.10. particularly if you live, work or have interests in this area and are concerned about flooding from sources other than tidal. This includes pluvial and urban drainage and fluvial flooding from the River Wandle.</p> <p>Our TE2100 Technical Report and local choices documents for the policy units provide further information on these matters and the choices which are available to assist with problems. If you would like to comment on these in more detail, please contact the project team.</p>

TE2100 action plan: action zone 3 – east London

Action plan for zone 3 – table A.3.

10 actions identified

Description of the policy units

- Isle of Dogs & Lea Valley
- Greenwich
- Royal Docks

Table A.3. describes the 10 actions for zone 3 – east London which have been identified through the TE2100 Plan. The actions are described under the following headings:

- TE2100 recommended actions (and whether or not costs for this have been included in the TE2100 Plan)
- Implementation partners
- How this will be achieved
- How your response can help us finalise the TE2100 Plan



Do you consider that we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?



Do you agree with the actions identified in the action plans and the timing of those actions?



Do you agree with the mechanisms we have set out to deliver the action plans?



Have we identified the right partner organisations to deliver the action plans and are you, or your organisation, able to contribute to these actions?

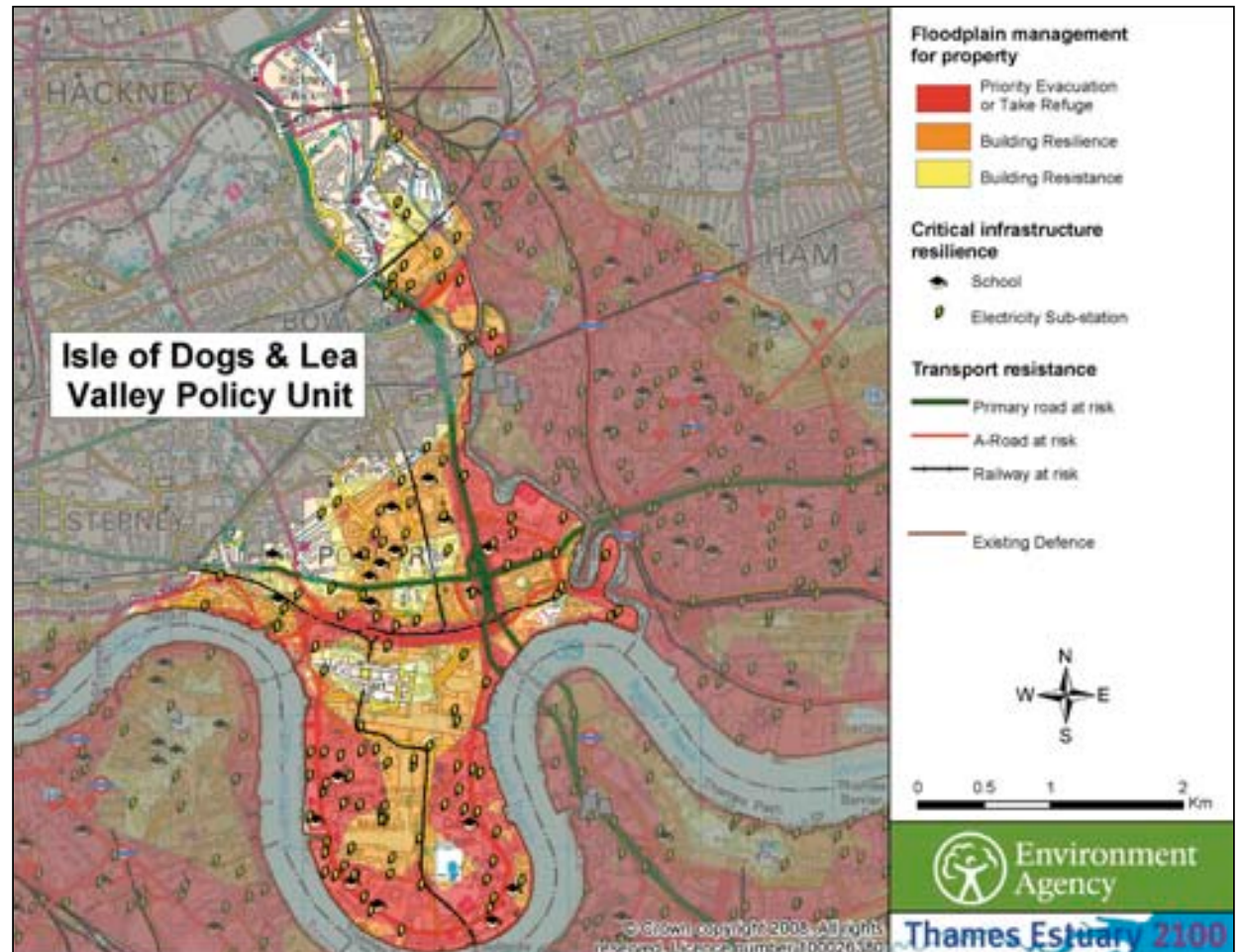
Policy unit – Isle of Dogs & Lea Valley

Policy: The recommended policy for Isle of Dogs is policy **P5** to take further action to reduce flood risk.

Description

The Isle of Dogs & Lea Valley policy unit has a very high density of development. It includes the Canary Wharf business district and the developing Olympic Park in the Lea Valley. It also contains extensive residential and industrial areas, and West India and Millwall Docks. Apart from the docks there are few open spaces, and the river frontage is almost continuously developed.

In the flood risk area there are over 100 electricity substations, the Docklands Light Railway, 19 schools and the Canary Wharf underground station. The Blackwall tunnel with its southbound approach roads and the northern entrance to the Greenwich foot tunnel are also in the flood risk area. There are no care homes or major hospitals here. This is former industrial land which has seen major changes in the past 20 years with the development of the Canary Wharf Docklands commercial area. It is anticipated that the investments associated with the Olympic site in the Lea Valley will be the catalyst for regeneration in the northern part of this unit. This policy unit



At risk in Isle of Dogs & Lea Valley policy unit

TE2100 action plan: action zone 3 – east London

also includes local choices for the River Lea, which forms the boundary between Isle of Dogs and the adjacent Royal Docks policy unit.

Sources of flooding

- Tidal from the Thames upriver of the Thames Barrier (probability 0.1% per annum or less frequent, Thames Barrier controlled), flood depths up to 3 m if the Thames Barrier failed.
- Tidal from the River Lea (probability 0.1% per annum or greater, Thames Barrier controlled).
- Fluvial from the River Lea (probability 1.5 to 3% per annum).
- There is a medium risk of flooding from pluvial and urban drainage sources in the areas between the docks and the defences.
- The docks provide a potential pathway for tidal flooding (but could also store fluvial floodwater – this has not been investigated by TE2100 but forms part of the local choices for further investigation).

Existing flood risk management system

- The Thames Barrier, to control tidal water levels.
- Secondary tidal flood defences along the Thames frontage and the River Lea.

- Fluvial flood defences on the River Lea (including the Lea Flood Relief Channel).
- The Lea system includes channels which could provide pathways for floodwater, for example the Limehouse Cut.
- Five combined sewer overflows (CSOs) for urban drainage flood mitigation.
- Flood forecasting and warning.



Looking over London Docklands and Canary Wharf

Policy context

The Isle of Dogs & Lea Valley policy unit lies within the Thames CFMP (Catchment Flood Management Plan) area. There is a separate flood risk strategy for the River Lea. There are locations where development is planned on or near the Estuary frontage. These provide opportunities to enhance the frontage and the defences. Like Greenwich on the south bank, this policy unit is the first major area of redevelopment on the north bank when travelling east from the centre of London. It is therefore covered by Thames Strategy East in addition to the Thames Gateway Parklands vision.

Vision

Our vision for the Isle of Dogs & Lea Valley policy unit is for a defence system that can provide an increasing level of protection against climate change. The defences should be integrated with new development wherever possible, blending with the modern and rapidly changing urban environment. There are some opportunities for set-back and environmental enhancement, for example at the old East India Dock site.

TE2100 action plan: **action zone 3** – east London

There is also a need to raise awareness of the flood risk for residents, business groups, commuters and tourists. Frequency of fluvial flooding on the Lea is greater than from tidal flooding, and the Lea should be a priority area for floodplain management. Flood risk should also be taken into account in land use planning and new development.

Local issues and choices

Where flood risk management Policy **P5** applies, a higher standard of protection is justified. This will be provided by the Thames Barrier for tidal flood risk for the foreseeable future. Fluvial flooding from the Thames is unlikely to be a problem for this policy unit because fluvial flood levels would not overtop the defences.

Some erosion of the river bed is occurring in the south east corner of the Isle of Dogs, and the bend in the river at Limehouse. It may be necessary to set the defence line back when the defences are upgraded to avoid erosion damage to them. Accretion of the river bed is occurring on the east and south sides of the Isle of Dogs.

Measures will be needed for tributary flooding from the River Lea and the associated channels. The flood relief channel and tidal Lower Lea are intended to contain high tidal water levels and





Docklands Commercial area

fluvial flows, but fluvial flooding may also occur from the Lea navigation and the associated channels (including the Limehouse Cut).

Work on the Lea is being undertaken as part of the Olympics development. This includes the new control structure and lock at Prescott Weir, river and floodplain restoration. This should be taken into account when planning flood risk management responses for the River Lea.

There is a risk of tidally influenced fluvial flooding from the River Lea. Choices for managing tidal and fluvial flood risk on the Lea are set out in our zone 3 action plan table A.3.

 Do you understand our assessment for the Isle of Dogs & Lea Valley policy unit?

 Do you agree with it?

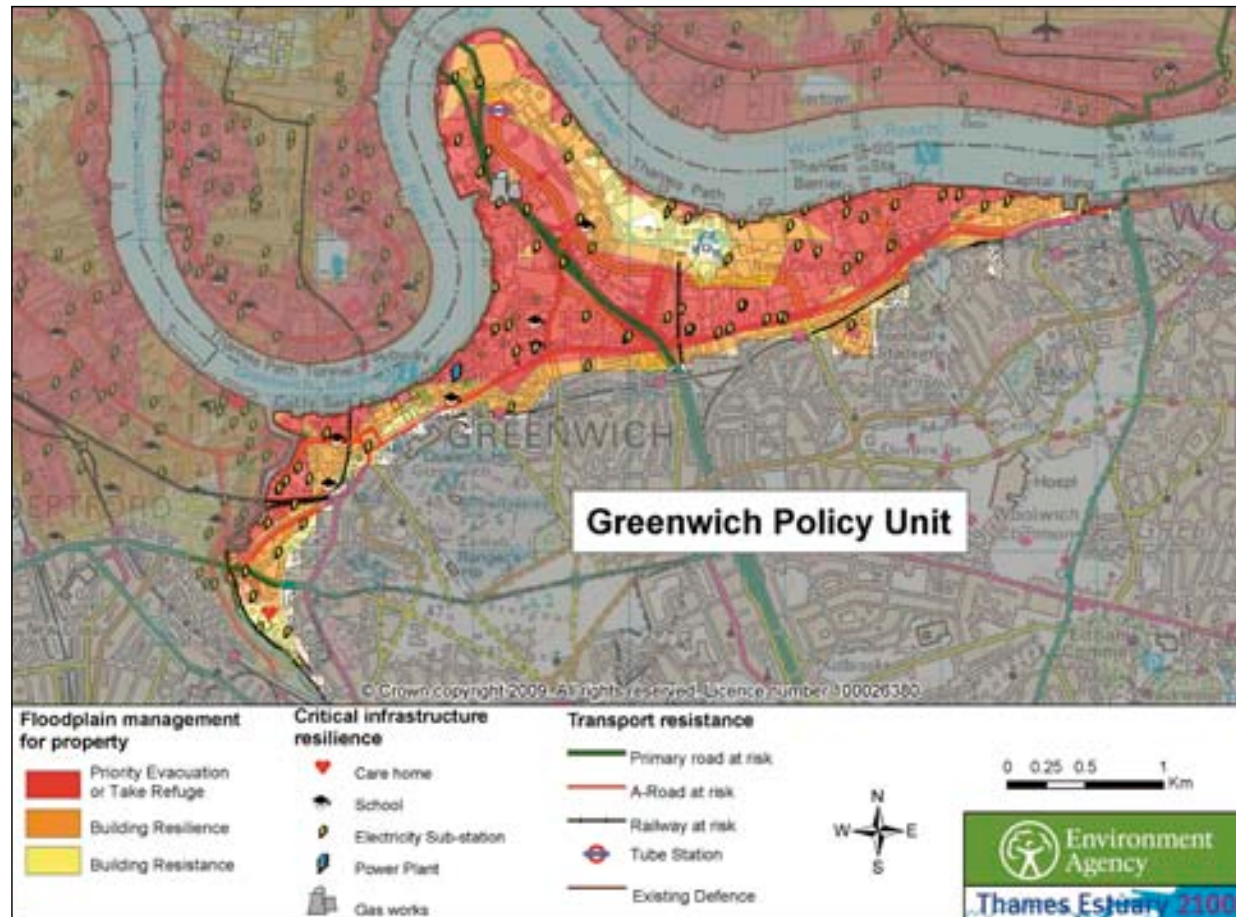
Policy unit – Greenwich

Policy: The selected policy is policy **P5** to take further action to reduce flood risk.

Description

The Greenwich policy unit includes the Millennium village and other redevelopment areas on Greenwich peninsula including the O₂ arena, together with North Greenwich underground station and bus terminus. The policy unit is a mixture of residential, urban and industrial areas. It also contains important historic buildings including part of maritime Greenwich, which is a World Heritage Site. The Thames Barrier including its south bank operational area is in this policy unit. There are also 70 electricity substations and a power station (currently mothballed), five schools and one care home. The A101(M) is raised but drops down to flood level as it approaches the Blackwall tunnel. The main road from Greenwich to Woolwich runs along the southern edge of the Greenwich policy unit.

A key feature of this policy unit is that it straddles the Thames Barrier so when the barrier is closed against high tides, there is a difference of up to 2 metres either side of the barrier. To accommodate this difference in water levels, the flood defences downstream of the Thames Barrier are up to 3 metres higher than those upstream.



At risk in Greenwich policy unit

Sources of flooding

- Tidal from the Thames upriver of the Thames Barrier (probability 0.1% per annum or less frequent, Thames Barrier controlled), flood depths up to 3 m if the Thames Barrier failed.
- Tidal from the Thames downriver of the Thames Barrier (eastern part of the policy unit) (probability 0.1% per annum or greater, flood depths up to 5 m).
- Fluvial and tidal/fluvial from the Ravensbourne River (probability 1–2% per annum).



The Greenwich peninsula

- There is a risk of urban drainage flooding, particularly, where the capacity of the urban drainage system is low. This risk is exacerbated by tide locking of outfalls.

Existing flood risk management system

- The Thames Barrier, to control tidal water levels upriver of the barrier.
- Secondary tidal flood defences upriver of the barrier on the Thames and the Ravensbourne River/Deptford Creek.
- Tidal flood defences downriver of the barrier on the Thames.
- Fluvial flood defences on the Ravensbourne River (enlarged channel).
- Three combined sewer overflows (CSOs) for urban drainage flood discharge.
- Flood forecasting and warning.

Policy context

Like the Isle of Dogs on the north bank, this policy unit is the first major area of redevelopment on the south bank when travelling east from the centre of London. It is covered by Thames Strategy East in addition to the Thames Gateway Parklands vision. Requirements that should be taken into account in the design of flood risk management interventions in order to achieve local planning objectives are based largely on the proposals in these documents.



Terraces at the O₂ – cheaper to build, subsequently increased value of the land and enhanced local ecology

Vision

Our vision for the Greenwich policy unit is to provide a flood risk management system keeps pace with climate change and improves on the defence standards provided. The defence system is integrated with new development and takes advantage of the space available to achieve a river frontage which is safe and is part of the regenerated cityscape. In some areas the defences could be integrated into the landscape. An example of how this can be done is provided on in this policy unit by the Greenwich peninsula intertidal habitat terraces.

Redevelopment and the existence of iconic sites such as the Thames Barrier, the O₂, the Cutty Sark historic ship site (now undergoing major refurbishment) and the Greenwich frontage provide opportunities for creative integration of the defences into the urban landscapes.

Flooding remains unlikely in this part of the Thames estuary but there is always a risk. We must engage with the community, local businesses and other groups to raise awareness of the flood risk. Our approach to floodplain management should be used to guide local decisions about i) what's vulnerable and how can it be protected or made resilient, ii) where to prioritise redevelopment and iii) considerations for emergency planning.

Local issues and choices

We are recommending a policy **P5** for this policy unit so a higher standard of protection is justified. This will be provided by the Thames Barrier for tidal flood risk upriver of the Thames Barrier. Downriver of the Barrier, policy **P5** will be introduced by increasing the amount of defence raising in 2070. Prior to 2070, defences will be raised to keep pace with climate change. The first of these raisings is likely to be around 2040.

Accretion of the river bed is occurring at Greenwich. This may provide opportunities to improve the ecological capacity and appearance of this frontage. Erosion of the river bed is occurring downriver of the Thames Barrier. It may be necessary to set the defence line back when the defences are upgraded to avoid erosion damage to the defences.

Measures will be needed for tributary tidal and fluvial flooding on the Ravensbourne River (Table A.3.).

There is a risk of urban drainage flooding in this policy unit, particularly in areas where the capacity of the urban drainage system is low. This risk is exacerbated by tide locking of outfalls. Measures for managing this source of flooding have not been investigated in detail by TE2100 but this is an action which must be picked up by the teams responsible.



Do you understand our assessment for the Greenwich policy unit?



Do you agree with it?

Policy unit – Royal Docks

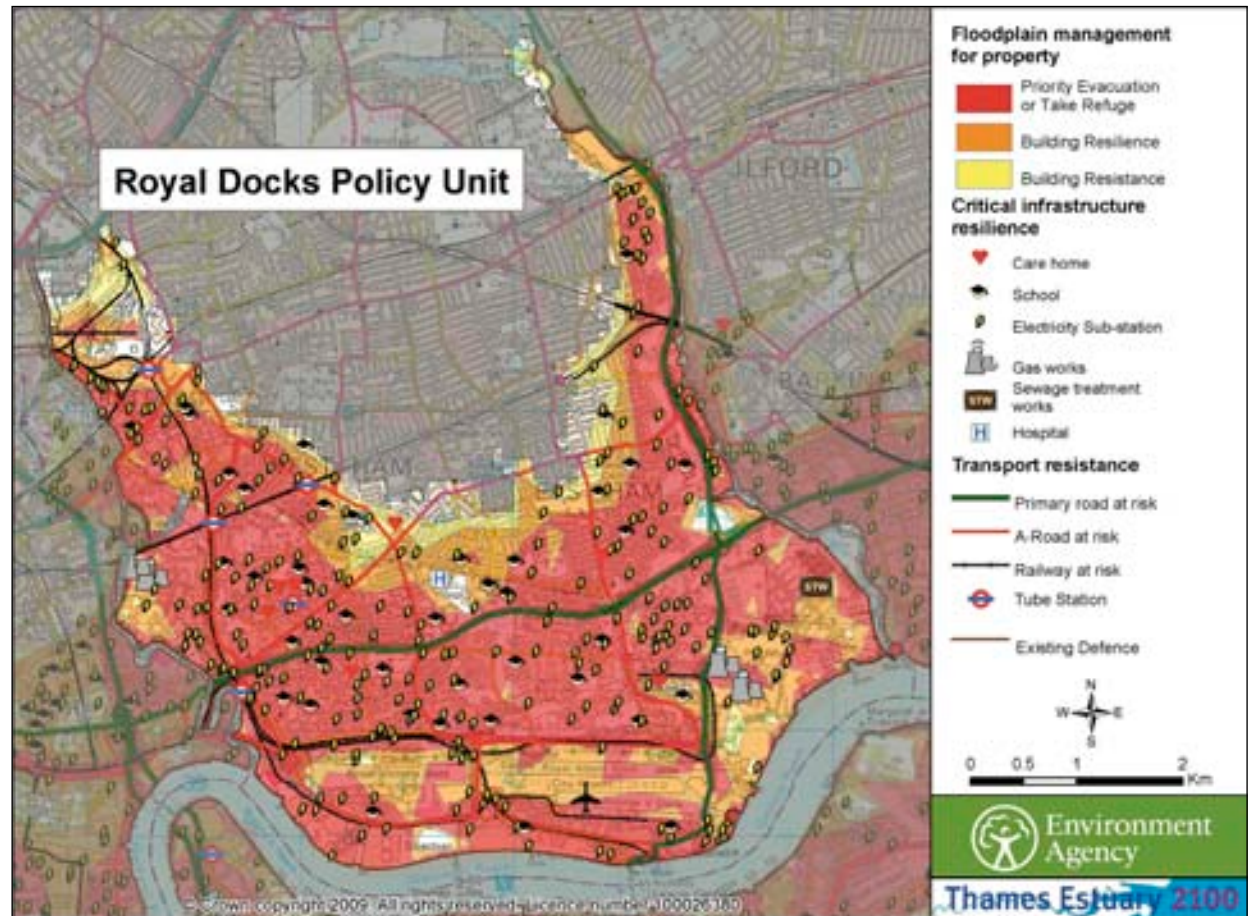
Policy: The recommended flood risk management policy is policy **P4** to take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change)

Description

The Royal Docks policy unit includes extensive and established residential and industrial areas. It also contains the three Royal Docks, which are a focus for redevelopment and which form a raised strip of land parallel to Woolwich Reach on the River Thames. It is anticipated that the investments associated with the Olympic site in the Lea Valley will be the catalyst for regeneration in the north western part of this policy unit.

The unit includes City Airport and associated new developments as well as the north bank of the Thames Barrier. There are also five underground stations, 36 schools, seven care homes and a hospital. Two power stations, over 200 electricity substations and the major Beckton sewage treatment works are also in the tidal flood risk area. The A13 arterial route cut across this policy unit from west to east.

The ground level in much of the Royal Docks policy unit is low (at 1 m AOD or less), whereas the levels



at the docks and the Thames frontage are higher (3 m to 5 m AOD). Thus there would be great difficulty evacuating floodwater should flooding occur. This also means that this area is vulnerable to pluvial (heavy/prolonged rainfall) flooding.

The options for the Royal Docks policy unit do not include the River Lea or the River Roding, which form the west and east boundaries of the unit and are covered in the Isle of Dogs & Lea Valley and Barking & Dagenham policy units respectively. A key feature of this policy unit is that it straddles the Thames Barrier so when the barrier is closed against high tides, there is a difference of up to 2 m metres either side of the barrier. To accommodate this difference in water levels, the flood defences downstream of the Thames Barrier are up to 3 m metres higher than those upstream.

Sources of flooding

- Tidal from the Thames upriver of the Thames Barrier (probability 0.1% per annum or less frequent, barrier controlled), flood depths up to 5 m if the Thames Barrier failed.
- Tidal from the Thames downriver of the Thames Barrier (probability 0.1% per annum or less frequent), flood depths up to 5 m but very variable.



The Thames Barrier has remained a constant feature in the rapidly changing urban landscape over the past 25 years

- There is a serious risk of pluvial and urban drainage flooding, particularly in areas where the capacity of the urban drainage system is low. This risk is exacerbated by tide locking of outfalls.
- Flooding on the River Lea is covered by the Isle of Dogs & Lea Valley policy unit.
- Flooding on the River Roding is covered by the Barking & Dagenham policy unit.

Existing flood risk management system

- The Thames Barrier, to control tidal water levels upriver of the barrier.
- Secondary tidal flood defences upriver of the barrier on the Thames.
- Tidal flood defences downriver of the Barrier on the Thames.
- Floodgates on lock entrances to the docks at King George V lock and Gallions sluice.

- Four Combined sewer overflows (CSOs) for urban drainage flood mitigation.
- Flood forecasting and warning.

Policy context

The Royal Docks policy unit forms part of the Thames Gateway regeneration area and is covered by Thames Strategy East in addition to the Thames Gateway Parklands vision.

There are extensive areas of redevelopment planned in this policy unit including much of the area to the south of the Royal Docks. This provides opportunities to improve flood risk management arrangements including floodplain management to achieve safer floodplains, and defences that enhance the riverfront environment.

The Thames Barrier has remained a constant feature in the rapidly changing urban landscape the past 25 years.

Requirements that should be taken into account in the design of flood risk management interventions in order to achieve local planning objectives are based largely on the proposals in Thames Strategy East and the Thames Gateway Parklands vision.

Vision

The extent of expected future development in this policy unit provides opportunities to modify the

layout of the flood defences and integrate them into new developments wherever possible, in order to improve the appearance of the river frontage and provide environmental enhancement and amenity opportunities.

New development should be safe, particularly in areas where the ground level is low and flood depths could be potentially high. Public awareness should be raised to facilitate emergency planning and response.

Local issues and choices

Accretion of the river bed is occurring at between Silvertown and the River Roding. This may provide opportunities to improve the ecological capacity and appearance of this frontage.

Erosion of the river bed is occurring near the River Lea confluence. It may be necessary to set the defence line back when the defences are upgraded to avoid erosion damage to the defences.

The docks provide a potentially important pathway for flooding. They are protected using flood control gates that form part of the tidal defences. The King George V flood gate is to be replaced by a new structure in the near future. As the sea level rises, this gate would have to be closed more and more frequently to prevent flooding via the docks.

There may be a practical limit to the number of closures of the dock flood control gates, and other flood mitigation measures might be needed. Possibilities include raising the quay levels or closing the docks (or parts of the docks) to navigation.

The Royal Docks policy unit is large and low-lying, and there is potentially a high risk of pluvial and urban drainage flooding, particularly in areas where the urban drainage system has relatively low capacity and/or is prone to tide locking. Choices for local flood risk management have not been designed or addressed in detail, and will be specified for further investigation in our action plans.



Do you understand our assessment for the Royal Docks policy unit?




Do you agree with it?

TE2100 action plan: action zone 3 – east London


Table A.3. – Policy units

Isle of Dogs & Lea Valley P5
 Greenwich P5
 Royal Docks P4


[Note that all dates are based on government’s current guidance on climate change – the TE2100 Plan will be reviewed and updated if these predictions change]

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.3.1. TE2100 Plan informs the development and revision of local authority strategic flood risk assessments (SFRAs) and flood plans.</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency</p> <p>London Boroughs in action zone 3:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Tower Hamlets • LB Newham <p>Local Resilience Fora:</p> <ul style="list-style-type: none"> • Central London • South East London • North East London 	<p>TE2100 information is provided to local authorities preparing flood plans and capability testing.</p> <p>Local Authority flood plans are developed with an understanding of TE2100 recommendations and data.</p> <p>Local Resilience Fora take ownership of the flood plans and all responders have confidence in them.</p> <p>A community engagement programme to ensure the public, businesses and other groups understand, are involved in and supportive of the flood plans.</p>	<p>Implementation partners: Do your flood plans include the findings and recommendations from TE2100? Do you have enough information from us to develop your flood plans so that they can be informed by TE2100? Your response will guide the development of our implementation blueprint during 2009 and improve arrangements for partnership working.</p> <p>Landowners, the public, business and other interested groups: The Thames Barrier and the downstream defences provide highly reliable protection to the east London zone against surge tides and when the Thames Barrier is not closed, the river walls provide protection to low-lying areas. But should there be a failure of a defence or an extreme event which overtops the defences, low-lying areas of this zone would be at risk</p> <p style="text-align: right;">(continued)</p>

TE2100 action plan: action zone 3 – east London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	A.3.1. (continued)			as shown on the policy unit “at risk” maps. The flood plans will set out arrangements for managing this sort of emergency. If you have views on this, please let us know and we will share your views with those responsible for preparing the flood plans.
	<p>A.3.2. To agree a programme to provide local flood protection, resilience and emergency plans for vulnerable key sites in action zone 3.</p> <p>[Note: The “at risk” maps show the particular sites and key infrastructure that would be particularly vulnerable in the TE2100 area in the event of a failure or overtopping of the defences. Underground areas and tunnels, particularly those where large numbers of people congregate will require evacuation plans]</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency</p> <p>London Boroughs in action zone 3:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Tower Hamlets • LB Newham <p>Local Resilience Fora:</p> <ul style="list-style-type: none"> • Central London South East London • North East London <p>Transport for London</p> <p>Canary Wharf Group</p> <p>EDF Energy</p> <p>Managers/ owners of vulnerable sites</p>	<p>We will discuss with implementation partners to agree strategic scope of measures required, informed by information from TE2100 (see at risk maps).</p> <p>Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.</p> <p>All site owners must be supportive of approach and confidence of public and users maintained. Local floodplain management measures in place or planned within 25 years.</p>	<p>Implementation partners: Are you aware of the risks and particular vulnerability of key sites in this action zone? Do you have arrangements in place for initiating the discussion concerning the scope of works required for the properties/areas in which you have an interest? Can the Environment Agency assist with this through implementation of action A.3.2?</p> <p>Landowners, the public, business and other interested groups: We would be interested to hear your views to assist us in planning the implementation of this action A.3.2. particularly if you live, work or have interests in this area.</p>

TE2100 action plan: action zone 3 – east London




	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.3.3. To agree partnership arrangements and principles to ensure that new development in the east London zone is safe, and that where possible the application of PPS25 reduces the consequence of flood risk – particularly in the areas where large numbers of people congregate or there is aggregation of flood risk.</p> <p>For flood risk management to be factored into the planning process at all levels for the first 25 years from 2010 to 2034.</p> <p>There is need for greater clarity over methods and procedures for safety in new development behind defences. Environment Agency and local authority staff are providing advice to developers and responding to difficult planning applications.</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency GLA, LDA, Thames Gateway London Partnership and Development Corporations Local Authority spatial and emergency planners in action zone 3:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Tower Hamlets • LB Newham <p>Developers & Architects</p>	<p>TE2100 Plan and associated information informs London Plan and Local Development Frameworks (LDF) and future revisions.</p> <p>Local authorities and our planning staff require guidance for applying the principles of PPS25⁸ to the complexities of London defended tidal floodplain.</p> <p>We along with implementation partners and CLG will develop guidance for development in London defended tidal floodplain.</p>	<p>Implementation partners: Are your Local Development Frameworks supported by sustainability appraisals that include local tidal flood risk and the implications of climate change? If not, does the TE2100 Plan provide you with the information you need to do this? If we draft guidance on the interpretation of PPS25 in a defended area, what sort of information would be most helpful to you? Would you be able to assist the Environment Agency in preparing this guidance – and would it be useful to you?</p> <p>Landowners, the public, business and other interested groups: We would be interested to hear your views to assist us in planning the implementation of this action A.3.3. particularly if you have had experience (good or bad) of dealing with us and other authorities over planning and building by the river and in the east London tidal floodplain.</p>

Greenwich



Royal Docks

⁸ Planning Policy Statement No. 25 Development and Flood Risk (CLG 2006)

TE2100 action plan: action zone 3 – east London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.3.4. To review and maintain from 2035 to 2069 the partnership arrangements and principles for development and flood risk management established in the first 25 years of our Plan.</p>	As above	Guidance is updated to reflect changing needs. The TE2100 10-yearly update to include review of action A.3.3. and recommend any changes or developments.	We cannot know what institutional arrangements will be in place during this period or what pressures there will be on the environment. We do know that for the east London zone to continue to thrive, flood risk management must continue to be integrated into the spatial planning process. If you would like to help shape the development of these arrangements during the middle years (2035 to 2069) of our Plan, then please let us have your views.
	<p>A.3.5. To review and maintain from 2070 and into the 22nd century the partnership arrangements and principles for development and flood risk management established in the middle years of the Plan.</p>	As above	TE2100 10-yearly update to include review of action A.3.4. and recommend further action. Guidance is updated to reflect changing needs.	Flood risk management continues to be integrated into the spatial planning process into the 22nd century. If you have views on how the relationship between spatial planning and flood risk management should be developing in the east London zone as we prepare for the 22nd century, then please respond to this Action A.3.5.
	<p>A.3.6. To maintain, enhance, improve or replace the river defence walls and active structures through east London over the first 25 years of the Plan from 2010 to 2034.</p>	<p>Environment Agency</p> <p>Local Authority spatial in action zone 3:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Tower Hamlets • LB Newham <p>Land Owners</p> <p>Developers</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset System Management teams will promote these schemes. However, the method of improving the defences is different from the present day approach.</p>	<p>This is the work which we do now in the Environment Agency. We will continue with our programme of operations, maintenance and replacement but we are looking for ways of working better and more effectively.</p> <p>We are also seeking opportunities for environmental and recreational enhancements which will create a better place through our east London zone, and for partnerships which will help us achieve this.</p> <p>We would welcome any comments that you or your organisation can provide which assist us in these aims.</p> <p style="text-align: right;">(continued)</p>


TE2100 action plan: action zone 3 – east London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
 <p>First 25 years</p>	<p>A.3.6. (continued)</p> <p>[Note: This is a continuation of our current activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>		<p>It involves greater maintenance and repair work in addition to replacement. Promotion of schemes through the capital programme may not be appropriate for maintenance and repair, and a different way of working may be required.</p>	<p>Our TE2100 Technical Report and local choices documents provide our assessment of the choices which are available in east London in the short term. If you would like to comment on these in more detail, please contact the project team.</p>
 <p>Middle 35 years</p>	<p>A.3.7.</p> <p>To maintain, enhance and improve or replace the defence walls and active structures through east London during the 30 year period of the Plan from 2035 to 2069.</p> <p>[Note: Continuing our activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Local authority spatial and emergency planners in action zone 3:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Tower Hamlets • LB Newham <p>Landowners</p> <p>Developers</p> <p>GLA</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset Systems Management teams will promote schemes through capital programme and they will form part of strategic and investment plans subject to replacement/repair working arrangements as A.3.6. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>Our aims remain as A.3.6. above, but during this period, there will be a major programme of rebuilding and refurbishment of the river walls and defences through east London. This provides many opportunities for creating a better place and to plan for a better riverside environment. If you would like to help shape the future environment in this area, then please let us have your views.</p> <p>During this period we will be preparing for the “end of the century” wall works – see A.3.8. below and any decisions made as part of Action A.3.7. must recognise that there may be major changes from 2065.</p> <p>Our TE2100 Technical Report and local choices documents provide our assessment of the choices which are available in east London in the medium term (2035 to 2069). If you would like to comment on these in more detail, please contact the project team.</p>

Greenwich


Royal Docks

TE2100 action plan: action zone 3 – east London



	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.3.8. To Implement a programme of defence raising through east London from 2065 to 2070 (with defences upriver of the Thames Barrier being raised by 2065 and downriver in 2070).</p> <p>These are the TE2100 “End of the Century” Raising of defence levels in east London to provide continuing tidal flood risk management for all options (except our end of the century option 4 – a downriver barrier with locks which will not require defence raising upriver of the Thames Barrier). They are in two sections, upriver and downriver of the Thames Barrier.</p> <p>Upriver of the Thames Barrier The defences will require raising for tidal flood risk management for all options except a downriver barrier with locks. This includes the tidal defences on the River Lea. The timing of defence raising will depend on the rate of sea level rise, but a maximum raise of 1m is envisaged for landscape reasons.</p> <p>There will be opportunities to realign defences along the River Lea to create space for the river and enhance the river frontage.</p>	<p>Environment Agency Landowners London Boroughs in action zone 3:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Tower Hamlets • LB Newham <p>Developers The public Local interest groups GLA Floodplain users Thames Estuary Partnership</p>	<p>The timing of defence raising will depend on the rate of sea level rise, but a maximum raise of 1 m is envisaged.</p> <p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>We will promote schemes through capital programme.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p> <p>The TE2100 10-yearly update will include a review of Action A.3.8. and recommend further whether the end of the century recommendations have changed.</p>	<p>2065 is a long way ahead but a decision needs to be made on the TE2100 “end of the century” option. This will enable us to finalise our Plan. The end of the century options (see estuary-wide action plan – action zone 0) affect the requirements for wall raising upriver of the Thames Barrier.</p> <p>Our end of the century options 1, 2, and 3 would mean we would need a wall raising through east London in 2065. Our end of the century option 4 (a barrier with locks – or “open” barrage) would mean that the walls through London upriver of the Thames Barrier could stay at the current levels. This is the most expensive one for the estuary as a whole and it would cause significant damage to the estuary environment.</p> <p>It is not currently one of our front runners identified through the appraisal process.</p> <p>So if you have views about the value of east London’s riverside and the effect of raising the walls by as much as a metre, please share them with us in submitting your response to this action (A.3.8.).</p> <p>We will make recommendations based on conditions now, in 2009, but the final decision of “end of the century” option to be adopted is likely to be made between 2050 and 2060, and the “front runners” may or may not change.</p>

(continued)

TE2100 action plan: **action zone 3** – east London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.3.8. (continued)</p> <p>This is because much of the Lower Lea valley is likely to be redeveloped, including the creation of the Park corridor.</p> <p>A flood control gate may also be needed on the entrance to the West India and Millwall Docks.</p> <p>Downriver of the Thames Barrier</p> <p>The defences downriver of the Thames Barrier will require raising during the period covered by the Plan for options that continue to rely on the Thames Barrier. The amount of raising will depend on the rate of sea level rise. If a new downriver barrier is constructed, this defence raising will not be needed and there will be an opportunity to lower the defences.</p> <p>Defence raising will include a new flood control gate at the KGV lock entrance to the Royal Docks, as the existing gate would not be suitable for raising.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>			<p>It is important to send us your views because the responses we receive during this consultation will set the baseline for establishing public attitudes to the east London riverside environment. This “2009 snapshot” of east London stakeholder views will form a starting point for measurement of public attitudes in the future.</p>

TE2100 action plan: action zone 3 – east London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.3.9. To maintain, improve, enhance or replace the river defence walls and active structures through central London post 2070 and into the 22nd century.</p> <p>Whether or not defences are raised, all defences will still require ongoing maintenance, repair and replacement (and hence engineering works) and this has been allowed for in our Plan investment profile.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency Land Owners Developers London Boroughs in action zone 3:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Tower Hamlets • LB Newham <p>GLA Thames Estuary Partnership</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset Systems Management teams will promote schemes through capital programme and they will form part of strategic and investment plans – subject to replacement/repair working arrangements as A.3.6. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>We cannot now what institutional arrangements there will be as we approach the 22nd century, but our TE2100 vision imagines an environment where the east London riverside complements the cityscape and is increasingly enjoyed and respected by the people who live, work and visit. This means that the actions established in A.3.6. and A.3.7. will be continued by whoever is looking after our environment at that time. If you have views about the long-term future management of east London’s riverside, we would like to hear them.</p> <p>This consultation provides an opportunity for you to have these views recorded and presented as part of an ongoing vision statement to those who follow us 60 to 100 years from now.</p>
	<p>A.3.10. To agree a programme of managing flooding from other sources in the defended tidal floodplain.</p> <p>Large areas of east London zone are low-lying, and there is potentially a high risk of pluvial and urban drainage flooding, particularly in areas where the urban drainage system has relatively low capacity and/or is prone to tide locking.</p>	<p>Environment Agency London Boroughs in action zone 3:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Tower Hamlets • LB Newham 	<p>We will discuss with implementation partners to agree strategic scope of measures required.</p> <p>Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.</p>	<p>Implementation partners: Are you aware of the risks and particular vulnerability of people and property to flooding from sources other than tidal? Flooding from other sources is far more likely than tidal flooding. Do you have arrangements in place for the scope of works required for the properties/areas in which you have an interest? Can the Environment Agency assist with this through implementation of action A.3.10?</p> <p style="text-align: right;">(continued)</p>

TE2100 action plan: **action zone 3** – east London

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.3.10. (continued)</p> <p>There is also fluvial flood risk from the River Lea and the Ravensbourne River. Choices for local flood risk management have not been designed or addressed in detail in TE2100 but this is identified as an action in the Plan.</p> <p><i>(Cost of implementing this action is not included in TE2100 Plan, but TE2100 data, information and recommendations are available to support the successful implementation of the action)</i></p>	<p>Internal Drainage Boards</p> <p>Sewage and water undertakers</p> <p>Land Owners</p> <p>Developers & Architects</p>	<p>All site owners must be supportive of approach and confidence of public and users maintained. Local measures for management of flooding from other sources to be in place or planned within 25 years.</p>	<p>Landowners, the public, business and other interested groups:</p> <p>We would be interested to hear your views to assist us in planning the implementation of this action A.3.10. particularly if you live, work or have interests in this area and are concerned about flooding from sources other than tidal. This includes pluvial and urban drainage and fluvial flooding from the River Lea and the Ravensbourne River.</p> <p>Our TE2100 Technical Report and local choices documents provide further information on these matters and the choices which are available to assist with problems. If you would like to comment on these in more detail, please contact the project team.</p>

Greenwich

Royal Docks

TE2100 action plan: **action zone 3** – east London

Greenwich

Royal Docks



TE2100 action plan: **action zone 4** – east London downstream of Thames Barrier

Action plan for zone 4 – table A.4.

12 actions identified

Description of the policy units

- Thamesmead
- Barking & Dagenham
- Rainham Marshes & Mar Dyke

Table A.4. describes the 12 actions for zone 4 – east London downstream of Thames Barrier which have been identified through the TE2100 Plan. The actions are described under the following headings:

- TE2100 recommended actions (and whether or not costs for this have been included in the TE2100 Plan)
- Implementation partners
- How this will be achieved
- How your response can help us finalise the TE2100 Plan



Do you consider that we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?



Do you agree with the actions identified in our action plans and the timing of those actions?



Do you agree with the mechanisms we have set out to deliver the action plans?



Have we identified the right partner organisations to deliver our action plans and are you, or your organisation, able to contribute to these actions?

Barking &
Dagenham

Rainham
Marshes &
Mar Dyke

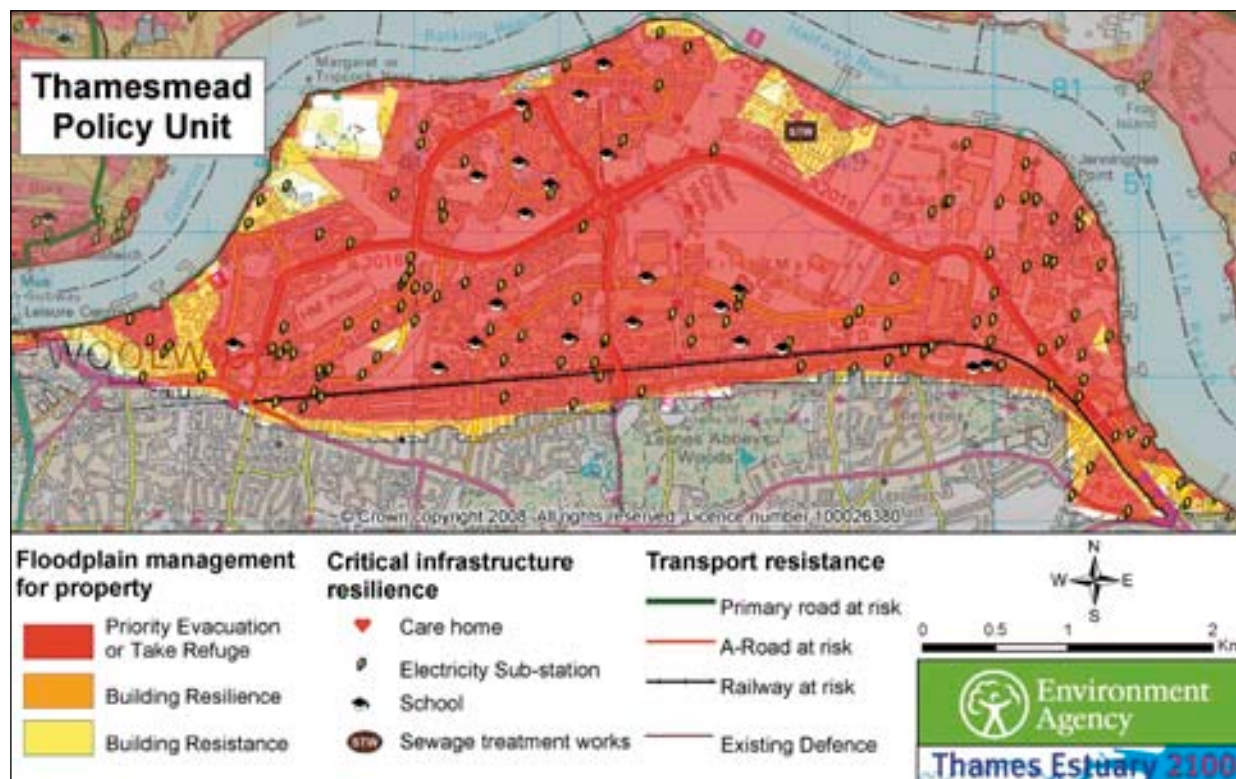
Policy unit – Thamesmead

Policy: Our recommended flood risk management policy for Thamesmead policy unit is policy **P4** to 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).

Description

The Thamesmead policy unit contains extensive development including the urban residential area of Thamesmead, the large industrial area west of Erith, and the Crossness Sewage Treatment Works. In the western sector of the Policy Unit, there is HM Prison Belmarsh.

A major road network serves the area and the main rail link to Dartford runs through the southern edge of the policy unit. The area is low lying, and ground levels are typically 2 m to 3 m below high water on spring tides. Flood depths in a surge tide event overtopping or breaching the defences could exceed 5 m. The area is therefore very vulnerable to tidal flood risk. In the tidal flood risk area there are 21 schools, six care homes and over 100 electricity sub stations. There are raised areas of landfill at the north west part of the policy unit where land has been set aside for a new east London river crossing (currently on hold).



At risk in Thamesmead policy unit

There is a substantial area of construction waste reprocessing in the same area which is part of the Tilfen site for proposed residential and parkland

use. In the same area there is a striking conical raised landscape feature formed of inert waste materials as part of the Thames Point development.

TE2100 action plan: action zone 4 – east London downstream of Thames Barrier

Sources of flooding

- Tidal: from the Thames downriver of the Thames Barrier (probability 0.1% per annum or less frequent, flood depths up to 5 m but very variable).
- Fluvial: from the Marsh Dykes drainage system in Thamesmead (probability 1% per annum or less, flood depths <2 m).



Landscape feature at Thamesmead

- Fluvial: from the Plumstead and Erith Marshes drainage systems (probability >1% per annum, flood depths <2 m).
- There is a serious risk of pluvial and urban drainage flooding in this policy unit, particularly in areas where the capacity of the drainage system is low. One reason for this is that the Thamesmead policy unit is made from a large area of reclaimed land and is low lying and very flat.
- Groundwater: This is from rock aquifers (i.e. not related to the Estuary) is also a source of flooding.

The existing flood risk management system

- Tidal flood defences downriver of the Thames Barrier.
- Fluvial flood management is provided by a system of open channels with pumped and gravity outfalls into the Thames (the ‘Marsh Dykes’ and Plumstead & Erith Marshes drainage systems).
- Flood forecasting and warning is provided for tidal flooding via Flood Warning Direct (FWD). Fluvial flooding or surface runoff are more likely, the former is covered by FWD. Surface runoff can be predicted by our Extreme Rainfall alert service but this is an inexact science.

Policy context

Thamesmead forms part of the Thames Gateway regeneration area and is covered by Thames Strategy East in addition to the Thames Gateway Parklands Vision.

There are extensive areas of redevelopment planned in this policy unit including much of the Erith industrial area. Improved transport links to London are likely to add to the development pressure.

Vision

The Thamesmead policy unit is vulnerable to tidal and fluvial flooding. Large defences are always likely to be needed but to some extent these have been landscaped within new development areas. There is scope to further improve the frontage as development takes place. It is likely that much of the industrial area of Erith Marshes will be redeveloped in the next 50 years. This provides opportunities to improve flood risk management arrangements including floodplain management to achieve safer floodplains, and defences that enhance the riverfront environment. This might include resilient development and realignment of defences. Existing open space could be further enhanced to provide for tidal flood storage.

TE2100 action plan: action zone 4 – east London downstream of Thames Barrier

If infrequently used this could also be enhanced to provide habitats and recreation opportunities. Erith Marshes may offer such an opportunity.

Wherever possible the estuary frontages should be enhanced to facilitate public access and improve the environment, particularly with such a large local population. During major reconstructions, setting back of defences would reduce the dependence on vertical walls and provide opportunities for sloping riversides and public amenity areas.

In view of the vulnerability of the area, flood awareness should be raised and flood risk management taken into account in new development and redevelopment. New buildings should be built so that people are safe and have a way to leave in an emergency. The risk of groundwater and surface runoff flooding are likely to increase. Property resilience could offset this increased risk.

Local issues and choices

Most of the ground level is very low (about 0 to 1 m AOD) but there is high ground near the defences in parts of Thamesmead. The main trunk sewer to the Crossness sewage treatment works divides the area into two parts. Development or redevelopment on the river frontage is almost continuous.



Canal at Thamesmead

The area is drained by the Marsh Dykes drainage system and the Plumstead and Erith Marshes drainage systems. These include system of canals, lakes, gravity outfalls and pumped outfalls. Whilst this provides an effective drainage system for much of the policy unit, there are some problem areas because of the large size and flat topography of the area.

Although Thamesmead is well defended, it is a vulnerable area because of the low ground level and size of the resident population. It is also vulnerable to pluvial and urban drainage flooding. The drainage systems in this area were state of the

art concepts when they were designed in the 1960s, but they are not sufficient for the current level of development. They will require improvements over the next 10 to 30 years as the sea level rises and fluvial flows increase. These could include control of runoff, enlargement of drainage channels, increases in flood storage and improvements to the outfall capacity.

Improvements will also be needed to the major Lake 4 pumping station if the defences are raised, as the outfall currently passes over the top of the defences. The vulnerability of the pumping station to fluvial flood and other hazards must also be investigated.

Erosion of the river bed is occurring at Thamesmead and Crossness. Accretion of the river bed is occurring elsewhere on most of the frontage. There are no reported problems with the defences (for example, erosion of the toe) or outfalls (for example, blockage by siltation).



Do you understand our assessment for the Thamesmead policy unit?



Do you agree with it?

Policy unit – Barking & Dagenham

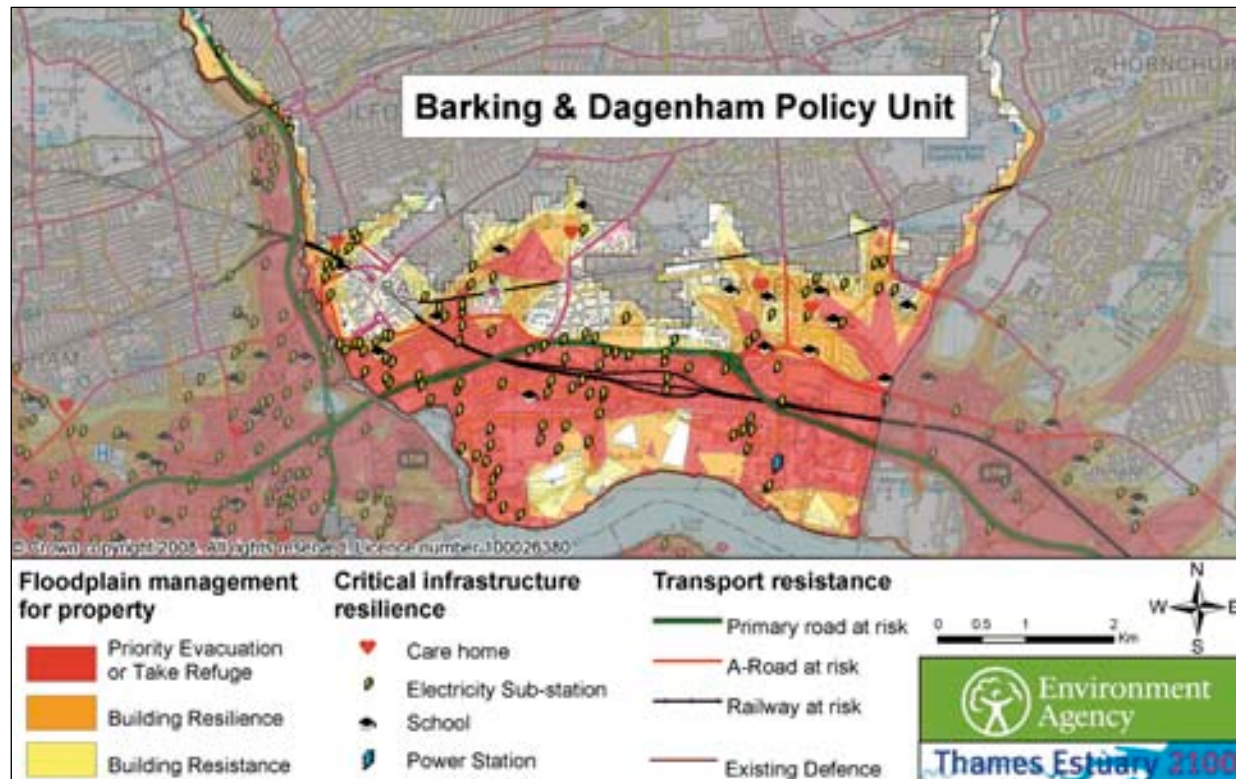
Policy: Our recommended policy for Barking & Dagenham is policy **P4** to either take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).

Description

The Barking & Dagenham policy unit contains major industrial areas, some of which are now redundant and land is available for redevelopment, and some dense residential development. The industrial areas are generally closer to the Thames but new residential areas are being developed on the river front. There are therefore opportunities to improve this area as new developments are implemented.

There are large areas of raised ground, and therefore a proportion of development in this policy unit is raised above flood level. There are also important transport links and two tributaries of the tidal Thames, the River Roding and the Beam River.

The River Roding forms the boundary with the Royal Docks policy unit, and the Beam River forms the boundary with Rainham Marshes policy unit.



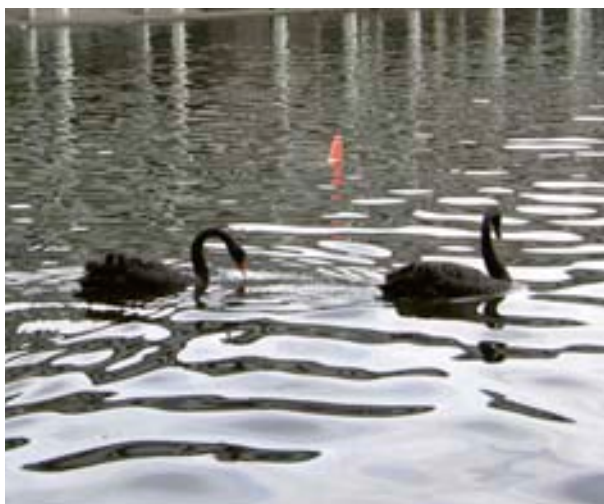
At risk in Barking & Dagenham policy unit

Consideration of the flood risk management for both tributaries are covered in the Rainham

Marshes & Mar Dyke policy unit. The River Roding and Beam River are both in this policy unit.

Sources of flooding

- Tidal: from the Thames downriver of the Thames Barrier (probability 0.1% per annum or less frequent), flood depths up to 5 m but very variable.
- Tidal: on the River Roding (probability about 0.1% per annum). Barrier controlled.
- Fluvial and tidal/fluvial: from the River Roding (probability >1% per annum), flood depths 0 m to 3 m. Inflow from Beckton STW when Thames levels are high.



Black swans – now a regular sight on the Thames

- Fluvial and tidal/fluvial: from the Beam River (West Bank) (probability 5% per annum), flood depths 0 m to 2 m.
- Fluvial from local watercourses: including Mayes Brook, Gores Brook and Buzzard Mouth Sewer (probability varies but >1% per annum in several cases), flood depths 0 to 3 m.
- Local drainage: This needs to be investigated further at a local level and is included in our action plan.

The existing flood risk management system

- Tidal flood defences downriver of the Thames Barrier.
- The Barking Barrier for tidal flood protection on the River Roding.
- Secondary tidal and tidal/fluvial flood defences on the River Roding.
- The Beam Washlands fluvial flood storage area on the Beam River.
- Fluvial flood storage on Mayes Brook.
- Local fluvial flood defences including the Beam River.

- Drainage system outfalls including Beam River, Mayes Brook, Gores Brook, Buzzard Mouth Sewer and Oakentrough Sewer.
- Flood forecasting and warning.

Policy context

Barking & Dagenham forms part of the Thames Gateway regeneration area and is covered by Thames Strategy East in addition to the Thames Gateway Parklands vision. There are extensive areas of redevelopment planned in this policy unit including the large Barking Riverside mixed use development and several Thames Gateway housing sites. These provide opportunities to improve flood risk management arrangements including floodplain management to achieve safer floodplains, and defences that enhance the riverfront environment.

Vision

Changes to the defences provide opportunities for local realignment and landscaping along the Thames frontage. This could provide amenity areas for the many people who live and work in the area. They also provide opportunities for the following: use of the Thames frontage to provide a public access route where possible, with associated facilities; creation of environmental

enhancements, taking account of likely accretion along the Thames frontage; reduced dependence on vertical walls where possible, thus providing more robust and sustainable flood defences with access for maintenance; and an improved river frontage on the River Roding, although there is little space for re-alignment of the defences.

In addition, resilient new development could reduce the flood risk to people and property, and provide a safer and more sustainable floodplain environment. For example, there is scope for the creation of open space in the same way as already implemented at Thamesmead, to provide both flood storage, environmental improvement and amenity areas.

Local issues and choices

Much of the Thames river frontage in this policy unit has relatively high ground as a result of landfill and fill for development. This area is therefore not as vulnerable as Thamesmead on the south bank. The river bed is accreting in front of the Thames defences. Not only does this mean that the defences are not threatened by erosion, but also that the accretion could contribute to enhancing the intertidal areas along the frontage.

Measures will be needed for tributary flooding from the River Roding. The River Roding is already protected from extreme tidal floods by the Barking Barrier. However, the River Roding is a tributary which has potentially serious flood risk management problems because: the flood risk is high; the River Roding is protected by the Barking Barrier but the volume of storage upriver is very limited; the storage problem is exacerbated by overflows from Beckton STW; and whilst there are tidal defences on the River Roding, there is very little space for improvement. For the River Roding our TE2100 Plan recommends that the tidal defences will be raised and fluvial flood storage will be provided. However a detailed study for the River Roding catchment is needed to develop a preferred approach at local level. This is covered in our action plan.

In addition to the River Roding and the Beam River, there are a number of important drainage channels including Mayes Brook and Gores Brook where responses and choices have been identified. There are already difficulties discharging drainage water at some outfalls, and improvement will be needed as the sea level rises and fluvial flows increase.



Reed beds on the River Roding



Do you understand our assessment for the Barking & Dagenham policy unit?



Do you agree with it?

Policy unit – Rainham Marshes & Mar Dyke

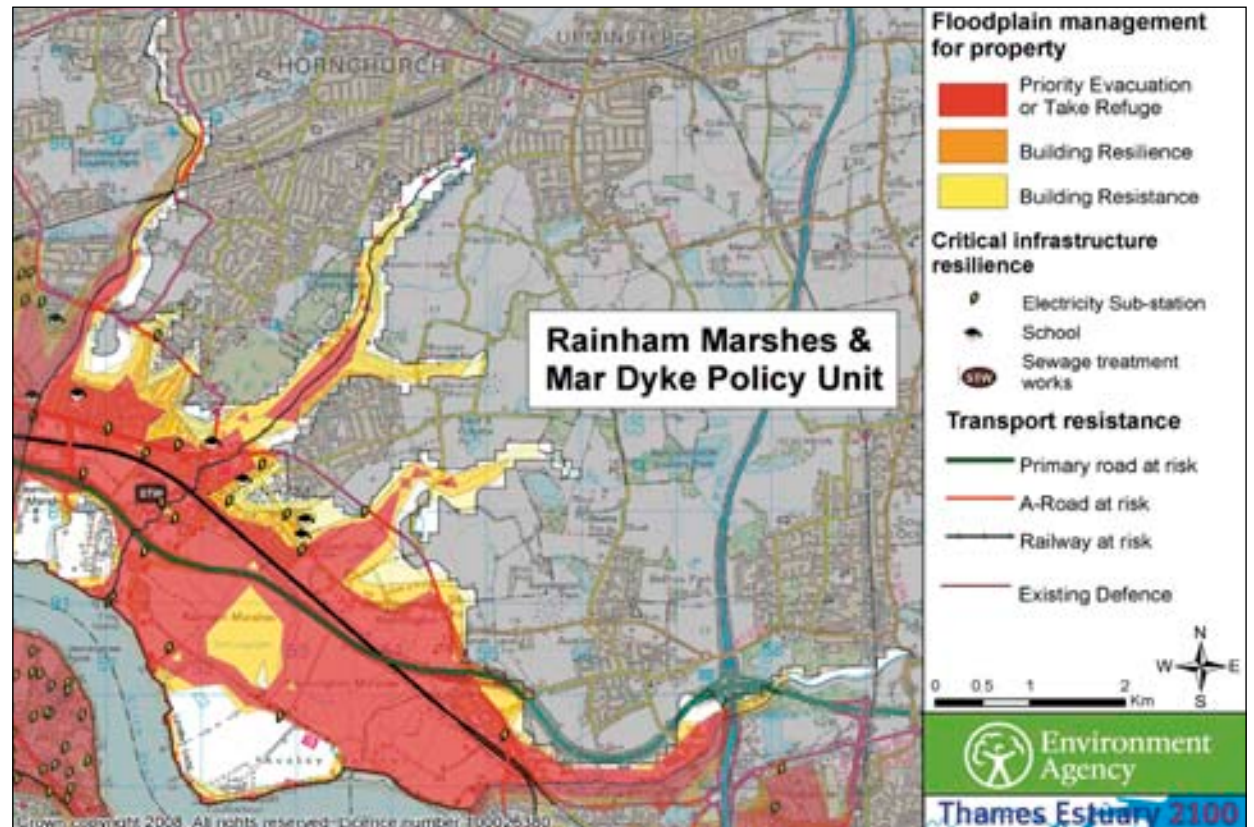
Policy: Our recommended flood risk management policy for Rainham Marshes and Mar Dyke is policy **P4** to take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).

Description

Rainham Marshes & Mar Dyke policy unit contains extensive freshwater marshes, a large landfill area, development and major transport links. The marshes are of particular importance. They already form a RSPB nature reserve and are included in a proposed community parkland in the Thames Gateway Parklands vision. They therefore provide a key area of green space on the Estuary.

This policy unit is within the Thames Gateway regeneration area, and new developments are planned. There are likely to be opportunities to improve this area as new developments are implemented.

The west boundary of this policy unit is the Beam River, and the east boundary is the Mar Dyke. Flood risk management for each tributary should be associated with a single policy unit. The Beam River is therefore covered by Barking & Dagenham



At risk in Rainham Marshes & Mar Dyke policy unit

policy unit, and the Mar Dyke is covered by the Purfleet, Grays & Tilbury policy unit.

Sources of flooding

- Tidal from the Thames downriver of the Thames Barrier (probability 0.1% per annum or less frequent), flood depths up to 5 m but very variable.
- Fluvial and tidal/fluvial from the Beam River (East Bank) (probability 5% per annum), flood depths 0 to 2 m.



High Speed One (CTRL) crossing Rainham Marshes on piled raft

- Fluvial and tidal/fluvial from the Ingrebourne River (probability 1% per annum), flood depths 0 to 2 m.
- Fluvial and tidal/fluvial from the Mar Dyke (West Bank) (probability >1% per annum), flood depths 0 to 2 m.
- Fluvial from local watercourses including Havering Sewer and the marsh drainage systems on Rainham, Aveley and Wennington marshes (probability generally about 1% per annum as development is on raised ground). The marshes inundate at lower flood probabilities.
- Local drainage.

The existing flood risk management system

- Tidal flood defences downriver of the Barrier on the Thames.
- The Beam Washlands fluvial flood storage area on the Beam River.
- Local fluvial flood defences on the Mar Dyke and Beam River.
- Drainage system outfalls including Havering Sewer and Rainham Marshes.

Policy context

Rainham Marshes & Mar Dyke policy unit forms part of the Thames Gateway regeneration area and is covered by Thames Strategy East in addition to the Thames Gateway Parklands vision. There is a large landfill between the marshes and the Estuary. When this reaches capacity and is landscaped, it will form part of proposed community parkland.

Vision

This policy unit can provide important green space in the middle of an otherwise heavily developed area. The parklands vision includes both the marshes and the landfill, and provides an opportunity for a key amenity, recreation and environmentally important area. Redevelopment is planned for other parts of this policy unit, particularly near the CTRL (Channel Tunnel Rail Link). Changes are likely to the industrial frontages. There is therefore scope to improve the overall environment as these changes take place.

Enhancement of the marshes in this policy unit could be carried out to improve their capacity to support freshwater and grazing marsh interest features in the Thames. This enhancement could contribute to compensation for losses of freshwater and grazing marsh features elsewhere

in the Thames. The Rainham, Aveley and Wennington Marshes and the Ingrebourne River Valley may provide these opportunities.

There is a need to work with planning authorities to create a plan that fully integrates flood risk management with new developments, new amenity areas and new/improved conservation areas.

Local issues and choices

Much of the frontage has raised ground or landfill, thus reducing vulnerability to tidal flood risk.

The river bed is accreting in front of the Thames defences. Not only does this mean that the defences are not threatened by erosion, but also that there may be environmental enhancement opportunities. In particular, there is an opportunity to set back the defence at the east end of the landfill near Coldharbour to create permit replacement intertidal and saltmarsh habitat.

Measures may be needed for tributary flooding from the Beam River, Ingrebourne River and Mar Dyke. The Beam River is covered under the Barking and Dagenham policy unit and the Mar Dyke under the Purfleet, Grays and Tilbury policy unit.

Flood risk from the Ingrebourne River is relatively low. Responses to manage fluvial flood risk on the

Ingrebourne River include local fluvial flood storage and upstream storage for fluvial flooding.

The marshes are drained by a system of open drains. This will require enhancement as the sea level rises and storm rainfall increases. Management measures for fluvial flood risk on the marsh drainage systems include outfall improvements (including pumps) and local fluvial flood storage.





Riverside at Rainham

Additional fluvial flood storage may be considered for some of the marsh areas, to store water from the Ingrebourne River, Beam River, smaller drainage systems and possibly the River Roding. The Beam Washlands scheme is a good example of what can be achieved at local level.

Works would be needed in the local drainage systems to mitigate changes in local flood risk if our end of the century option 2 the proposed storage area on Aveley and Wennington marshes is implemented – although this is not currently a preferred option.

Choices for local flood risk management have not been designed or assessed in detail, and must be the subject of consultation and subsequent appraisal.

 Do you understand our assessment for the Rainham Marshes & Mar Dyke policy unit?

 Do you agree with it?

TE2100 action plan: **action zone 4** – east London downstream of Thames Barrier

Table A.4 – Policy units


■ Thamesmead ■ Barking & Dagenham ■ Rainham Marshes & Mar Dyke

P4

P4


P4


[Note that all dates are based on government's current guidance on climate change – the TE2100 Plan will be reviewed and updated if these predictions change]

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
 First 25 years	<p>A.4.1. TE2100 Plan informs the development and revision of local authority strategic flood risk assessments (SFRAs) and flood plans.</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency</p> <p>London Boroughs in action zone 4:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Bexley • LB Barking & Dagenham • LB Havering <p>North East Local Resilience Forum</p>	<p>TE2100 information is provided to LAs preparing Flood Plans and capability testing.</p> <p>TE2100 information is provided to LRF to inform Community Risk Registers and support exercises.</p> <p>Local Authority flood plans are developed with an understanding of TE2100 recommendations and data.</p> <p>A community engagement programme to ensure the public, businesses and other groups understand, are involved in and support the flood plans.</p>	<p>Implementation partners: Do your flood plans include the findings and recommendations from TE2100? Do you have enough information from us to develop your flood plans so that they can be informed by TE2100? Your response will guide the development of our implementation “blueprint” during 2009 and improve arrangements for partnership working.</p> <p>Landowners, the public, business and other interested groups: Downstream of the Thames Barrier, the river defences provide highly reliable protection to this area against surge tides. But should there be a failure of a defence or an extreme event which overtops the defences, low-lying areas of this zone would be at risk as shown on the policy unit At Risk maps. Flooding from non tidal sources is much more likely. The Flood Plans will set out arrangements for preparing for and managing these sort of emergencies. If you have views on this, please let us know and we will share your views with those responsible for preparing the flood plans.</p>

Barking & Dagenham




Rainham Marshes & Mar Dyke

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.4.2. To agree a programme to provide localised flood protection, resilience and local emergency plans for vulnerable key sites in action zone 4.</p> <p>[Note: The At Risk maps show that particular sites and key infrastructure which would be particularly vulnerable in the TE2100 area in the event of a failure or overtopping of the defences]</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency</p> <p>London Boroughs in action zone 4:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Bexley • LB Barking & Dagenham • LB Havering <p>North East Local Resilience Forum</p> <p>Transport for London</p> <p>EDF Energy</p> <p>Thames Water</p> <p>CTRL</p> <p>Highways Authority</p> <p>RSPB</p> <p>Other owners and managers of vulnerable sites</p>	<p>We will discuss with our implementation partners to agree strategic scope of measures required.</p> <p>Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.</p> <p>All site owners must be supportive of approach and confidence of public and users maintained. Local floodplain management measures in place or planned within 25 years.</p>	<p>Implementation partners: Are you aware of the risks and particular vulnerability of key sites in this action zone? Do you have arrangements in place for initiating the discussion concerning scope of works required for the properties/ areas in which you have an interest? Can the Environment Agency assist with this through implementation of action A.4.2?</p> <p>Landowners, the public, business and other interested groups: We would be interested to hear your views to assist us in planning the implementation of this action A.4.2. particularly if you live, work or have interests in this area.</p>



	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.4.3. To agree partnership arrangements and principles to ensure that new development in this zone is safe, and that where possible, the application of PPS25 reduces the consequence flood risk – particularly in the areas where large numbers of people congregate or there is aggregation of flood risk.</p> <p>For flood risk management to be factored into the planning process at all levels for the first 25 years from 2010 to 2034.</p> <p>[Note: There is need for greater clarity over methods and procedures for safety in new development behind defences. We, along with local authority staff, are providing advice to Developers and responding to difficult Planning applications]</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency GLA, LDA, TGLP, Development Corporations</p> <p>Local Authority spatial and emergency planners in action zone 4:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Bexley • LB Barking & Dagenham • LB Havering <p>Land Owners & Site managers Developers & Architects</p>	<p>TE2100 Plan and associated information informs London Plan and Local Development Frameworks (LDF) and future revisions.</p> <p>Local authority and our Planning staff require guidance for applying the principles of PPS25⁹ to the complexities of London defended tidal floodplain.</p> <p>This could be provided by local guidance for planning staff (Environment Agency and Local authority) and developers. The guidance could be a supplement to our Developers Pack.</p>	<p>Implementation partners: Are your LDFs supported by sustainability appraisals that include local tidal flood risk and the implications of climate change? If not, does the TE2100 Plan provide you with the information you need to do this? If local guidance is produced to provide interpretation of PPS25 in a defended area, what sort of information would be most helpful to you? Would you be able to assist the Environment Agency in preparing local guidance – and would it be useful to you?</p> <p>Landowners, the public, business and other interested groups: We would be interested to hear your views to assist us in planning the implementation of this action A.4.3, particularly if you have had experience (good or bad) of dealing with us and other authorities over planning and building by the river and in tidal floodplain in this east London downstream of Thames Barrier zone.</p>

⁹Planning Policy Statement No. 25 “Development and Flood Risk” (CLG 2006)

TE2100 action plan: **action zone 4** – east London downstream of Thames Barrier

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.4.4.</p> <p>To review and maintain from 2035 to 2069, the partnership arrangements and principles for development and flood risk management established in the first 25 years of our Plan.</p>	As above	Local guidance is updated to reflect changing needs. The TE2100 10-yearly update to include review of action A.4.3 and recommend any changes or developments.	We cannot know what institutional arrangements will be in place during this period or what pressures there will be on the environment. We do know that for the east London downstream of Thames Barrier zone to continue to thrive, flood risk management must continue to be integrated into the spatial planning process. If you would like to help shape the development of these arrangements during the middle years (2035 to 2069) of our Plan, then please let us have your views.
	<p>A.4.5.</p> <p>To review and maintain from 2070 and into the 22nd century, the partnership arrangements and principles for development and flood risk management established in the middle years of the Plan.</p>	As above	TE2100 10-yearly update to include review of action A.4.4 and recommend further action. Local guidance is updated to reflect changing needs.	Flood risk management continues to be integrated into the spatial planning process into the 22nd century. If you have views on how the relationship between spatial planning and flood risk management should be developing in the east London downstream of Thames Barrier zone as we prepare for the 22nd century, then please respond to this action A.4.5.
	<p>A.4.6.</p> <p>To maintain, enhance and improve or replace, the river defence walls and active structures through the east London downstream of Thames Barrier zone over the first 25 years of the Plan from 2010 to 2034.</p>	<p>Environment Agency</p> <p>Local Authority spatial planners in action zone 4:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Bexley • LB Barking & Dagenham • LB Havering 	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset System Management teams will promote these schemes. However, the method of improving the defences is different from the present day approach.</p>	<p>This is the work which we do now in the Environment Agency. We will continue with our programme of operations, maintenance and replacement but we are looking for ways of working better and more effectively.</p> <p>We are also seeking opportunities for environmental and recreational enhancements which will create a better place through our east London downstream of Thames Barrier zone, and for partnerships which will help us achieve this.</p> <p>We would welcome any comments that you or your organisation can provide which assist us in these aims.</p> <p style="text-align: right;">(continued)</p>



TE2100 action plan: **action zone 4** – east London downstream of Thames Barrier

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
 First 25 years	<p>A.4.6. (continued)</p> <p>[Note: This is a continuation of our current activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>GLA</p> <p>Land Owners</p> <p>Developers & Architects</p> <p>Thames Estuary Partnership</p>	<p>It involves greater maintenance and repair work in addition to replacement. Promotion of schemes through the capital programme may not be appropriate for maintenance and repair, and a different way of working may be required.</p>	<p>Our TE2100 Technical Report and local choices document for the policy units provide our assessment of the choices which are available in the east London downstream of Thames Barrier zone in the short term. If you would like to comment on these in more detail, please contact the project team.</p>
 Middle 35 years	<p>A.4.7.</p> <p>To maintain, enhance and improve or replace the defence walls and active structures through east London downstream of Thames Barrier during the 30 year period of the Plan from 2035 to 2069.</p> <p>[Note: Continuing our activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Local Authority spatial planners in action zone 4:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Bexley • LB Barking & Dagenham • LB Havering <p>Land Owners</p> <p>Developers & Architects</p> <p>Thames Landscape Strategy</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset Systems Management teams will promote schemes through capital programme and they will form part of strategic and investment plans subject to replacement/repair working arrangements as A.4.6. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>Our aims remain as A.4.6 above, but during this period, there will be a major programme of rebuilding and refurbishment of the river walls and defences through our east London downstream of Thames Barrier zone. This provides many opportunities for creating a better place and to plan for a better riverside environment. If you would like to help shape the future environment in this area, then please let us have your views.</p> <p>During this period we will be preparing for the “end of the century” options – see A.4.8 below and any decisions made as part of action A.4.7 must recognise that there may be major changes from 2070.</p> <p>Our TE2100 Technical Report and local choices document for the policy units provide our assessment of the choices which are available in east London downstream of Thames Barrier in the medium term (2035 to 2069). If you would like to comment on these in more detail, please contact the project team.</p>



Barking & Dagenham

Rainham Marshes & Mar Dyke

TE2100 action plan: **action zone 4** – east London downstream of Thames Barrier

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	A.4.7. (continued)		The TE2100 Plan 10-yearly review and update will give a clear picture of the end of the century works to be recommended.	
	<p>A.4.8. To Implement our “end of the century” option in 2070.</p> <p>Our front runners at this stage for end of the century options are:</p> <p>Option 1.4 – Improve Existing system which includes improvements to the Thames Barrier and defence raising down river of the Thames Barrier.</p> <p>Option 3.2 – New Barrier at Long Reach.</p> <p>If a new downriver barrier is constructed in 2070 (option 3.2), further defence raising in this zone will not be needed in this zone and there will be an opportunity to lower the defences by up to a metre.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Landowners</p> <p>London Boroughs in action zone 4:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Bexley • LB Barking & Dagenham • LB Havering <p>Developers & Architects</p> <p>The public</p> <p>Local interest groups</p> <p>GLA</p> <p>Floodplain users</p> <p>Thames Landscape Strategy</p> <p>Thames Gateway Parklands Vision</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset Systems Management teams will promote schemes through capital programme.</p> <p>There are major opportunities for reshaping the local landscape as part of these works and changing the relationship with the river.</p> <p>The TE2100 10-yearly update will include a review of action A.4.8. and recommend further whether the end of the century recommendations have changed.</p>	<p>2070 is a long way ahead but a decision needs to be made on the TE2100 “end of the century” option. This will enable us to finalise our Plan. The end of the century options (see estuary-wide action plan – action zone 0) affect the requirements for wall raising in this zone and could provide an opportunity for reducing wall levels upstream of a new Long Reach Barrier. This could provide the catalyst for a significant change in the riverside landscape in this area.</p> <p>So if you have views about the effect of raising (by +1 m) or lowering (by 1 m) the height of the defence walls in this area, or your views on a barrier at Long Reach, please share them with us in submitting your response to this action (A.4.8).</p> <p>We will make recommendations based on conditions now, in 2009, but the final decision on “end of the century” option to be adopted is likely to be made between 2050 and 2060, and our front runners may or may not change.</p> <p>It is important to send us your views because the responses we receive during this consultation will set the baseline for establishing public attitudes to the east London downstream of Thames Barrier riverside environment. This “2009 snapshot” of east London downstream of Thames Barrier stakeholder views will form a starting point for measurement of public attitudes in the future.</p>


TE2100 action plan: **action zone 4** – east London downstream of Thames Barrier

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.4.9. To maintain, improve and enhance or replace the river defence walls and active structures in east London downstream of Thames Barrier zone post 2070 and into the 22nd century.</p> <p>Whether or not there is a new barrier (i.e. option 3.2) all the defences in east London downstream of Thames Barrier zone raised will still require ongoing maintenance, repair and replacement (and hence engineering works) and this has been allowed for in our Plan investment profile.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Land Owners</p> <p>Developers</p> <p>London Boroughs in action zone 4:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Bexley • LB Barking & Dagenham • LB Havering <p>Thames Landscape Strategy</p> <p>Thames Gateway Parklands Vision</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>We will promote schemes through capital programme and they will form part of strategic and investment plans subject to replacement/repair working arrangements as A.4.6. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>We cannot know what institutional arrangements there will be as we approach the 22nd century, but our TE2100 vision imagines an environment where the estuary environment downstream of the Thames Barrier continues to thrive and the riverside is increasingly enjoyed and respected by the people who live, work and visit. This means that the actions established in A.4.6. and A.4.7. will be continued by whoever is looking after our environment at that time. If you have views about the long-term future management of the east London downstream of Thames Barrier riverside, we would like to hear them. This consultation provides an opportunity for you to have these views recorded and presented as part of an ongoing vision statement to those who follow us 60 to 100 years from now.</p>
	<p>A.4.10. To agree a programme of managing flooding from other sources in the defended tidal floodplain.</p> <p>Large areas of east London downstream of Thames Barrier are low-lying, and there is potentially a high risk of pluvial and urban drainage flooding, particularly in areas where the urban drainage system has relatively low capacity and/or is prone to tide locking.</p>	<p>Environment Agency</p> <p>London Boroughs in action zone 4:</p> <ul style="list-style-type: none"> • LB Greenwich • LB Bexley • LB Barking & Dagenham • LB Havering 	<p>We will discuss with our implementation partners to agree strategic scope of measures required.</p> <p>Agreement between implementation partners on the development and implementation of a Surface Water Management Plan.</p>	<p>Implementation partners: Are you aware of the risks and particular vulnerability of people and property to flooding from sources other than tidal? Do you have arrangements in place for initiating the discussion concerning scope of works required for the properties/areas in which you have an interest? Can the Environment Agency assist with this through implementation of Action A.4.10?</p> <p style="text-align: right;">(continued)</p>



Barking & Dagenham

Rainham Marshes & Mar Dyke

TE2100 action plan: **action zone 4** – east London downstream of Thames Barrier

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.4.10. (continued)</p> <p>There is also fluvial flood risk from:</p> <ul style="list-style-type: none"> • Marsh Dykes • River Roding • Beam River <p>Some of the local choices to be investigated are listed in this action A.4.10. There are issues which must be better understood before schemes are promoted. For example, There are potential difficulties with any new structure on the River Roding because the river is an important fish migration route.</p> <p>Our TE2100 Technical Report provides further information on these matters and the choices which are available to assist with problems. If you would like to comment on these in more detail, please contact the project team.</p> <p><i>(Cost of implementing this action is not included in TE2100 Plan, but TE2100 data, information and recommendations are available to support the successful implementation of the action)</i></p>	<p>Internal Drainage Boards</p> <p>Thames Water</p> <p>Land Owners</p> <p>Developers & Architects</p>	<p>All site owners must be supportive of approach and confidence of public and users maintained. Local measures for management of flooding from other sources to be in place or the planned within 25 years.</p>	<p>We would be interested to hear your views to assist us in planning the implementation of this action A.4.10, particularly if you live, work or have interests in this area and are concerned about flooding from sources other than tidal. This includes pluvial and urban drainage and fluvial flooding from the Marsh Dykes, River Roding and Beam River.</p> <p>Responses to manage fluvial flood risk:</p> <p>Managing fluvial flood risk on the Marsh Dykes could include:</p> <ul style="list-style-type: none"> • increase in flood storage volume in the system; • managing surface runoff; • land raising; • improved outfalls including an increase in pumping capacity; • combinations of the above. <p>Local choices for the River Roding could include:</p> <ul style="list-style-type: none"> • raising the tidal defences; • a new flapped outfall upstream of the navigation area, to reduce the need for defence raising; • realignment of the tidal defences where improvement on the existing line would be difficult; • upstream fluvial flood storage. This is the response favoured in the Roding strategy for fluvial flood management, although its effectiveness has not been demonstrated; • diversion of fluvial flows. A provisional route has been identified, which could divert flows to Rainham marshes although the feasibility of this idea has not been investigated. <p style="text-align: right;">(continued)</p>



TE2100 action plan: **action zone 4** – east London downstream of Thames Barrier

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.4.10. (continued)</p>			<p>Responses and choices for the Beam River could include:</p> <ul style="list-style-type: none"> • improvements to the outfall including possible pumping; • more local fluvial flood storage (in addition to the existing scheme); • local defence raising; • a combination of the above responses. <p>Other watercourses Responses to manage fluvial flood risk on drainage channels including Mayes Brook and Gores Brook could include:</p> <ul style="list-style-type: none"> • outfall improvements incl. pumps; • local fluvial flood storage; • local defence improvements; • a combination of the above responses.
	<p>A.4.11. Understanding Local views on alternative end of the century options.</p> <p>In Thamesmead policy unit, Erith marshes have been identified as a suitable area for tidal flood storage in estuary-wide option 2, although there are strong development pressures in this area.</p> <p>Aveley Marshes in Rainham Marshes and Mar Dyke policy unit has also been identified as a suitable area for tidal flood storage.</p>	<p>RSPB</p> <ul style="list-style-type: none"> • LB Bexley • LB Havering 	<p>We will discuss with our implementation partners to review changes to flood risk drivers. Should options which, at this point in the TE2100 plan, are not considered ‘front runners’ become more viable in the future agree strategic scope of measures required.</p>	<p>We cannot now what how the drivers of flood risk, be they climate, environment or social/economic, will change in the future. We are interested to know your thoughts on the options that through the TE2100 appraisal process have not been identified as front runners for the plan. If you have views about the long-term future management of the east London downstream of Thames Barrier riverside, we would like to hear them. This consultation provides an opportunity for you to have these views recorded and presented as part of an ongoing vision statement to those who follow us 60 to 100 years from now.</p> <p style="text-align: right;">(continued)</p>

Barking & Dagenham

Rainham Marshes & Mar Dyke

TE2100 action plan: **action zone 4** – east London downstream of Thames Barrier

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	A.4.11. (continued)		<p>Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.</p> <p>All site owners must be supportive of approach and confidence of public and users maintained. Local measures for management of flooding from other sources to be in place or the planned within 25 years.</p>	
	<p>A.4.12.</p> <p>To agree a programme for habitat enhancement and creation.</p> <p>In 2024 planning and, soon after, groundworks may need to be started in this policy unit to compensate for the loss of designated freshwater and grazing marsh interest features as a result of potential loss as a result of intertidal habitat creation. The following sites have been identified in this policy unit as having the potential to support the interest features that could be lost, either through enhancement of existing habitat features:</p> <ul style="list-style-type: none"> • Aveley, Wennington and Rainham Marshes • Ingrebourne River. 	<p>Environment Agency</p> <p>Natural England</p> <p>Land owners</p> <p>Local Authorities</p> <p>Public and local interest groups</p> <p>RSPB</p> <p>Wildlife Trusts</p>	<p>Planning and groundworks would take at least 5 years and there would be an additional 10 years before the habitat is fully established at the sites.</p> <p>We will be looking for partnership arrangements to manage these sites and get the best for the natural environment, for the local population and for visitors.</p>	<p>We would like to hear your views on our 2024 habitat creation proposal.</p> <p>It is important that we use this consultation to have a proper and effective airing of information and views regarding any land use change. In the Environment Agency we see habitat creation as a positive step toward the goal of sustainability and supporting the habitats and species that make the Thames estuary internationally important.</p> <p>Habitat creation also provides opportunities for enhancements for recreation, visitors centres and other facilities. In order to finalise our plans, we need to hear what you think – in general terms, or at a local level.</p>

Barking & Dagenham

Rainham Marshes & Mar Dyke

TE2100 action plan: **action zone 5** – middle Estuary

Action plan for zone 5 – table A.5.

12 actions identified


Description of the policy units


- Dartford & Erith
- Swanscombe & Northfleet
- Purfleet, Grays & Tilbury


Table A.5. describes the 12 actions for Zone 5 – middle Estuary which have been identified through the TE2100 Plan. The actions are described under the following headings:


- TE2100 recommended actions (and whether or not costs for this have been included in the TE2100 Plan)
- Implementation partners
- How this will be achieved
- How your response can help us finalise the TE2100 Plan



 Do you consider that we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?

 Do you agree with the actions identified in our action plans and the timing of those actions?

 Do you agree with the mechanisms we have set out to deliver the action plans?

 Have we identified the right partner organisations to deliver our action plans and are you, or your organisation, able to contribute to these actions?

Policy unit – Dartford & Erith

Policy: Our recommended flood risk management policy is policy **P4** to 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).

Description

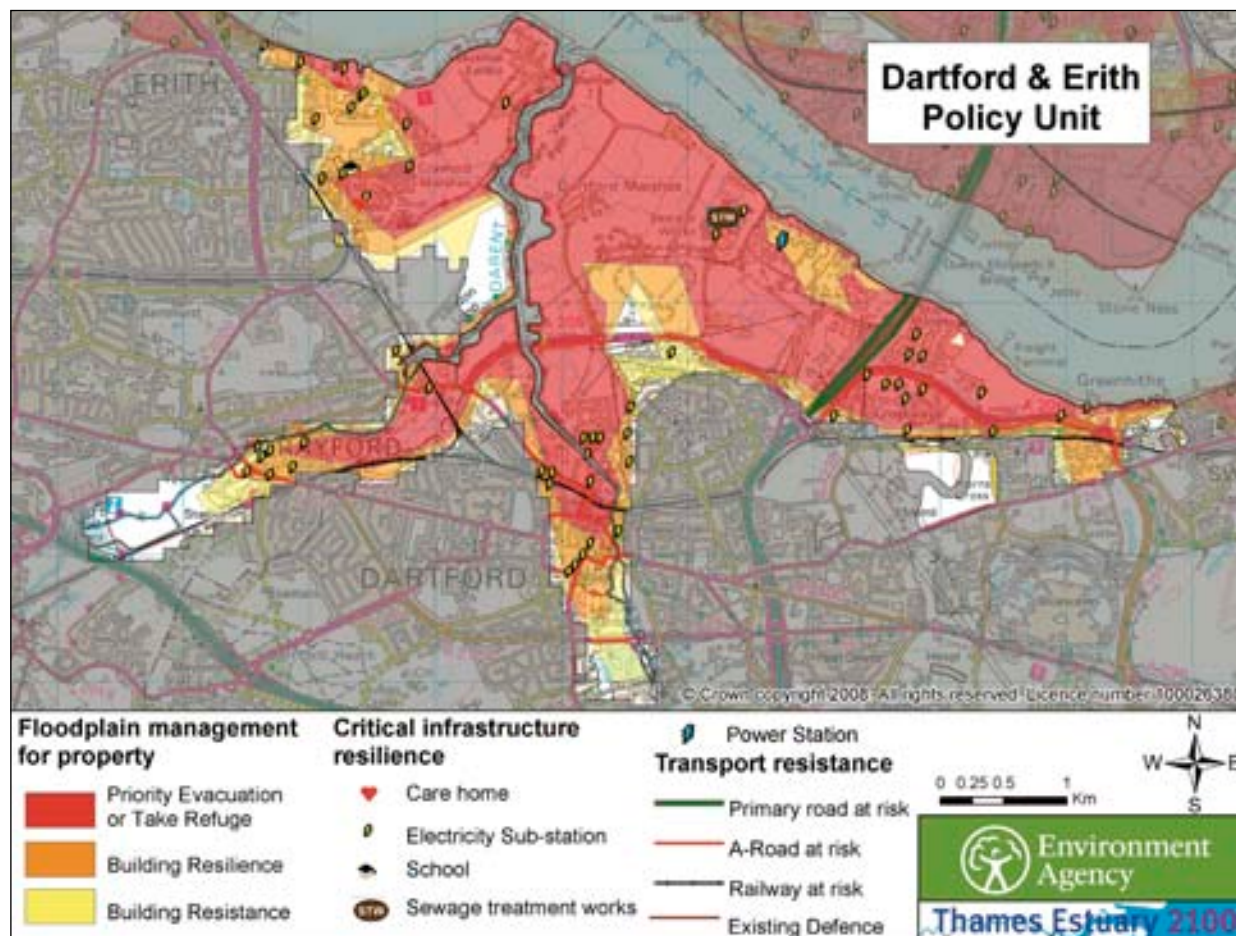
The Dartford & Erith policy unit includes extensive areas of undeveloped and developed marshes and the riverfront town of Greenhithe. It also includes parts of Dartford and Crayford.

The new developments include large areas of ground raising to reduce flood risk. Much of the development is recent, and further development is planned. There is new residential development on the east side of Erith, and new commercial development on Stone Marshes near the Queen Elizabeth II Bridge.

The River Darent (and a tributary, the River Cray) pass through the policy unit. The lower reaches of these rivers pass through the largely undeveloped Dartford and Crayford Marshes.

Sources of flooding

- Tidal from the Thames downriver of the Thames Barrier (probability 0.1% per annum or greater), flood depths up to 5 m.



At risk in Dartford & Erith policy unit

TE2100 action plan: action zone 5 – middle Estuary

- Tidal on the Rivers Darent and Cray (probability about 0.1% per annum). Barrier controlled.
- Fluvial from the Rivers Darent and Cray (probability 1 to 20% per annum), flood depths up to 2 m.
- Fluvial from the marsh drainage system on Crayford marshes (probability >1% per annum).
- Fluvial from marsh drainage systems on Dartford and Stone marshes (probability <1% per annum).
- Local drainage.
- Groundwater from rock aquifers.

The existing flood risk management system

- Tidal flood defences downriver of the Barrier on the Thames.
- The Dartford Barrier for tidal water levels on the Rivers Darent and Cray.
- Secondary tidal and tidal/fluvial flood defences on the Rivers Darent and Cray.
- Local fluvial flood defences.
- Drainage system outfalls including Crayford, Dartford and Stone Marshes.

Policy context

Dartford & Erith policy unit forms part of the Thames Gateway regeneration area and is covered by Thames Strategy East in addition to the Thames Gateway Parklands vision. There are extensive areas of redevelopment planned in this policy unit, which provide opportunities to improve flood risk

management arrangements including floodplain management and new defences that enhance the riverfront environment.

Vision

There is likely to be considerable new development in this policy unit, and there are opportunities to improve the river frontage as new defences are constructed. In particular, there is scope to combine new defences with new development, and possibly retreat the defence in some areas with resilient development on the riverward side.

The marshes should be retained as an important green space in an otherwise developed area. There is a possibility that these marshes could be used for tidal flood storage. If infrequently used the storage area could also be enhanced to provide habitats and recreation opportunities. The marshes are included as community parklands in the Thames Gateway Parklands vision, and provide considerably opportunities for environmental and amenity enhancement with or without the proposed flood storage area at this location.

Local issues and choices

Measures will be needed for tributary flooding from the River Darent and the River Cray, which joins the Darent in this policy unit. The Darent is already

protected from extreme tidal floods by the Dartford Barrier but defence raising will be needed. Choices for the River Darent are given in table A.5.

Separate fluvial flood risk management schemes would be needed for Dartford and Crayford. These schemes could include fluvial storage in the marshes to draw flood levels down, although at present this would not be very effective because of the restricted conveyance upstream.

In addition to the River Darent/Dartford Creek, there are a number of marsh drainage systems with outfalls into the Estuary. Responses to manage fluvial flood risk in these systems might include outfall improvements, local fluvial flood storage and management of surface runoff. The need for these has not been investigated.

Responses for local flood risk management have not been designed or assessed in detail, and will be the subject of consultation and subsequent appraisal. This work is included in our action Plan.



Do you understand our assessment for the Dartford & Erith policy unit?



Do you agree with it?

Policy unit – Swanscombe & Northfleet

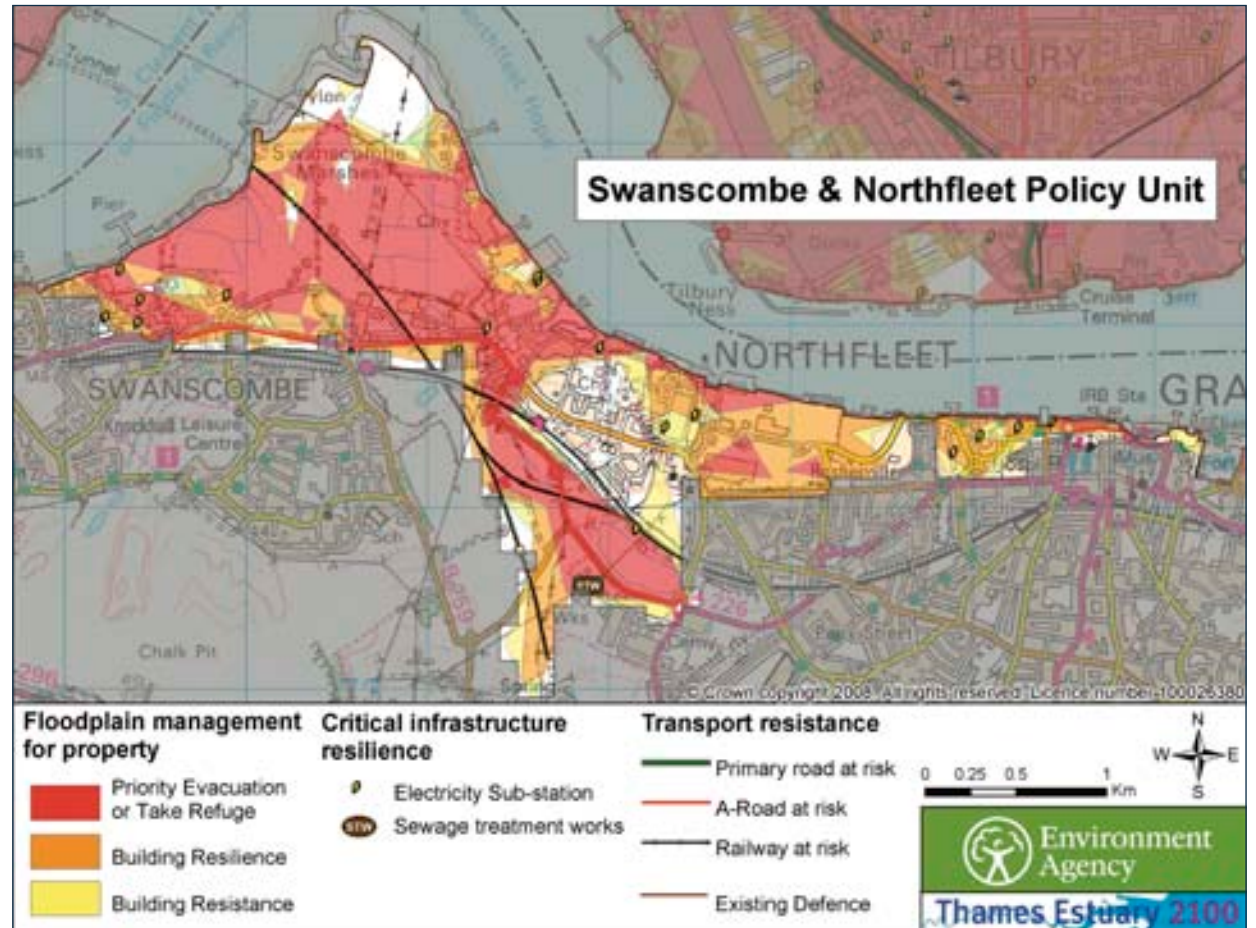
Policy: Our recommended flood risk management policy is policy **P4** to take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).

Description

Swanscombe & Northfleet includes the Swanscombe peninsula, the industrial area of Northfleet and part of the town of Gravesend. The Gravesend and Northfleet frontage includes residential, industrial and recreation areas. The industrial area extends into the Swanscombe peninsula. Most of the peninsula is currently undeveloped. It includes landfill sites and two areas of freshwater marsh. It also contains a portal of the High Speed One (formerly CTRL) tunnel under the Thames.

Sources of flooding

- Tidal from the Thames downriver of the Thames Barrier (probability 0.1% per annum or greater), flood depths up to 5 m but much less in most of the area owing to raised ground levels.



At risk in Swanscombe & Northfleet policy unit

- Fluvial from local watercourses including the River Ebbsfleet and the marsh drainage systems on Swanscombe and Botany marshes (probability >1% per annum in marsh areas).
- Local drainage.
- Groundwater from rock aquifers.

The existing flood risk management system

- Tidal flood defences downriver of the Barrier on the Thames.
- Drainage system outfalls including the River Ebbsfleet and the marsh drainage systems on Black Duck and Botany marshes.

Policy context

Swanscombe & Northfleet forms part of the Thames Gateway regeneration area and is covered by Thames Strategy East in addition to the Thames Gateway Parklands vision.

There are extensive areas of redevelopment planned in this policy unit.

This provides opportunities to improve flood risk management arrangements including floodplain management and new defences that enhance the riverfront environment.



Swanscombe – High Speed One (formerly CTRL)

Vision

There are opportunities to combine improved arrangements for flood risk management in this area with the creation of green space on the Swanscombe peninsula. This could be developed to promote closer links between the floodplain and the Estuary in Northfleet and Gravesend.

There is also a need to work with planning authorities to create a plan that fully integrates flood risk management with new developments, new amenity areas and new/improved conservation areas.

Local issues and choices

Management of flood risk on the River Ebbsfleet might include improvements to the outfall or conserving the floodplain and maximising flood storage.

The fluvial flood risk on the Swanscombe marsh drainage systems is small. Flood mitigation measures might include improved outfalls and local fluvial flood storage.

There is a potential flood risk from groundwater emerging from the chalk aquifer which is very close to the Estuary in this policy unit, although this is unconnected with the Estuary.

Choices for local flood risk management have not been designed or assessed in detail, and will be the subject of consultation and subsequent appraisal.



Do you understand our assessment for the Swanscombe & Northfleet policy unit?



Do you agree with it?

Policy unit – Purfleet, Grays & Tilbury

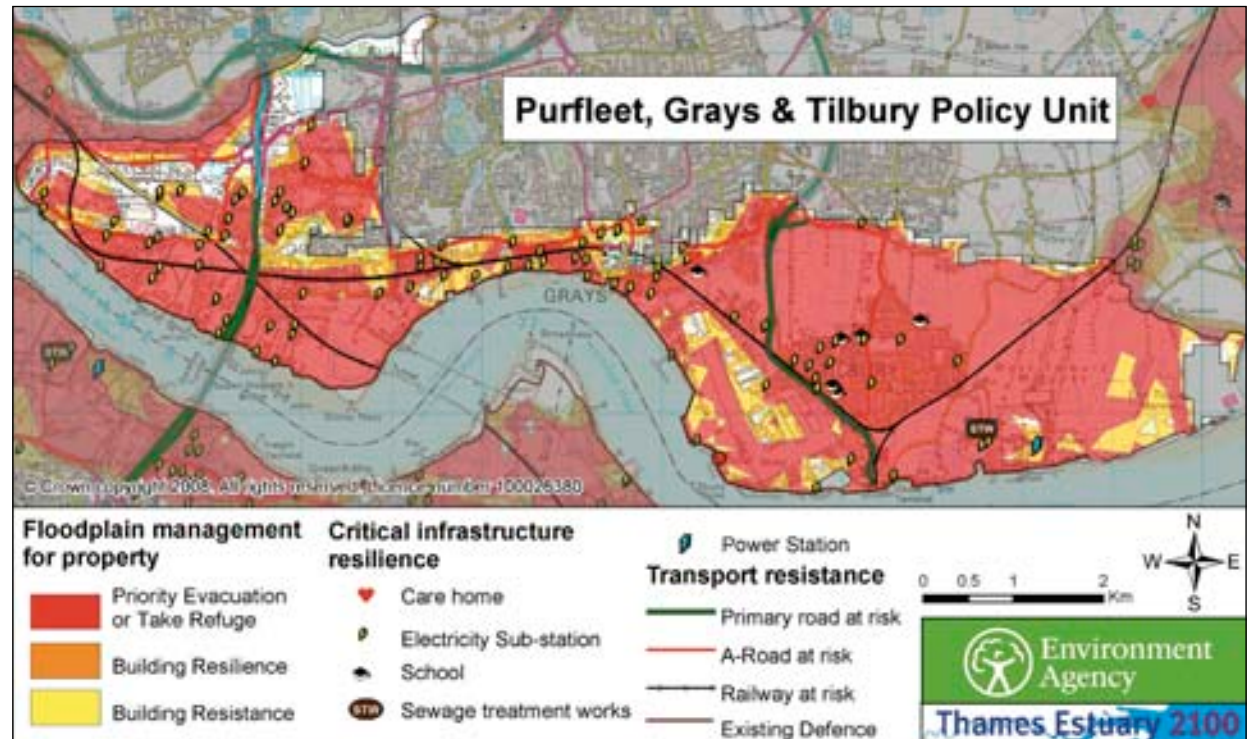
Policy: Our recommended flood risk management policy is policy **P4** to take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).

Description

Purfleet, Grays & Tilbury is a large policy unit that includes Tilbury Town and parts of the urban areas of Grays and Purfleet. This policy unit has two main floodplain areas, at Tilbury and West Thurrock/Purfleet. Much of the marsh areas are low lying, less than 1 m AOD, and some of the developed areas are very vulnerable to flooding.

Purfleet and West Thurrock marshes are mainly industrial and commercial, with some residential areas and large redevelopment sites. Tilbury marshes include Tilbury Docks and Tilbury Power Station together with the residential area of Tilbury Town.

Part of the riverside town of Grays is on strip of floodplain between these two areas. This policy unit contains numerous port facilities and there are a large number of active riverside jetties and wharves.



At risk in Purfleet, Grays & Tilbury policy unit

The western boundary of the Purfleet, Grays and Tilbury policy unit is the Mar Dyke, which is included within this policy unit.

The Dartford tunnel northern portal is in this policy unit.

Sources of flooding

- Tidal from the Thames downriver of the Thames Barrier (probability 0.1% per annum or greater), flood depths up to 5 m.
- Fluvial and tidal/fluvial from the Mar Dyke (probability >1% per annum).
- Fluvial from local watercourses in West Thurrock Marshes (probability about 1% per annum).
- Fluvial from local watercourses in West and East Tilbury Marshes (probability about 1% per annum).
- Local drainage.

The existing flood risk management system

- Tidal flood defences downriver of the Barrier on the Thames.
- Tilbury Dock floodgate.
- Local fluvial flood defences on the Mar Dyke.
- Local fluvial defences at Tilbury Town.
- Drainage system outfalls including West Thurrock and West Tilbury marshes.

Policy context

Purfleet, Grays & Tilbury forms part of the Thames Gateway regeneration area and is covered by Thames Strategy East in addition to the Thames Gateway Parklands vision. There are extensive areas of redevelopment planned in this policy unit which provide opportunities to improve flood risk

management arrangements including floodplain management and new defences that enhance the riverfront environment.

Vision

It is likely that this area will continue to be an important commercial and industrial centre. However there are likely to be major changes following the extensive development and redevelopment in the area, and plans to create parks and green corridors.

Future flood defences can be an important catalyst for improvement by providing good access to the Estuary and helping to create important public amenity areas. There is also an opportunity to create a safer floodplain where developments are resilient to flood damage and people would be safe during a flood event.

Local issues and choices

Measures are not included in our Plan for tributary flooding from the Mar Dyke as the flood risk is very low.

Drainage systems in the Purfleet, West Thurrock and Tilbury areas will require upgrading as the sea level rises and storm rainfall is expected to increase. Mitigation measures might include improved outfalls and drainage channels,

additional pumping capacity, additional flood storage and new or improved local flood defences.

There is likely to be a limit to the number of times the new Tilbury Dock flood gate can be closed because of the interference with shipping. A possible mitigation measure would be to raise the quay edges in the dock, although this may interfere with commercial operations.

Choices for local flood risk management have not been designed or assessed in detail for the TE2100 Plan, but they are identified in our action plan and will be the subject of consultation and subsequent appraisal.



Do you understand our assessment for the Purfleet, Grays & Tilbury policy unit?



Do you agree with it?

TE2100 action plan: action zone 5 – middle Estuary


Table A.5. – Policy units

■ Dartford & Erith P4



■ Swanscombe & Northfleet P4

■ Purfleet, Grays & Tilbury P4

[Note that all dates are based on government’s current guidance on climate change – the TE2100 Plan will be reviewed and updated if these predictions change]




	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.5.1. TE2100 Plan informs the development and revisions of local authority Strategic Flood Risk Assessments (SFRAs) and flood plans.</p> <p>[Note: there is a night time population of over 29,000 and over 50,000 workers during the day. Some 5600 are classed as highly vulnerable to a flood, implying physical immobility or other severe health problems and the financially deprived. These factors provide particular to challenges to LA in the event of a flood. Particularly, with limited transport infrastructure, much of which could be inaccessible – see At Risk maps]</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency</p> <ul style="list-style-type: none"> • LB Bexley • Dartford District Council • Gravesham District Council • Thurrock Unitary Authority <p>Kent Resilience Forum, Essex Resilience Forum</p>	<p>TE2100 information is provided to local authorities preparing flood plans and emergency capability testing.</p> <p>Local authority flood plans are developed with an understanding of TE2100 recommendations and data.</p> <p>TE2100 information is provided to LRF to inform Community Risk Registers and support exercises.</p> <p>A community engagement programme to ensure the public, businesses and other groups understand, are involved in and supportive of the flood plans.</p>	<p>Implementation partners: Do your flood plans include the findings and recommendations from TE2100? Do you have enough information from us to develop your flood plans so that they can be informed by TE2100? Your response will guide the development of our implementation “blueprint” during 2009 and improve arrangements for partnership working.</p> <p>Landowners, the public, business and other interested groups: The Thames tidal defences are robust and well managed. But should there be a failure of a defence or an extreme event which overtops the defences large areas of the middle Estuary zone would be at risk. The Flood Plans will set out arrangements for managing this sort of emergency. Your response on the TE2100 proposals will be shared with Agencies responsible for preparing the flood plans.</p>

TE2100 action plan: action zone 5 – middle Estuary



	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.5.2. To agree a programme to provide localised flood protection and resilience for vulnerable key sites in the middle Estuary action zone.</p> <p>[Note: there are 203 electricity sub-stations, four railway stations and three care homes in the middle Estuary. There are small proportions of basements and mobile homes which are particularly vulnerable in this zone. The At Risk map provides more detail and our proposed floodplain management measures]</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<p>Environment Agency</p> <ul style="list-style-type: none"> • LB Bexley • Dartford District Council • Gravesham District Council • Thurrock Unitary Authority <p>Kent Resilience Forum, Essex Resilience Forum</p>	<p>We will discuss with implementation partners to agree strategic scope of measures required.</p> <p>Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.</p> <p>All site owners supportive of approach and confidence maintained. Local floodplain management measures in place or planned within 25 years.</p>	<p>Implementation partners: Are you aware of the risks and particular vulnerability of sites and infrastructure in this zone? Do you have arrangements in place to investigate the scope of works required for the properties/areas in which you have an interest? Can the Environment Agency assist with this through implementation of action A.5.2?</p> <p>Landowners, the public, business and other interested groups: We would be interested to hear your views to assist us in planning the implementation of this action A.5.2. particularly if you live, work or have interests in this area.</p>
	<p>A.5.3. To agree partnership arrangements and principles to ensure that new development in this zone is safe, and flood risk management is factored into the planning process at all levels for the first 25 years from 2010 to 2034.</p>	<p>Environment Agency</p> <p>GLA , LDA, Essex CC, Kent CC, SEEDA, SEERA</p> <p>Local Authority spatial and emergency planners</p> <ul style="list-style-type: none"> • LB Bexley • Dartford District Council 	<p>TE2100 Plan and associated information informs RSS and Local Development Frameworks (LDF) and future updates of existing LDFs.</p> <p>Application of PPS25 for new development and encourage adoption of property-level protection and resilience.</p>	<p>Implementation partners: Are your RSS and LDFs supported by sustainability appraisals that include local tidal flood risk and the implications of climate change? If not, does the TE2100 Plan provide you with the information you need to do this? If guidance is produced on interpretation of PPS25 in a defended area, what sort of information would be most helpful to you? Would you be able to assist the Environment Agency in preparing this guidance?</p>

(continued)



TE2100 action plan: action zone 5 – middle Estuary

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.5.3. (continued)</p> <p>[Note: there is need for greater clarity over methods and procedures for safety in new development behind defences. Environment Agency and local authority staff are providing advice to developers and responding to difficult Planning applications]</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to assist)</i></p>	<ul style="list-style-type: none"> Gravesham District Council Thurrock Unitary Authority <p>Developers & architects</p>	<p>Local guidance for local authority and Environment Agency staff for planning applications to reflect the complexities of the west London defended tidal/fluvial floodplain.</p>	<p>Landowners, the public, business and other interested groups:</p> <p>We would be interested to hear your views to assist us in planning the implementation of this action A.5.3, particularly if you have had experience (good or bad) of dealing with us and other authorities over planning and building by the river and in the tidal floodplain in this middle Estuary zone.</p>
	<p>A.5.4.</p> <p>To review and maintain partnership arrangements and principles from 2035 to 2069.</p> <p>As A.5.3. above</p>	<p>As A.5.3. above</p>	<p>Local guidance updated to reflect changing needs. The TE2100 10-yearly update to include review of Action A.5.3. and recommend further action.</p>	<p>We cannot know what institutional arrangements will be in place during this period or what pressures there will be on the environment. We do know that for the middle Estuary zone to continue to thrive, flood risk management must continue to be integrated into the spatial planning process. If you would like to help shape the development of these arrangements then please let us have your views.</p>
	<p>A.5.5.</p> <p>To review and maintain partnership arrangements and principles from 2070 and into the 22nd century</p> <p>As A.5.3. above</p>	<p>As A.5.3. above</p>	<p>TE2100 10-yearly update to include review of Action A.5.4. and recommend further action. Local guidance is updated to reflect changing needs.</p>	<p>Flood risk management continues to be integrated into the spatial planning process into the 22nd century – see above.</p>



TE2100 action plan: action zone 5 – middle Estuary

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.5.6. To maintain, enhance and replace the river defence walls and active structures through the middle Estuary zone over the first 25 years of the Plan from 2010 to 2034.</p> <p>[Note: This is a continuation our current activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency Land Owners Developers and local authority planning teams Thames Strategy East Parklands vision</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset System Management teams will promote theses schemes. However, the method of improving the defences is different from the present day approach. It involves greater maintenance and repair work in addition to replacement. Promotion of schemes through the capital programme may not be appropriate for maintenance and repair, and a different way of working may be required.</p>	<p>This is the work which the Environment Agency does now. We will continue with our programme of operations, maintenance and replacement but we are looking for ways of working better and more effectively.</p> <p>We are also seeking opportunities for environmental and recreational enhancements which will create a better place, and for partnerships which will help us achieve this.</p> <p>We would welcome any comments that you or your organisation can provide which assist us in these aims.</p>
	<p>A.5.7. To operate, maintain and enhance the defence walls and active structures through the middle Estuary zone the 35 year period of the Plan from 2035 to 2069 – this will include defence raising in 2040.</p>	<p>Environment Agency Land Owners Developers and local authority planning teams Thames Strategy East</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p>	<p>Our aims remain as A.5.6. above, but during this period, there will be a major programme of rebuilding and refurbishment of the river walls and defences through middle Estuary zone. This provides many opportunities for creating a better place and to plan for a better riverside environment. If you would like to help shape the future environment in this area, then please let us have your views.</p> <p style="text-align: right;">(continued)</p>

TE2100 action plan: action zone 5 – middle Estuary

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.5.7. (continued)</p> <p>[Note: Continuing our activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out]</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>		<p>We will promote schemes through capital programme and they will form part of strategic and investment plans subject to replacement/repair working arrangements as A.5.6. above</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>During this period we will be preparing for the “end of the century” any decisions made as part of action A.5.7. must recognise that there may be major changes from 2070.</p>
	<p>A.5.8.</p> <p>To Implement our “end of the century” option in 2070.</p> <p>Our front runners at this stage for end of the century options are:</p> <p>Option 1.4 – Improve Existing system</p> <p>Option 3.2 – New Barrier at Long Reach.</p> <p>The Long Reach barrier site is within this zone.</p>	<p>Environment Agency</p> <p>Defra/CLG</p> <p>Landowners</p> <p>Local Authorities</p> <p>Developers</p> <p>The public</p> <p>Local interest groups</p> <p>GLA/SEERA/EERA</p> <p>Floodplain users</p>	<p>This will be a major multi-£bn construction project and the arrangements for implementation are likely to differ from our normal defence construction projects.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>2070 is a long way ahead but a decision needs to be made on the TE2100 “end of the century” option. This will enable us to finalise our Plan. The end of the century options (see estuary-wide action plan – action zone 0) affect conditions in the middle Estuary.</p> <p>So if you have views about the value of the Middle Estuary riverside and the effect of raising the walls versus construction of a barrier, please share them with us in submitting your response to this action (A.5.8). We can then weigh up all the evidence before finalising our Plan. We will make recommendations based on conditions now, in 2009, but the final decision on the end of the century options will not be taken until 2040 or 2050.</p> <p style="text-align: right;">(continued)</p>

TE2100 action plan: action zone 5 – middle Estuary

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.5.8. (continued)</p> <p>If a new barrier is constructed in 2070 (option 3.2), further defence raising upstream of the barrier site will not be needed in this zone and there will be an opportunity to lower the defences by up to a metre. The TE2100 10-yearly update will include a review of action A.5.8. and recommend further whether the end of the century recommendations have changed.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>		<p>The defences will require raising during the period covered by the Plan including the Dartford Barrier. The amount of raising will depend on the rate of sea level rise. The flood control gate at Tilbury Dock would be difficult to raise and will require replacement.</p>	<p>It is important to send us your views because the responses we receive during this consultation will set the baseline for establishing public attitudes to the west London riverside environment. This “2009 snapshot” of Middle Estuary stakeholder views will form a starting point for measurement of public attitudes in the future.</p>
	<p>A.5.9.</p> <p>To maintain and enhance the river defence walls and active structures through the Middle Estuary post 2070 and into the 22nd century.</p> <p>Whether or not defences are raised, all defences will still require ongoing maintenance, repair and replacement (and hence engineering works) and this has been allowed for in our Plan investment profile.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency</p> <p>Land owners</p> <p>Developers and local authority planning teams</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>We will promote schemes through capital programme and they will form part of strategic and investment plans subject to replacement/repair working arrangements as A.5.6. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>We cannot now what institutional arrangements there will be as we approach the 22nd century, but our TE2100 vision imagines an environment where the middle estuary riverside continues to thrive, is increasingly enjoyed and respected by the people who live, work and visit. This means that the actions established in A.5.6. and A.5.7. will be continued by whoever is looking after our environment at that time. If you have views about the long-term future management of this part of the Estuary, we would like to hear them. This consultation provides an opportunity for you to have these views recorded and presented as part of an on-going vision statement to those who follow us 60 to 100 years from now.</p> <p style="text-align: right;">(continued)</p>

TE2100 action plan: action zone 5 – middle Estuary



A.5.10.

To agree a programme of works required to manage fluvial flood risk in the tidal zone from the River Darent in the first 25 years of the plan.

Local choices which could be considered:

1. Retain and enhance the existing system including defence raising.
2. Replacement of the Dartford Barrier by an outfall structure.
3. Construction of a new flapped outfall at the upstream end of the flood storage areas, and combine Dartford and Crayford marshes into a single tidal flood storage unit.
4. Retain and enhance the existing system including defence raising.
5. Replacement of the Dartford Barrier by an outfall structure.
6. Construction of a new flapped outfall at the upstream end of the flood storage areas, and combine Dartford and Crayford marshes into a single tidal flood storage area.

Implementation partners

Environment Agency
Land Owners
Developers and local authority planning teams

How this will be achieved

These works will be the responsibility of local EA area teams. The planning and agreement on what is needed should happen in the short term.

Implementation may be a medium term action, depending on local scheme justification.

Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.

All site owners must be supportive of approach and confidence of public and users maintained. Local measures for management of flooding from other sources to be in place or the planned within 25 years.


How your response can help us finalise the TE2100 Plan

We would be interested to hear your views to assist us in planning the implementation of this action A.5.10. particularly if you live, work or have interests in this area and are concerned about flooding from sources other than tidal. This includes pluvial and urban drainage and fluvial flooding from the River Darent and the River Cray.

Our TE2100 Technical Plan and local choices documents for the policy units provide further information on these matters and the choices which are available to assist with problems. If you would like to comment on these in more detail, please contact the project team.

(continued)

TE2100 action plan: action zone 5 – middle Estuary

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.5.10. (continued)</p> <p>7. Possible realignment of the River Darent.</p> <p>8. Separate fluvial flood management schemes for Dartford and Crayford.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>			
	<p>A.5.11.</p> <p>Understanding Local views on alternative end of the century options.</p>	<p>Environment Agency</p> <p>GLA</p> <p>Local Authority spatial and emergency planners</p> <ul style="list-style-type: none"> • LB Bexley • Dartford District Council <p>Developers & architects</p>	<p>We will discuss with implementation partners to review changes to flood risk drivers.</p> <p>Should options which, at this point in the TE2100 plan, are not considered ‘front runners’ become more viable in the future agree strategic scope of measures required.</p>	<p>We cannot know how the drivers of flood risk, be they climate, environment or social/economic, will change in the future.</p> <p>We are interested to know your thoughts on the options that through the TE2100 appraisal process have not been identified as front runners for the Plan (see table A.O. for further information). If you have views about the long-term future management of the middle Estuary riverside, we would like to hear them. This consultation provides an opportunity for you to have these views recorded and presented as part of an on-going vision statement to those who follow us 60 to 100 years from now.</p>

TE2100 action plan: action zone 5 – middle Estuary



A.5.12.

To agree a programme for habitat enhancement and creation

In 2024 planning and, soon after, groundworks may need to be started in this policy unit to compensate for the potential loss of designated freshwater and grazing marsh interest features as a result of intertidal habitat creation. The following sites have been identified in this policy unit as having the potential to support the interest features that could be lost, either through enhancement of existing habitat features or creation of new sites:

- Dartford Marshes East
- Dartford and Crayford Marshes
- Tilbury Marshes and West Tilbury Marshes
- Mar Dyke.

Implementation partners

Environment Agency
 Natural England
 Land owners
 Local Authorities
 Public and local interest groups
 RSPB
 Wildlife Trusts

How this will be achieved

Planning and groundworks would take at least five years and there would be an additional 10 years before the habitat is fully established at the sites.
 We will be looking for partnership arrangements to manage these sites and get the best for the natural environment, for the local population and for visitors.

How your response can help us finalise the TE2100 Plan

We would like to hear your views on our 2024 habitat creation proposal.

It is important that we use this consultation to have a proper and effective airing of information and views regarding any land use change. In the Environment Agency we see habitat creation as a positive step toward the goal of sustainability and supporting the habitats and species that make the Thames estuary internationally important.

Habitat creation also provides opportunities for enhancements for recreation, visitors centres and other facilities. In order to finalise our plans, we need to hear what you think – in general terms, or at a local level.

TE2100 action plan: **action zone 8** – Seaside/fishermen’s frontage

Action plan for zone 8 – table A.8.

Nine actions identified

Description of the policy units

■ Leigh-on-Sea & Southend-on-Sea

Table A.8. describes the nine actions for zone 8 – Seaside, fishermen’s frontage which have been identified through the TE2100 Plan. The actions are described under the following headings:

- TE2100 recommended actions (and whether or not costs for this have been included in the TE2100 Plan)
- Implementation partners
- How this will be achieved
- How your response can help us finalise the TE2100 Plan



Do you consider that we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?



Do you agree with the actions identified in our action plans and the timing of those actions?



Do you agree with the mechanisms we have set out to deliver the action plans?



Have we identified the right partner organisations to deliver our action plans and are you, or your organisation, able to contribute to these actions?

Policy unit – Leigh-on-Sea & Southend-on-Sea

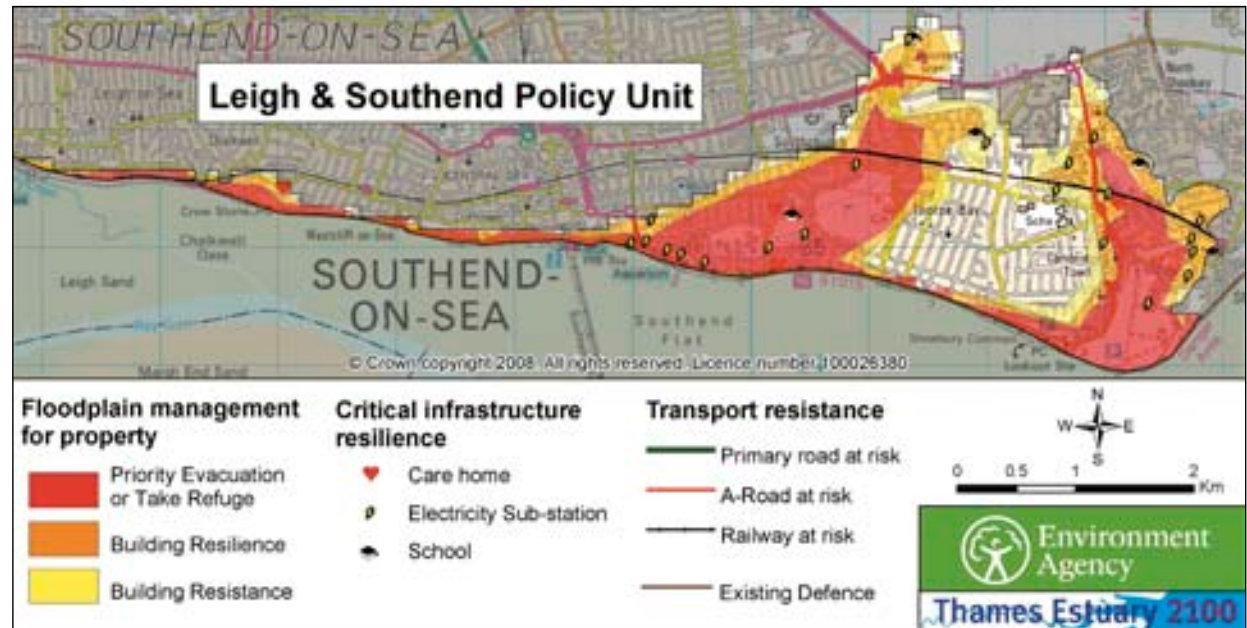
Policy: Our recommended flood risk management policy for Leigh-on-Sea & Southend-on-Sea is policy **P4**, to take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change).

Description

Southend-on-Sea (including Westcliff-on-sea) and Leigh-on-Sea are distinctly different areas, and are considered separately.



The seafront



At risk in Leigh & Southend policy unit

Southend-on-Sea has a continuous sea frontage with beaches and very extensive (designated) intertidal areas and a pier. Whilst most of Southend-on-Sea is on high ground and not at risk from tidal flooding, much of the sea front is at risk of flooding and there is a flood defence along the entire frontage.

There are five schools, six care homes and 21 electricity sub stations within the flood risk area. This is an important amenity and recreation area, with a parallel road and footpaths along much of the frontage. The two main areas of floodplain are to the east of the city centre.

TE2100 action plan: **action zone 8 – Seaside/fishermen’s frontage**

The beach at Southend-on-Sea

The number of properties at risk is relatively small but, as the standard of protection is lower than elsewhere on the estuary, the flood risk is relatively high at 0.5% (or 1:200) per annum or greater compared to the general standard of 0.1% (or 1:1,000) elsewhere in the estuary.

Leigh-on-Sea has a narrow but historic frontage bounded by the railway line to the north. It has close links with the estuary with a strong fishing tradition, and floodplain management is practised to avoid creating a barrier between the village and the Estuary.

This means that the defence level is low and properties have been built with raised thresholds

and other resilience measures to protect against tidal flooding. There is evidence that more recent riverside users are unaware of this and stock for shops is stored in the floodable area.

Sources of flooding

- Tidal from the Thames (probability 0.5% per annum or greater), flood depths up to 4 m but very variable.
- Fluvial from local watercourses including Prittle Brook.
- Local drainage: Not investigated in TE2100.

The existing flood risk management system

- Tidal flood defences on the Thames including revetment and wave walls.
- Beaches with associated groynes to improve the frontage and mitigate the impacts of wave action. Beach recharge has been recently used to build up the beach and reduce the effects of wave action.
- Drainage system outfalls including Prittle Brook.
- Receptor responses in Leigh-on-Sea including resilient buildings and measures for rapid drainage of tidal flood water.

Policy context

This policy unit overlaps with the Essex SMP (Shoreline management Plan) currently in

development. It is essential that there is good communication between TE2100 and the Essex SMP to ensure that there are no conflicts in the flood and coastal management policies and action plans developed by these two strategies.

Re-activation of the waterfront at Southend-on-Sea is included in the Thames Gateway Parklands vision, which also identifies the importance of the historic urban environment in the vicinity of Southend Pier.

It is likely that the Southend-on-Sea frontage will continue to be developed and improved as it is an important leisure and recreation area.

Raising of defences would affect the close link between the fishing community at Leigh-on-Sea and the Estuary. The intention of the TE2100 Plan would be to minimise visual impacts on Leigh-on-Sea as much as possible by implementing further floodplain management measures.

Reducing potential flood impacts with local resilience measures is already practised in Leigh-on-Sea, where flood boards are used together with means of allowing the area to drain of tidal water in the event of inundation. Any new development should also be designed so that the potential flood impacts are minimised and a programme

TE2100 action plan: **action zone 8** – Seaside/fishermen’s frontage

of public information is required to ensure that residents are aware of these floodplain management arrangements.

Vision

Improvements to the flood risk management system should provide amenity, recreation and environmental enhancement, and be designed to minimise any adverse impacts on the frontage whilst supporting and enhancing the fishing industry activities.

Local issues and choices

Raised and new defences on the Southend-on-Sea frontage should be designed so that:

- They do not encroach into the Estuary.
- The raised part of the defences could consist of a new defence on a new alignment behind the sea front where space permits (for example, park areas) so that the heights of walls on the sea front are limited.
- Walkways are raised to provide sea views, and access points are improved.
- Demountable defences and gated access points may be included in the designs in some areas providing that satisfactory arrangements can be made for security of closure.

The Southend-on-Sea frontage is subject to wave attack and overtopping. Beach recharge has been

implemented both to improve the beach and reduce the impacts of waves. Improvements to this approach would reduce the need for defence raising.

Local cockle fishermen have particular problems relating to siltation in and around Leigh-on-Sea. It is recommended that this should be included in any local morphological investigations relating to beach recharge.

Responses to mitigate the impacts of the estuary on local flooding may be needed, including improvement of outfalls, although this has not been investigated in TE2100.

Choices for local flood risk management have not been designed or assessed in detail, and will be the subject of consultation and subsequent appraisal.



The seafront at Leigh-on-Sea



Do you understand our assessment for the Leigh-on-Sea & Southend-on-Sea policy unit?




Do you agree with it?



TE2100 action plan: action zone 8 – Seaside/fishermen’s frontage

Table A.8. – Policy units ■ Leigh-on-Sea & Southend-on-Sea policy unit **P4**

[Note that all dates are based on government’s current guidance on climate change – the TE2100 Plan will be reviewed and updated if these predictions change]



	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.8.1. TE2100 Plan informs the development and revision of local authority strategic flood risk assessments (SFRAs) and flood plans.</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to support the action)</i></p>	<p>Environment Agency Southend-on-Sea Borough Council Essex SMP (shoreline management plan) Client Steering Group Essex Resilience Forum</p>	<p>TE2100 information is provided to Southend-on-Sea Council for its flood plan and capability testing.</p> <p>Local authority flood plan is developed with an understanding of TE2100 recommendations and data.</p> <p>Local Resilience Forum takes ownership of the flood plan and all responders have confidence in it.</p> <p>A community engagement programme to ensure the public, businesses and other groups understand, are involved in and supportive of the flood plans.</p>	<p>Implementation partners: Do your flood plans include the findings and recommendations from TE2100? Do you have enough information from us to develop your flood plans so that they can be informed by TE2100? Your response will guide the development of our implementation “blueprint” during 2009 and improve arrangements for partnership working.</p> <p>Landowners, the public, business and other interested groups: Thames tidal defences provide highly reliable protection to Southend-on-Sea against surge tides. But should there be a failure of a defence or an extreme event which overtops the defences, low-lying areas of Southend-on-Sea and Leigh-on-Sea would be at risk as shown on the policy unit At Risk maps. The Flood Plans will set out arrangements for managing this sort of emergency. If you have views on this, please let us know and we will share your views with those responsible for preparing the flood plans.</p>

TE2100 action plan: **action zone 8** – Seaside/fishermen’s frontage

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.8.2.</p> <p>To agree a programme to provide local flood protection, resilience and emergency plans for vulnerable key sites in action zone 8.</p> <p>Our At Risk maps for Leigh-on-Sea and Southend-on-Sea show that particular sites and key infrastructure which would be vulnerable in the event of a failure or overtopping of the defences. Areas of the Southend-on-Sea sea front are on the seaward side of the defended area and Leigh-on-Sea seafront is likely to flood during normal high tides. It is important that residents, businesses and visitors are aware of this and the measures they should be taking for their own protection.</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to support the action)</i></p>	<p>Environment Agency</p> <p>Local Authority</p> <ul style="list-style-type: none"> • Southend-on-Sea BC <p>Essex Resilience Forum</p> <p>Developers and vulnerable site owners/ managers</p>	<p>We will discuss with our implementation partners to agree strategic scope of measures required, informed by information from TE2100 (see at risk maps).</p> <p>Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.</p> <p>All site owners must be supportive of approach and confidence of public and users maintained. Local floodplain management measures in place or planned within 25 years.</p>	<p>Implementation partners:</p> <p>Are you aware of the risks and particular vulnerability of key sites in this action zone? Do you have arrangements in place for initiating the discussion concerning scope of works required for the properties/ areas in which you have an interest? Can the Environment Agency assist with this through implementation of action A.8.2?</p> <p>Landowners, the public, business and other interested groups:</p> <p>We would be interested to hear your views to assist us in planning the implementation of this action A.8.2. particularly if you live, work or have interests in this area.</p>
	<p>A.8.3.</p> <p>To agree partnership arrangements and principles to ensure that new development in Seaside and Fishermen’s frontage zone 8 is safe, and that where possible the application of PPS25 reduces the consequence of flooding.</p>	<p>Environment Agency</p> <p>Essex CC</p> <p>EEDA, EERA</p>	<p>TE2100 Plan and associated information informs developing Local Development Frameworks (LDF) and future revisions.</p>	<p>Implementation partners:</p> <p>Are your LDFs supported by sustainability appraisals that include local tidal flood risk and the implications of climate change? If not, does the TE2100 Plan provide you with the information you need to do this? If we draft guidance on the interpretation of PPS25 in a defended area, what sort of information would be most helpful to you?</p>



(continued)

TE2100 action plan: action zone 8 – Seaside/fishermen’s frontage


	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
 <p>First 25 years</p>	<p>A.8.3. (continued)</p> <p>Environment Agency and local authority staff are providing advice to Developers and responding to difficult Planning applications. For flood risk management to be factored into the planning process at all levels for the first 25 years from 2010 to 2034, there is need for greater clarity over methods and procedures for safety in new development behind defences.</p> <p><i>(Cost of implementing this action not included in TE2100 Plan, but TE2100 data and information will be available to support the action)</i></p>	<p>Local Authority spatial and emergency planners:</p> <ul style="list-style-type: none"> • Southend-on-Sea <p>Thames Gateway Essex Partnerships</p> <p>Developers and site owners</p>	<p>Local authority and Environment Agency Planning staff require guidance for applying the principles of PPS25¹² to a defended tidal floodplain.</p> <p>We along with our implementation partners and CLG will develop guidance for development in a defended tidal floodplain.</p>	<p>Would you be able to assist the Environment Agency in preparing this guidance – and would it be useful to you?</p> <p>Landowners, the public, business and other interested groups:</p> <p>We would be interested to hear your views to assist us in planning the implementation of this action A.8.3. particularly if you have had experience (good or bad) of dealing with us and other authorities over planning and building by the river and in the defended tidal floodplain.</p>
 <p>Middle 35 years</p>	<p>A.8.4.</p> <p>To review and maintain from 2035 to 2069, the partnership arrangements and principles for development and flood risk management established in the first 25 years of our Plan.</p>	<p>As above</p>	<p>Guidance is updated to reflect changing needs. The TE2100 10-yearly update to include review of action A.8.3. and recommend any changes or developments.</p>	<p>We cannot know what institutional arrangements will be in place during this period or what pressures there will be on the environment. We do know that for the Leigh-on-Sea and Southend-on-Sea to continue to thrive and for regeneration to be a success, flood risk management must continue to be integrated into the spatial planning process. If you would like to help shape the development of these arrangements during the middle years (2035 to 2069) of our Plan, then please let us have your views.</p>

¹² Planning Policy Statement No. 25 “Development and Flood Risk” (CLG 2006)


TE2100 action plan: action zone 8 – Seaside/fishermen’s frontage

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.8.5. To review and maintain from 2070 and into the 22nd century, the partnership arrangements and principles for development and flood risk management established in the middle years of the Plan.</p>	As above	TE2100 10-yearly update to include review of action A.8.4. and recommend further action. Guidance is updated to reflect changing needs.	Flood risk management continues to be integrated into the spatial planning process into the 22nd century. If you have views on how the relationship between spatial planning and flood risk management should be developing in the Seaside Fishermen’s frontage zone as we prepare for the 22nd century, then please respond to this action A.8.5.
	<p>A.8.6. To maintain, enhance, improve or replace, the river defence walls, active structures and beach nourishment schemes in Seaside Fishermen’s frontage zone 8 over the first 25 years of the Plan from 2010 to 2034.</p> <p>This is a continuation of our current activities to ensure that confidence in the Thames tidal flood risk management system is maintained and that opportunities for environmental enhancements and partnership through planning are actively sought and carried out.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency Essex CC Local Authority spatial and emergency planners</p> <ul style="list-style-type: none"> • Southend-on-Sea <p>Essex SMP (shoreline management plan) Client Steering Group Thames Gateway Essex Partnerships Developers and site owners Thames Strategy East</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset System Management teams will promote these schemes. However, the method of improving the defences is different from the present day approach. It involves greater maintenance and repair work in addition to replacement. Promotion of schemes through the capital programme may not be appropriate for maintenance and repair, and a different way of working may be required.</p>	<p>This is the work which we do now in the Environment Agency. We will continue with our programme of operations, maintenance and replacement but we are looking for ways of working better and more effectively.</p> <p>We are also seeking opportunities for environmental and recreational enhancements which will create a better place through the Seaside/Fishermen’s frontage zone, and for partnerships which will help us achieve this. We also need to understand better how changes to the frontage defence arrangements can help local businesses and the fishing industry.</p> <p>We would welcome any comments that you or your organisation can provide which assist us in these aims.</p> <p>Our TE2100 Technical Report and local choices documents for the policy units provide our assessment of the choices which are available in the Seaside Fishermen’s frontage zone 8 in the short term. If you would like to comment on these in more detail, please contact the project team.</p>


TE2100 action plan: action zone 8 – Seaside/fishermen’s frontage

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.8.7. To maintain, enhance and improve or replace the defence walls, active structures and beach nourishment schemes through Seaside Fishermen’s frontage zone 8 during the 30 year period of the Plan from 2035 to 2065.</p> <p>The defences at Southend-on-Sea will require raising during the period covered by the TE2100 Plan. Any raising of the defences should include ground raising and landscaping so that the public can view the estuary; public access to the beaches and foreshore is not impaired; the defences blend with the sea front environment and do not form a barrier between the urban area and the estuary; and opportunities are taken to enhance the sea frontage landscape and access when the defences are improved.</p> <p>The defences at Leigh-on-Sea may not be raised in order to maintain the link with the estuary, but floodplain management measures will be needed to control the flood risk.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency Essex CC EEDA, EERA Local Authority spatial and emergency planners: • Southend-on-Sea Essex SMP (shoreline management plan) Client Steering Group Thames Gateway Essex Partnerships Developers and site owners Thames Strategy East</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset Systems Management teams will promote schemes through capital programme and they will form part of strategic and investment plans subject to replacement/repair working arrangements as A.8.6. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>Our aims remain as A.8.6. above, but during this period, there will be a major programme of rebuilding and refurbishment of the river walls and defences through the Seaside Fishermen’s frontage zone 8. This provides many opportunities for creating a better place and to plan for a better riverside environment. We also need to understand better how changes to the frontage defence arrangements can help local businesses and the fishing industry.</p> <p>If you would like to help shape the future environment in these areas, then please let us have your views on this action A.8.7.</p> <p>Our TE2100 Technical Report and local choices documents for the policy units provide our assessment of the choices which are available in the Seaside Fishermen’s frontage zone in the medium term (2035 to 2069). If you would like to comment on these in more detail, please contact the project team.</p>

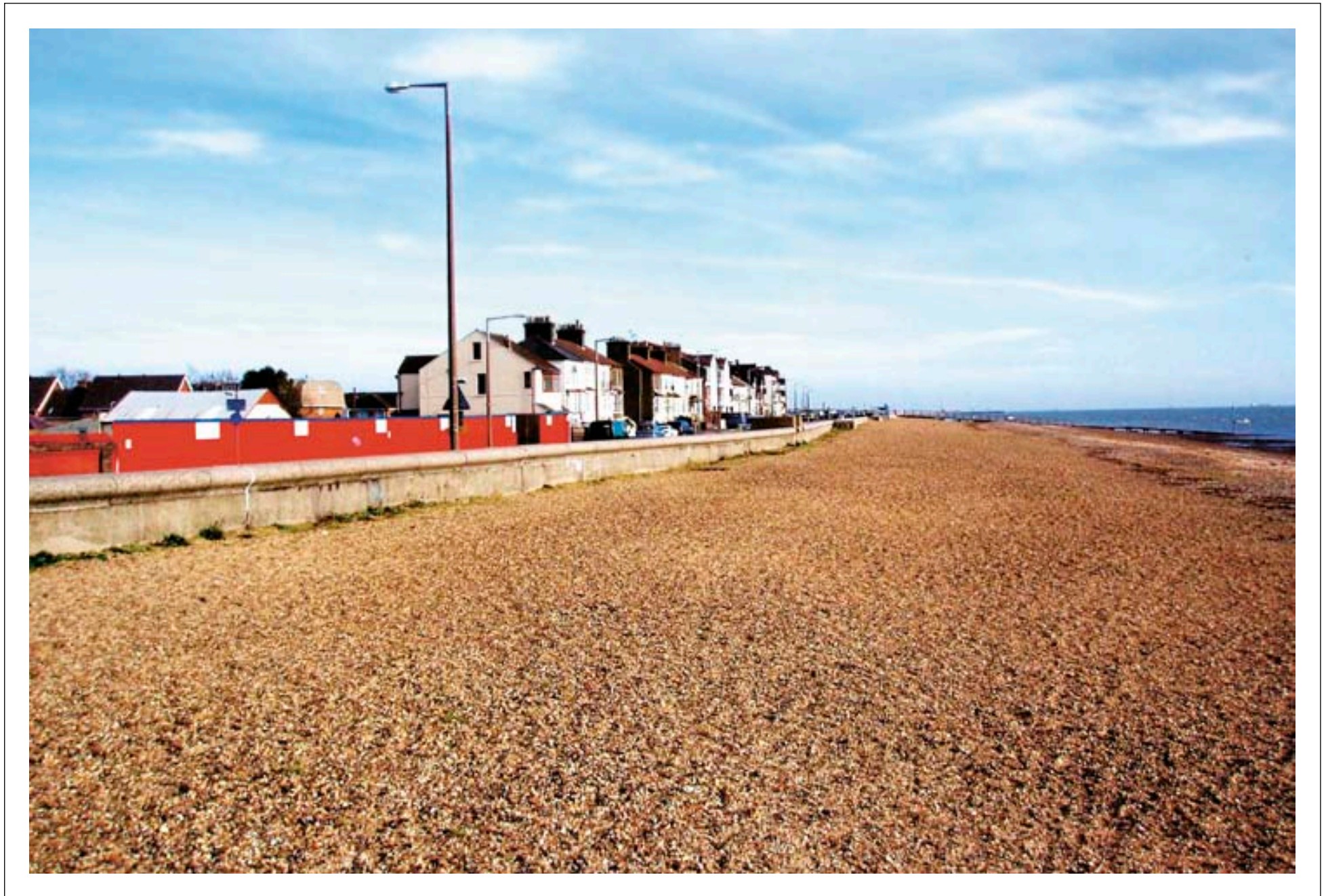
TE2100 action plan: **action zone 8** – Seaside/fishermen’s frontage

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.8.8. To maintain, improve, enhance or replace the river defence walls, active structures and beach nourishment schemes through lower Estuary zone 8 post 2070 and into the 22nd century.</p> <p>These are the TE2100 “end of the century” raising of defence levels to provide continuing tidal flood risk management to the Seaside Fishermen’s frontage zone 8. The defence raising will be the same in this zone, whatever TE2100 “end of the century” option is selected.</p> <p>Whether or not defences are raised, all defences will still require ongoing maintenance, repair and replacement (and hence engineering works) and this has been allowed for in our Plan investment profile.</p> <p><i>(Cost of implementing this action is included in TE2100 Plan)</i></p>	<p>Environment Agency Essex CC EEDA, EERA Local Authority spatial and emergency planners:</p> <ul style="list-style-type: none"> • Southend-on-Sea <p>Essex SMP (shoreline management plan) Client Steering Group Thames Gateway Essex Partnerships Developers and site owners Thames Strategy East</p>	<p>Our Planning Liaison and Development Control staff will promote these works as part of ongoing development applications.</p> <p>Our Asset Systems Management teams will promote schemes through capital programme and they will form part of strategic and investment plans subject to replacement/repair working arrangements as A.8.6. above.</p> <p>There are major opportunities for reshaping the local landscape as part of these works.</p>	<p>We cannot know what institutional arrangements there will be as we approach the 22nd century, but our TE2100 vision imagines an environment where the Leigh-on-Sea and Southend-on-Sea riverside has thriving regeneration areas and a stable, flourishing natural environment which is increasingly enjoyed and respected by the people who live, work and visit. This means that the actions established in A.8.6. and A.8.7. will be continued by whoever is looking after our environment at that time. If you have views about the long-term future management of the Leigh-on-Sea & Southend-on-Sea riverside, we would like to hear them. This consultation provides an opportunity for you to have these views recorded and presented as part of an on-going vision statement to those who follow us 60 to 100 years from now.</p>

TE2100 action plan: action zone 8 – Seaside/fishermen’s frontage

	TE2100 recommended actions	Implementation partners	How this will be achieved	How your response can help us finalise the TE2100 Plan
	<p>A.8.9. To agree a programme of local beach recharge measures and investigation into siltation and erosion patterns in this policy unit.</p> <p>The Southend-on-Sea frontage is subject to wave attack and overtopping. Beach recharge has been implemented both to improve the beach and reduce the impacts of waves. Improvements to this approach would reduce the need for defence raising.</p> <p>Local cockle fishermen have particular problems relating to siltation in and around Leigh-on-Sea. It is recommended that this should be included in any local morphological investigations relating to beach recharge.</p> <p><i>(Cost of implementing this action is not included in our TE2100 Plan, but TE2100 data, information and recommendations are available to support the implementation of this action)</i></p>	<p>Environment Agency</p> <p>Local Authority</p> <ul style="list-style-type: none"> • Southend-on-Sea <p>Essex SMP (shoreline management plan) Client Steering Group</p> <p>Fishermen</p>	<p>Discussion between Environment Agency and implementation partners to agree strategic scope of measures required.</p> <p>Agreement between implementation partners on the strategic approach, and roles and responsibilities for achieving it.</p> <p>All site owners must be supportive of approach and confidence of public and users maintained. Local measures for management of accretion and erosion to be in place or planned within 25 years.</p> <p>Good dialogue to be maintained between TE2100 and Essex shoreline management plan to ensure no contradictory advice provided by these two overlapping strategies.</p>	<p>Implementation partners: Are you aware of the risks and particular vulnerability of people and property to siltation or erosion in this area?</p> <p>Do you have arrangements in place for the scope of works required for the properties/areas in which you have an interest? Can the Environment Agency assist with this through implementation of Action A.8.9?</p> <p>Landowners, the public, business and other interested groups: We would be interested to hear your views to assist us in planning the implementation of this action A.8.9. particularly if you live, work or have interests in this area and are concerned about erosion or accretion on the foreshore at Leigh-on-Sea & Southend-on-Sea.</p> <p>This has not been designed or addressed in detail in TE2100 but a number of areas have been identified as requiring further study at local level:</p> <p>Our TE2100 Technical Report and local choices documents for the policy units provide further information on these matters and the choices which are available to assist with problems. If you would like to comment on these in more detail, please contact the project team.</p>

TE2100 action plan: **action zone 8** – Seaside/fishermen's frontage



Have your say

The consultation period on our Thames Estuary 2100 Plan will last for three months, closing at the end of June 2009.

This Plan for consultation has been developed through years of study, assessment and appraisal. We have also twice consulted on our Plan to help inform its development through to the final consultation document you see today. We have, where possible, taken on board views expressed up to now so that this Plan represents the concerns and aspirations of the many organisations and interest bodies in the estuary. This however is the first time that all of our work has been presented in one complete plan and we would welcome your views.

The final TE2100 will influence not only how we manage flood risk in the short, medium and long term, but also how the river landscape may change in the future. As a strategic Plan it does not detail how particular recommended changes may be implemented as this would be more relevant to any future implementation plans. We are therefore focussing this consultation on whether we have identified the **right strategic options for managing flood risk in the estuary** and whether you agree with the **strategic actions required to achieve these**. We recognise that it is difficult to comment

on options that are a long way in the future but it is important to put in place actions now so that some of the long term options can be safeguarded for future generations.

We value your views, not only as potential implementation partners for the flood risk management local or strategic options, but also as organisations or individuals with an interest in the estuary and its future.

How to respond

You can respond to this consultation in a number of ways:

By email: te2100@environment-agency.gov.uk

In writing: Thames Estuary 2100
c/o Thames Barrier Information & Learning Centre
Environment Agency
FREEPOST SW1450
1 Unity Way, Woolwich
London SE18 5BR





In person:

During the period of consultation we will be hosting and attending a number of events across the Thames estuary where you can come along, meet us, find out more about the Plan for

Consultation and leave us any comments you have. Details of these events will be posted on our webpages (www.environment-agency.gov.uk/te2100) or can be obtained by calling our customer services phoneline on 08708 506 506.

You can access this document and the Strategic Environmental Assessment, environmental report summary from our website: www.environment-agency.gov.uk/te2100

If you need further information please contact us through the above number.

-  Do you consider that we have identified the right strategic options for managing tidal flood risk in the Thames estuary, and do you agree with the final preferred options?
-  Do you agree with the actions identified in our action plans and the timing of those actions?
-  Do you agree with the mechanisms we have set out to deliver the action plans?
-  Have we identified the right partner organisations to deliver our action plans and are you, or your organisation, able to contribute to these actions?

Chapter 10: Have your say – now it is over to you

To help us collate and respond to your comments please reference your comments with the relevant chapters/pages/action plans/action zones.

Following the consultation your views will, where possible, be taken account of. We will report on the results of the consultation indicating where we have been able to incorporate your comments, or if that is not possible, we will indicate why.

Thank you in advance for your time and effort in responding.

A reminder: the consultation will close at the end of June 2009.



Chapter 11: Find out more



After six years of study and working with people across the Thames estuary we have produced and gathered lots of information. We are not able to present all of this within this document and the supporting Environmental Report Summary.

However, if you would like to find out more, we have produced two comprehensive technical reports:

- (i) The TE2100 Technical Report, which describes how we have developed our Plan including, the approach we have taken, the supporting studies and the evidence which underpins our conclusions.
- (ii) The TE2100 Environmental Report, which describes how we have undertaken the Strategic Environmental Assessment (SEA), the key significant impacts of our Plan, suggested mitigation, enhancement and monitoring. It also explains how we have complied with other environmental legislation.

These documents are available on request in an electronic format, and are available for viewing in hard copy at Environment Agency offices and in a number of Local Authority offices and libraries.

In addition, more than 300 reports of studies and investigations with associated data sets have been produced during the lifetime of the TE2100 project. These will be made available on request and will be subject to standard Environment Agency requests for information and charging practices.

To find out more, including details of the events we will be attending during the consultation, please take a look at our website:

www.environment-agency.gov.uk/te2100

Or contact us:

By email at TE2100@environment-agency.gov.uk

By phone on 08708 506 506

Next steps in TE2100

What is going to happen to your comments?

Once the consultation closes in June, we will collate and review all of the comments received and make changes to the Plan where necessary.

The comments we receive from you and from others will help us shape the final Plan which we will submit to Government at the beginning of 2010.

We are hoping that lots of people will take part in this consultation and we will receive plenty of comments, therefore we will not be able to respond to all comments individually. We will however, produce a summary of the comments received, not attributable to individuals or organisations and this will be posted on our website in the summer. This summary will also highlight how we have changed the Plan to take account of the comments raised, but also if we decided that the comment was not valid, we will explain why we made this decision.

What other work is needed to finalise the Plan?

The TE2100 Plan cannot be finalised until we have taken account of the views and comments that you give us. In addition we also need to fully demonstrate that we have taken account of environmental legislation in the final Plan. Over the summer we will complete the following

activities to meet the requirements of environmental legislation:

Strategic Environmental Assessment (SEA) We will take account of the comments received from this consultation on the TE2100 Plan and the accompanying Environmental Report. The SEA process will also recommend what monitoring of environmental impacts will be required to support the implementation of the TE2100 final Plan.

Habitats Regulation Assessment (HRA) We will continue working with Natural England to complete the assessment of the TE2100 Plan on internationally important habitats in the Lower estuary. This will require the application of a number of tests, before submitting the final recommendation to the Secretary of State of the Environment.

Water Framework Directive (WFD) We will continue to work with colleagues to ensure that the final TE2100 Plan feeds into the delivery of and future revisions of the Thames River Basin Management Plan.

Have your say

For comments on this consultation document and to find out more about how we are planning for a changing estuary:

Thames Estuary 2100:

TE2100@environment-agency.gov.uk

or 08708 506 506

Would you like to find out more about us, or about your environment?

Then call us on

08708 506 506 (Mon–Fri 8–6)

email

enquiries@environment-agency.gov.uk

or visit our website

www.environment-agency.gov.uk

incident hotline 0800 80 70 60

floodline 0845 988 1188



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