# Thurrock Local Flood Risk Management Strategy

## Final

December 2015

# Version

| Version | Date | Amendments |
|---|---|---|
| Draft v1.0 | June 2015 | |
| Draft v2.0 | July 2015 | Minor text amendments |
| Draft v3.0 | December 2015 | Amendments following consultation |
| Final v1.0 | December 2015 | Updated property counts and mapping |

# Foreword

The development of this first Local Flood Risk Management Strategy for Thurrock shows we are better prepared than ever to tackle the threats and impacts of flooding here.

Although most people will consider Thurrock is mainly if not only at risk from river flooding – especially from the Thames – we are in fact at risk from intense rainfall overwhelming our drainage systems and sewers; from other rivers bursting their banks; and from high tides and even stormy seas.

With an aging infrastructure and pressures such as housing and other developments increasing our vulnerability, it is more important than ever we implement this strategy to increase our resistance, resilience and preparedness.

Although Thurrock has not suffered the effects of flooding to the same extent as other parts of the country in recent years, we do have a history that many will remember and evidence suggests the severity and frequency of flooding events is likely to increase so we must not be complacent.

This strategy has been developed together with other partners responsible for flood risk across the region and I welcome this approach of working together.

I trust you find the information in this strategy reassuring and understand how Thurrock Council and its partners are taking a collaborative and pro-active approach to minimising the risks to our residents, their homes, their businesses and our valuable natural environment.

Cllr Gerard Rice, portfolio holder for Environment.

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# Contents

# Table of figures



# Table of Tables

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# Glossary

| | |
|---|---|
| AEP (Annual exceedance probability) | The percentage chance of a flood occurring in any one year. For example, a flood event with a 1% AEP has a 1% chance of occurring in any one year. |
| AoCD (Area of Critical Drainage) | A discrete geographic area where multiple and/or interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure. |
| Asset Register | A database of flood risk assets for use by RMAs. It includes information on each asset and ownership. |
| Register of flooded properties | A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years. |
| Fluvial Flooding | Flooding resulting from water levels exceeding the bank level of a watercourse |
| Groundwater | All water which is below the surface of the ground and in direct contact with the ground and subsoil. |
| Habitats Regulations Assessment | Required by Article 6 of the EC Habitats Directive 1992 (92/44/EEC) and Regulation 48 of the Conservation (Natural Habitats) Regulations 1994, to assess the potential impact of implementing a plan or programmes objectives and measures against European Designated Sites. |
| IDB (Internal Drainage Board) | A local public authority established in areas of special drainage need in England and Wales. They have permissive powers to manage water levels within their respective drainage districts and undertake work to reduce flood risk to people and property. |
| Local Flood Risk | Risk of flooding from surface water, ordinary watercourses and groundwater. |
| Main River | A watercourse shown as such on the Main River Map, and for which the Environment Agency has regulatory responsibilities and permissive powers. |
| Ordinary Watercourse | All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood risk management. However, the riparian owner has the responsibility of maintenance. |
| Pluvial (surface water) flooding | Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity. |
| Resilience Measures | Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances. |
| Resistance Measures | Measures designed to keep flood water out of properties and businesses; could include flood guards for example. |

| | |
|---|---|
| Riparian owner | A landowner whose land lies on or adjacent to a watercourse. |
| Risk | In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring and the consequence of the flood. |
| Risk Management Authorities (RMAs) | Defined in Section 6(13) of the Flood and Water Management Act 2010 as District and Borough Councils, Lead Local Flood Authorities, the Environment Agency, Water Companies, Highways Authorities and Internal Drainage Boards |
| Return Period | An estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time. It should be remembered that the chance of experiencing a flood with a given Return Period is the same for each and every year and is not the actual interval between flood events (see also Annual Exceedance Probability – AEP). |
| Sewer flooding | Flooding caused by a blockage or overflowing in a sewer or urban drainage system. |
| SoP | Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a standard of protection against a 1% AEP flood. |
| Stakeholder | A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities. |
| Strategic Environmental Assessment | Required to assess how a plan or programme might impact or contribute to the achievement of wider environmental objectives (SEA Directive) alongside the Conservation of Habitats and Species Regulations 2010 (HRA) and Water Framework Directive (WFD). |
| SuDS | Sustainable Drainage System - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques |
| Surface water (pluvial) flooding | Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity. |
| SWMP | Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study. |
| Tide locked | The difference in relative water levels of watercourses and tides impacts on drainage assets such as flaps and non-return valves. It causes fluvial flows on tributaries to be prevented from entering the estuary. The effect of high tide levels results in raised water levels in the tributaries which can cause localised flooding. |

# Acronyms

| | |
|---|---|
| AEP | Annual Exceedance Probability (AEP) |
| AIMS | Environment Agency's Asset Information Management System |
| CFMP | Catchment Flood Management Plan |
| CIRIA | Construction Industry Research and Information Association |
| DEFRA | Department for Environment, Food and Rural Affairs |
| EA | Environment Agency |
| EU | European Union |
| FRA | Flood Risk Assessment |
| FRM | Flood Risk Management |
| FRMP | Flood Risk Management Plan (Risk Regulations, 2009) |
| FWMA | Flood and Water Management Act 2010 |
| GiA | Grant in Aid |
| LFRMS | Local Flood Risk Management Strategy |
| LLFA | Lead Local Flood Authority |
| PFRA | Preliminary Flood Risk Assessment |
| SFRA | Strategic Flood Risk Assessment |
| uFMfSW | Updated Flood Map for Surface Water |

# Using this document

**Hyperlinks**

Hyperlinks have been provided where there are useful reference points. These are shown as **green bold text.**

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# 1 Introduction

## 1.1 Background

Following severe flooding in 2007 the Government commissioned a review (The Pitt Review, 2008) to learn from what had happened and to set out what should be done in the future to reduce the risk and impacts of flooding on communities. The review contained 92 recommendations, of which many have now been translated into primary legislation through the enactment of the Flood and Water Management Act 2010 (FWMA).

One of the recommendations (14) was that

'*local authorities should lead on the management of local flood risk, with the support of the relevant organisations*.'

This particular requirement of the FWMA has established Thurrock Council as a Lead Local Flood Authority (LLFA) with responsibility for:

- Developing, maintaining, applying and monitoring a Local Flood Risk Management Strategy (LFRMS) that encompasses all localised sources of flooding.

Flooding from ordinary watercourses, surface water and groundwater are called 'local sources' of flood risk and these were investigated in 2011 during the preparation of the Thurrock Preliminary Flood Risk Assessment (PFRA). The PFRA was prepared to meet the requirements of the Flood Risk Regulations, 2009, which transposed the EU 'Floods Directive' 2007 into English and Welsh Law. The Local Flood Risk Management Strategy is able to make good use of the results obtained in the PFRA.

## 1.2 What is a Local Flood Risk Management Strategy?

This document is the Local Flood Risk Management Strategy (hereinafter referred to as the Flood Strategy) for Thurrock and aims to provide a framework for how we will manage local flood risk. This Local Strategy sets out how we, as the LLFA, alongside other Risk Management Authorities (RMAs), are responding to the flood risk identified in Thurrock.

Our Strategy specifies:

i. the RMAs in Thurrock;

ii. the flood and coastal erosion risk management functions that may be exercised by the RMAs in relation to Thurrock;

iii. the objectives for managing local flood risk;

iv. the measures proposed to achieve those objectives;

v. how the measures are expected to be implemented;

vi. the timeframe for implementing the measures;

vii. the costs and benefits of the measures, and how they will be paid for;

viii. how and when the Strategy is to be reviewed; and

ix. how the Flood Strategy contributes to the achievement of wider environmental objectives.

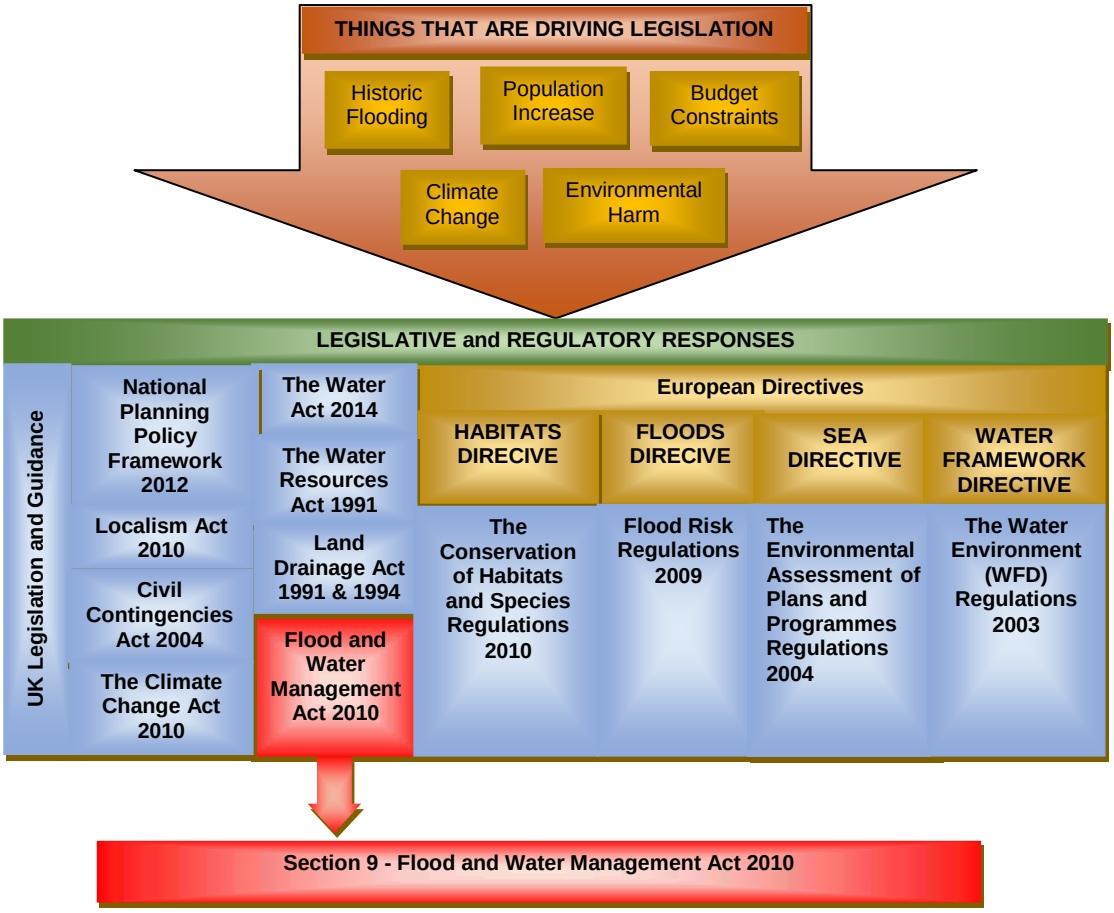
## 1.3 Legislative context

Some of the key legislation that provides the current context to the Flood Strategy is detailed in Table E-2 in Appendix E. Legislation on flood risk sits alongside other legislation pertaining to the water environment and has largely been prepared in response to:

- Historic flooding (such as that described in 2007).
- Increasing population and the need for new housing and infrastructure.
- The effects of climate change (more severe and frequent events that could cause flooding).
- The requirement to protect the environment from harm and where appropriate to make provision for long term improvements.
- A need to identify affordable responses and measures in circumstances where the budget is constrained.

Figure 1-1 shows the drivers, regulatory responses and legislation influencing the Flood Strategy. Summary descriptions of the legislation and guidance can be found in Appendix E. It should also be noted that the Health and Safety at Work Act 1974 and subordinate regulations such as Construction Design and Management 2015 apply to many aspects of the Flood Strategy.

**Figure 1-1 Outline Figure showing other legislation affecting the Flood Strategy**

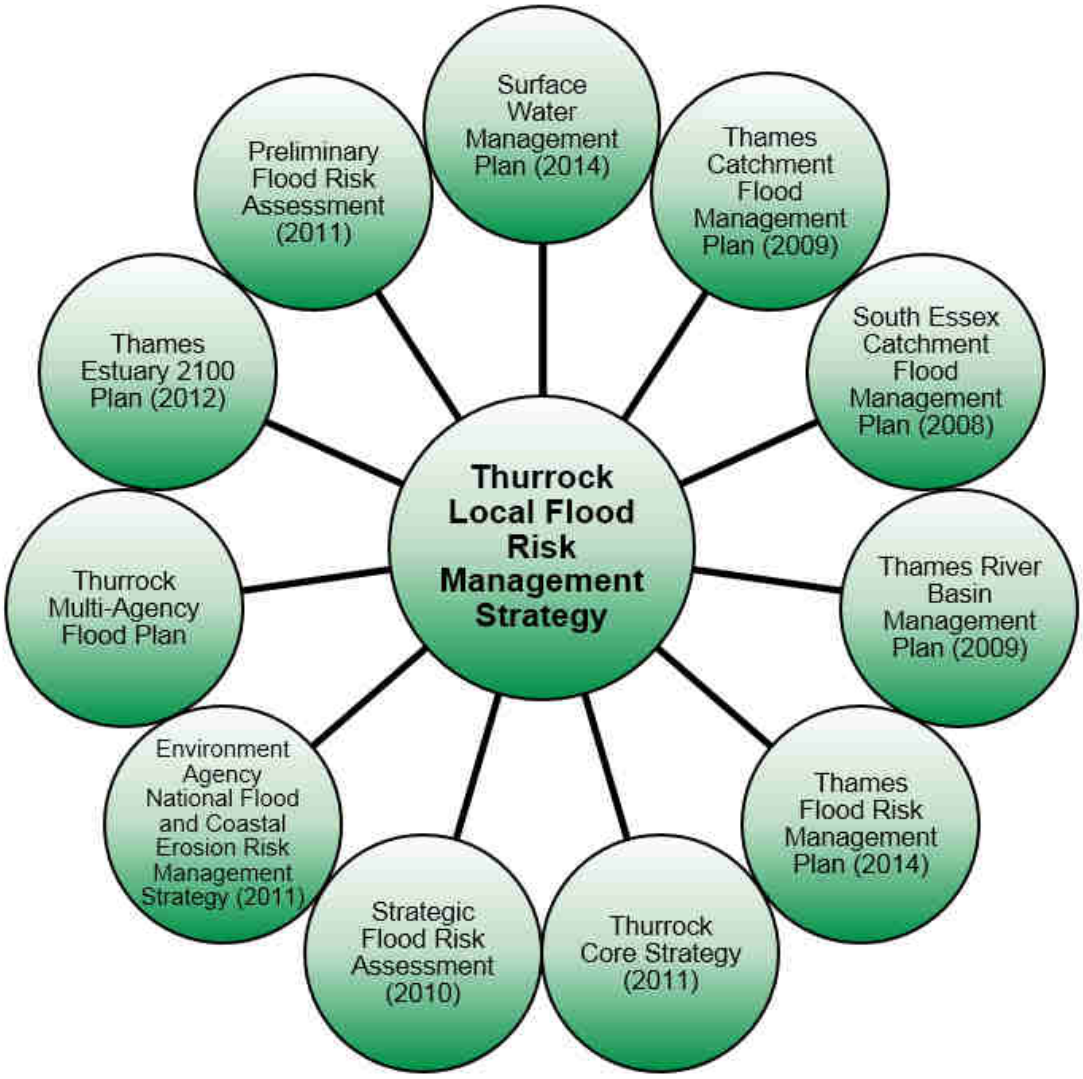



## 1.4 Related documents

Figure 1-2 illustrates a number of different documents that should be considered in conjunction with the Flood Strategy. The list is far from exhaustive and focuses on documents most often used by the LLFA.

These documents contain policies, plans and strategies for the strategic management of flooding and coastal erosion risk at catchment and coastal cell levels. The existing policies in these plans and strategies have been taken into consideration during the preparation of our Flood Strategy to help set the strategic direction of flood risk management within Thurrock, with particular influential policies being described in the AoCD reviews in Appendix B. We will work closely with our partner RMAs to ensure consistency with flood risk management aspirations within Thurrock.

**Figure 1-2 Studies and plans informing the Strategy**




**Preliminary Flood Risk Assessment (PFRA):** The Flood Risk Regulations required Thurrock Council (as the LLFA) to prepare and publish a Preliminary Flood Risk Assessment (PFRA) on past and future flood risk from local sources of flooding. The PFRA does not report flooding from Main Rivers and Reservoirs, which are covered by the Environment Agency, and sub-standard performance of the adopted sewer network (covered under the remit of Anglian Water). The information provided within the PFRA has helped identify areas within Thurrock considered to be at higher risk of flooding which may require actions to manage the risk. The level of local flood risk is below the threshold used to define 'Significant' flood risk and thus there is no requirement under the regulations to prepare a Flood Risk Management Plan for Local Flood Risk.

**Thames Estuary 2100 Plan (TE2100):** TE2100 sets out the Environment Agency's recommendations for flood risk management for London and the Thames Estuary through to the end of the century and beyond. The plan primarily looks at tidal flooding. TE2100 advocates the following policies for policy units within Thurrock:

Action Zone 5 (Middle Estuary) which includes the Swanscombe, Northfleet & Purfleet and Grays & Tilbury policy units: Policy P4 – take further action to keep up with climate change and land use change so that flood risk does not increase.

Action Zone 6 (Lower Estuary Marshes) which includes the East Tilbury & Mucking Marshes policy unit: Policy P3 – continue with existing or alternative actions to manage flood risk, accepting the likelihood of flooding will increase in the future due to climate change.

Action Zone 7 (Lower Estuary, Urban/industrial and Marshland) which includes the Shell Haven & Fobbing Marshes Policy unit: Policy P3 - continue with existing or alternative actions to manage flood risk, accepting the likelihood of flooding will increase in the future due to climate change (with secondary defence arrangements at key sites).

Our Flood Strategy has taken the TE2100 policies into account during its preparation which include setting out proposed actions in our Programme and Strategic Investment Plan to investigate and improve drainage systems in the Purfleet, West Thurrock and Tilbury areas. As we develop these actions during the Strategy period we will undertake local consultation and appraisal and identify and work with potential project partners to ensure they are consistent with the TE2100 policies.

**Catchment Flood Management Plans (CFMPs):** Catchment Flood Management Plans are high-level strategic plans providing an overview of flood risk across each river catchment. The Environment Agency use CFMPs to work with other key-decision makers to identify and agree long-term policies for sustainable flood risk management.

There are six pre-defined national policies provided in the CFMP guidance and these are applied to specific locations through the identification of 'Policy Units'. These policies are intended to cover the full range of long-term flood risk management options that can be applied to different locations in the catchment.

The Thames and the South Essex CFMPs have assigned a Policy 4 to the policy units covering the Thurrock area. Policy 4 applies to areas of "low, moderate or high flood risk where we [the Environment Agency and other RMAs] are already managing the flood risk effectively but where we may need to take further action to keep pace with climate change".

When developing the actions set out in the Programme and Strategic Investment Plan we will assess them against the CFMP policies to ensure a holistic, catchment approach, seeking opportunities to work in close collaboration with partner RMAs to ensure consistency in strategic flood risk management across Thurrock and neighbouring areas.

**Thames River Basin Management Plan (RBMP):** RBMPs identify the pressures facing the water environment in a River Basin District and the actions that will address them. The Thames RBMP sets out the current quality of water bodies in the Borough and describes the objectives for making further improvements to the ecological and

chemical quality. Thurrock lies in the South West Essex catchment of the RBMP.

As we develop the actions set out in our Flood Strategy we will seek to encompass compliance with wider environmental objectives and targets (e.g. those set out by Water Framework Directive and the RBMP) by considering whether water bodies and protected areas are suitably protected and that the implementation of any scheme where feasible enhances existing waterbodies. Further detail on how we have taken the WFD and RBMP into consideration is provided in Section 6.3.3.

**Thames Flood Risk Management Plan (FRMP):** FRMPs are required under the provisions of the EU Floods Directive. They identify the risk from flooding on a catchment scale and set out objectives and measures for managing that risk. They aggregate information about all sources of flooding (and coastal erosion where applicable) to better inform prioritisation, decision making and work programming. Thurrock falls within the South Essex Catchment in the FRMP. The FRMP sets out a series of overarching social, economic and environmental objectives for the South Essex Catchment, including:

- Reduce the risk of flooding to communities, where possible
- Raise community awareness and understanding of all sources of flooding
- Enhance recreation and general amenity across the catchment
- Ensure development and redevelopment in areas at risk of flooding is appropriate, does not increase flood risk and reduces risk where possible
- Promote the use of sustainable drainage systems in development to help reduce pressure on existing drainage networks
- Protect and enhance biodiversity through flood risk management schemes
- Restore naturally functioning river systems where possible
- Promote sustainable land use management to land owners across the catchment to achieve reductions in flood risk

The actions identified during the action planning process have the potential to contribute to the achievement of a number of the FRMP objectives. As we work through the Flood Strategy programme and develop our actions, we will continue to ensure our plans are consistent with the wider objectives set out in the FRMP and will work with partner RMAs to ensure a holistic, catchment approach to managing flood risk. At the time of preparation of the LFRMS the draft version of the FRMP has been through public consultation.

**National Flood and Coastal Erosion Risk Management Strategy:** The overall aim of the National Flood and Coastal Erosion Risk Management Strategy for England is to make provision for the

coordinated management of the risk of flooding and coastal erosion. The National Strategy sets out five National Objectives for the management of flood and coastal erosion.

The Local Objectives set out in the Flood Strategy were formulated by the Thurrock Flood Partnership with due consideration of the National Objectives, so that the objectives and actions in our Local Strategy are consistent with the National Objectives. Many of our objectives are consistent with multiple National Objectives. More detail is provided in Section 4.

**Thurrock Surface Water Management Plan:** Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are undertaken, when required, by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. SWMPs establish a long-term action plan to manage surface water in a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments. The modelling undertaken for the SWMP has been used to assess surface water flood risk in Thurrock and identify Areas of Critical Drainage (AoCD). The action plan from the SWMP has been used as the basis for the Flood Strategy Programme and Strategic Investment Plan.

**Thurrock Core Strategy:** The Thurrock Core Strategy and Policies for Management of Development was adopted by Thurrock Council in 2011; it set out the spatial vision, strategy and planning policies for Thurrock up to and beyond 2026. In February 2014 it was agreed a new Local Plan for Thurrock will be prepared, replacing the 2011 Core Strategy. Actions have been included within our Flood Strategy and Programme and Strategic Investment Plan to work with planning colleagues to ensure policies are in place in the new Local Plan to ensure future development does not have a detrimental impact on flooding or the wider environment, in Thurrock and neighbouring areas.

**Thurrock Strategic Flood Risk Assessment (SFRA):** SFRAs provide a strategic assessment of flood risk across an area. Their primary objective is to support a local planning authority undertake the Sequential Test in line with the National Planning Policy Framework and to provide an evidence base for Local Plans. It assists with the development of sustainable development policies and integrating flood risk management into the spatial planning of the area.

**Thurrock Multi-Agency Flood Plan:** Multi-agency flood plans are designed to aid responders in delivering an effective and coordinated response to flooding. They set out arrangements and provide information for a multi-agency response to a flood event. In addition to the actions within our Programme and Strategic Investment Plan specifically aimed at working with emergency planners and other partners to facilitate emergency planning, other actions will also contribute to emergency planning within Thurrock, through improving

understanding of flood risk as well as closer working, data sharing and cooperation between partners.

## 1.5 How the Local Strategy is set out

| Chapter | Title / Description |
|---|---|
| 2 | **How will we work together to manage flood risk**<br>*Sets out the roles and responsibilities of RMAs and non RMAs regarding flood risk, as well as the governance and scrutiny of the document.* |
| 3 | **Local flood risk**<br>*Describes the sources of local flood risk in Thurrock and sets out how this may change in the future* |
| 4 | **Objectives and measures**<br>*Sets out the LFRMS objectives as well as the Environment Agency's national objectives* |
| 5 | **Funding**<br>*Details the different potential sources of funding for flood risk management* |
| 6 | **Delivery**<br>*Describes how the Flood Strategy will be delivered over the Strategy period. Summarises borough-wide actions as well as Area of Critical Drainage specific actions. Includes some examples of where we have already carried out some of the actions.* |
| 7 | **Reviewing the Local Strategy**<br>*Sets out how the Local Strategy will be reviewed throughout the Flood Strategy period* |
| 8 | **Environmental Assessment**<br>*Sets out the Environmental Assessment process and summarises the key documents produced.* |
| Appendix A | **Annual Action Plan**<br>*To be updated annually* |
| Appendix B | **Flood risk maps**<br>*Series of flood risk maps for different sources of flooding.*<br>*Summaries of the Areas of Critical Drainage* |
| Appendix C | **Communication and engagement**<br>*Summarises the communication and engagement undertaken for the Local Strategy including questionnaire responses.* |
| Appendix D | **Strategic Environmental Assessment**<br>*SEA Reports* |
| Appendix E | **Legislative context**<br>*Summarises the legislation relevant to the Local Strategy* |

| Chapter | Title / Description |
|---|---|
| Appendix F | Ordinary watercourse enforcement protocol |
| Appendix G | Sustainable Drainage Systems Guidance |
| Appendix H | LFRMS Programme and Strategic Investment Plan |

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# 2 How will we work together to manage flood risk

## 2.1 Introduction

The roles and responsibilities of Risk Management Authorities are clearly set out in the relevant legislative documents and guidance provided in Appendix E.

This chapter provides an overview of these roles and responsibilities, as well as information on how we will work with other organisations to sustainably manage flood risk, both now and into the future.

## 2.2 Roles and responsibilities

### 2.2.1 Thurrock Council

Our role in managing flood risk was extended with the introduction of the Flood and Water Management Act 2010, when we became an LLFA. The new duties for us as an LLFA include:

- Local Flood Risk Management Strategy: We must develop, maintain, apply and monitor a Flood Strategy (this document) to outline how we will manage flood risk, identify areas vulnerable to flooding and target resources where they are needed most.
- Flood Investigations: When appropriate and necessary we must investigate and report on flooding incidents in Thurrock.
- Register of Flood Risk Features: We must establish and maintain a register of structures or features which, in our opinion, are likely to have a significant effect on flood risk in Thurrock.
- Designation of Features: We may exercise powers to designate structures and features that affect flood risk, requiring the owner to seek consent from the authority to alter, remove or replace it.
- Consenting: When appropriate we will perform consenting of works on ordinary watercourses.
- Sustainable Drainage Systems (SuDS): We have a statutory consultee role for assessing and commenting on surface water drainage proposals on large developments (developments of 10 properties or more). Guidance on SuDS is provided in Appendix G.

When carrying out our flood risk management role we must co-operate with other relevant authorities and have actively participated in the formation of new partnerships with other RMAs (we lead the Thurrock Flood Partnership and attend the Essex Flood Officers' Group).

The changes also mean we must work more efficiently and effectively, so where necessary all strategies, proposals, policies and actions in Thurrock take consideration of the objectives contained in this Flood Strategy.

In particular, we will coordinate our actions with other departments, including Highways, Development Management and Emergency Planning, as well as other RMAs; to make best use of available resources, prevent inappropriate development and support and inform preparations for flood emergencies, tactical responses and recovery following flood events.

### 2.2.2 Thurrock Flood Partnership

The Thurrock Flood Partnership was set up in 2014, as a central point where flood risk issues in Thurrock are reviewed and appropriate action agreed. The Partnership is made up of representatives from Council departments as well as key stakeholders such as the Environment Agency, Essex Fire and Rescue, Anglian Water and neighbouring LLFAs.

### 2.2.3 Environment Agency and flood risk

The Environment Agency has a strategic overview role for the management of flood risk from all sources, as well as responsibilities for the prevention, mitigation and remedying of flood damage for Main Rivers, the Sea and reservoirs.

The EA is responsible for developing, maintaining and monitoring a National Flood and Coastal Erosion Risk Management Strategy and this Flood Strategy has been developed to be consistent with this document.

The EA has permissive powers to work on Main Rivers and the sea to manage flood risk. However, it does not have to maintain or construct new works. It is also unlikely to maintain a watercourse to improve the amenity of a river or to stop erosion that does not affect flood risk.

The EA enforces the Reservoirs Act 1975. Although the responsibility for reservoir safety lies with the reservoir owners (the Act refers to owners as 'undertakers'), the EA is responsible as the Enforcement Authority of reservoirs in England and Wales that are greater than 25,000$m^3$ and must ensure flood plans are produced for specified reservoirs where the risk to people would be high if there was a problem with the dam.

The EA is also responsible for establishing and maintaining a register of reservoirs. The FWMA introduced the possibility that the regulations applying to reservoirs of 25,000 $m^3$ capacity or greater could also apply to smaller reservoirs of greater than 10,000 $m^3$ capacity, but on the basis of the available information Defra decided in February 2015 that it is not possible to make this change without potentially introducing unjustifiable costs[1]. Instead Defra has commissioned further research to determine whether the decision on regulation should be changed in the future.

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/406700/reservoir-safety-201502.pdf

The EA issues flood warnings on sections of Main River and the coast, as well as monitoring and supporting emergency responders when flooding occurs.

Under the Water Resources Act 1991 and through their Land Drainage and Sea Defence Byelaws, the EA is responsible for controlling works which affect Main Rivers and flood defences.

The EA provide advice to Government on flood and coastal erosion risk as well as technical and administrative support to the Regional Flood and Coastal Committees (RFCC).

The EA also provide support to LLFAs by providing data and guidance on assessing, planning and carrying out flood risk management for flooding from ordinary watercourses, surface runoff and groundwater; for example, the updated Flood Map for Surface Water and Areas Susceptible to Groundwater flooding datasets, climate change guidance, and **flood and coastal erosion risk management appraisal guidance**. Further information on guidance documents for LLFAs, other RMAs and local authorities is provided on the **Defra website**.

The Environment Agency has many other functions, in particular with respect to water quality, the environment, climate change and sustainability and which will also involve partnership working with Thurrock.

### 2.2.4 Water and sewerage undertakers

Anglian Water is responsible for managing the risk of flooding from foul and surface water sewers. These responsibilities may be carried out in partnership with others, for example working with developers or landowners to reduce input into sewers through sustainable drainage. Water and sewerage companies have the following flood risk management responsibilities

- To respond to flooding incidents involving their assets
- To maintain a register of properties at risk of flooding due to overloading of sewerage infrastructure and undertake improvements to alleviate sewer flooding problems
- To provide, maintain and operate public sewer systems
- To cooperate with other RMAs
- Have a duty to adopt private sewers

Essex and Suffolk Water are responsible for flooding from burst water mains in its area. Water and sewerage company businesses are regulated by the Water Services Regulation Authority (OfWAT). OfWAT's role is to monitor and review the performance of the Water and Sewerage companies so they meet customer requirements

### 2.2.5 Highways Authority

Thurrock Council as Highways Authority is responsible for the provision and management of highways drainage under the Highways Act

(1980). This excludes motorways and trunk roads that are the responsibility of the Highways England.

Owners of land adjoining a highway have a common law duty to maintain ditches.

### 2.2.6 Infrastructure and utility providers

These may include energy companies, telecommunication companies, Network Rail and Highways England. Although not RMAs, assets owned by these providers may play an important role in flood risk management, for example ownership and maintenance of culverts. Highways England is currently investigating and consulting on options for a new Lower Thames crossing to the east of London. This may have a potential impact on the Thurrock area as well as involving significant investment.

### 2.2.7 Neighbouring LLFAs

Neighbouring authorities are responsible for carrying out duties under the FWMA within their own authority boundaries. They have a mutual duty to cooperate with neighbouring LLFAs in the undertaking of flood risk management duties and to address cross boundary flood management issues. Neighbouring LLFAs for Thurrock include Havering London Borough Council, Bexley London Borough Council, Medway Borough Council, Kent County Council and Essex County Council.

In addition to working with neighbouring LLFAs through the Thurrock Flood Partnership, Thurrock Council is a member of the Essex Flood Partnership with the aim of contributing to a strategic overview of flooding matters in Essex.

### 2.2.8 Riparian owners

Owners of land adjoining a watercourse, 'riparian owners', have certain rights and responsibilities including:

- maintaining river beds and banks;
- allowing the flow of water to pass without obstruction; and
- controlling invasive alien species e.g. Japanese knotweed.

More information about riparian owner responsibilities can be found in the Environment Agency publication **'Living on the Edge' (2012)**.

### 2.2.9 Property owners and residents

Flooding can occur despite all organisations meeting their responsibilities. It is therefore important that householders and businesses who are at risk of flooding take steps to protect their property. This may include ensuring the property is protected from flooding, is resilient to flooding or that preparations have been made in the event of a flood.

A public survey was undertaken in January 2015 to allow residents to provide information on their own experiences of flooding within

Thurrock as well as their thoughts on management of flood risk, flood risk funding and what actions they would consider undertaking to manage flood risk.

Members of the public were also given the opportunity to comment on this Flood Strategy during the public consultation that took place in summer 2015.

## 2.3 Governance and scrutiny

### 2.3.1 Thurrock Overview and Scrutiny Committee

The Flood Strategy will be reviewed and approved by Cabinet and subject call-in through the Council's scrutiny procedures. Scrutiny ensures that the decision making process is clear and accessible to the public, allowing members of the community and Councillors to influence policy development and improve public service delivery.

### 2.3.2 Thurrock Flood Partnership

The Thurrock Flood Partnership meets twice a year where flooding issues in Thurrock are reviewed and appropriate action agreed. The aim of the Partnership is to ensure a long-term sustainable approach to flood management in Thurrock, ensuring appropriate accountability and co-ordination between relevant stakeholders.

### 2.3.3 Key Stakeholders

The EA, Essex Fire and Rescue Service and Anglian Water have contributed to the Flood Strategy; enhanced partnership working will be important for delivery of the measures identified in the Action Plan (see Appendix A).

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# 3 Local Flood Risk

## 3.1 What is flood risk?

A flood as formally defined in the FWMA:

*'includes any case where land not normally covered by water becomes covered by water'* and can be the result of water emanating from a number of sources.

Flooding can be caused by a range of sources; including heavy rainfall, rivers overflowing or banks being breached, dams overflowing or being breached, tidal waters, or groundwater. A flood does not include water from any part of the sewerage system unless it is wholly or partially caused by an increase in the volume of rainwater (including snow and other precipitation) entering or otherwise affecting the system. Nor does it include flooding caused by a burst water main (since these events are looked after by Essex and Suffolk Water).

In the context of the Flood Strategy, local flooding is from surface runoff, groundwater and ordinary watercourses.

**Flood risk**

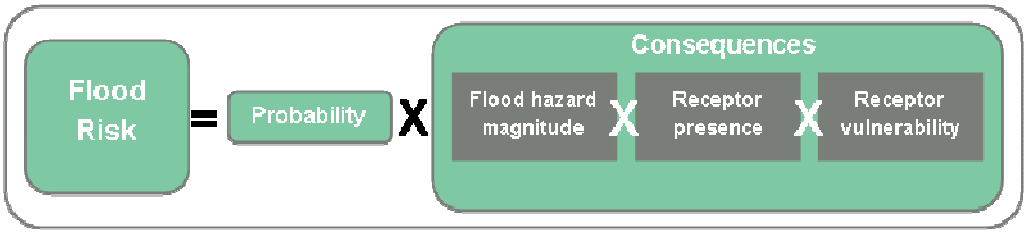
Flood risk can be described as the combination of the chance or probability of a flood occurring (often expressed as a chance in any one year or Annual Exceedance Probability AEP) and the scale of its potential consequences or impact (for example, the effect on people, homes, infrastructure and the environment).

It is possible to define flood risk as:

**Flood Risk = (Probability of a flood) x (scale of the consequences)**

This definition is illustrated in Figure 3-1.

**Figure 3-1 Flood risk definition**




Using this definition it is seen that flood risk can be increased by

- Increasing the probability or chance of a flood being experienced
- Increasing the severity of the consequences by
    - Increasing the flood hazard magnitude
    - Increasing the number of receptors affected
    - Increasing the vulnerability of the receptors

## 3.2 History of flooding in Thurrock

The Thurrock PFRA presents a history of flooding in Thurrock. The South Essex area has suffered two major flood events; in 1928 and 1953. In 1953 a major storm surge coincided with a high spring tide and resulted in wide spread flooding. Flood levels at Tilbury reached six feet above its predicted level and inundation depths were approximately 2-3 metres. Flood defences were improved in response to these major floods, including barriers at Purfleet, Grays, Tilbury, and Tilbury Fort amongst others. Many kilometres of raised walls in both the upper and lower reaches of the Thames Estuary were also erected. Flood warning systems have also been improved.

Other incidents of flooding in Thurrock since 1953 include a period between December 2002 and January 2003, in Bulphan and in Tilbury, and most recently in 2014 in Tilbury.

## 3.3 What are the local sources of flooding?

Thurrock is affected by flooding from a number of local sources including

- Surface water (overland flow and surface runoff)
- Ordinary watercourses
- Sewer (from pipe, pumping station and manhole systems)
- Groundwater

In addition to these local sources, Thurrock is also at risk from Main River and the sea.

Flooding can occur due to a combination of different sources, so it is important that our Flood Strategy describes all types of flooding.

This section of the Flood Strategy describes the sources of local flooding that result in the most notable risks.

### 3.3.1 River and Sea flooding

Flooding from rivers (fluvial) and channels happens when they overflow and overtop. This type of flooding often occurs following heavy or prolonged rainfall, which causes river levels to increase and the river channels not having enough capacity to contain the flow. Fluvial flooding can also be the result of blockages or obstructions.

Flood risk in rivers can also be affected by the sea level as this can cause high water levels along rivers that flow into the sea. This effect is called ‘tide locking’ and in Thurrock can be caused by high water levels in the Thames Estuary. High tide levels that increase flood risk can happen when normal tide levels are raised due to the effects of high pressure weather systems and high winds resulting from storms.

Rivers in England and Wales are divided into two categories; Main Rivers or ordinary watercourses.

As LLFA, Thurrock Council is responsible for the management of flood risk from ordinary watercourses whilst the EA is responsible for the management of flood risk from Main Rivers.

The location of recorded ordinary watercourses in Thurrock is shown in Figure 3-2.

'Ordinary Watercourses' are generally smaller rivers, ditches and streams such as Running Water Brook which flows through Belhus Woods Country Park on the western boundary of the Borough. These watercourses tend to form the upper reaches of watercourses before they become Main River; or are small, unnamed watercourses and drains that flow into Main Rivers. In the Borough's marshland they also form an extensive network of channels that provide storage when gravity outfalls are tide locked such as within the Tilbury and Aveley Marshes.

The flood risk from the majority of these ordinary watercourses is not covered by the Environment Agency's flood maps; however, the uFMfSW can give an indication of possible flood extents.

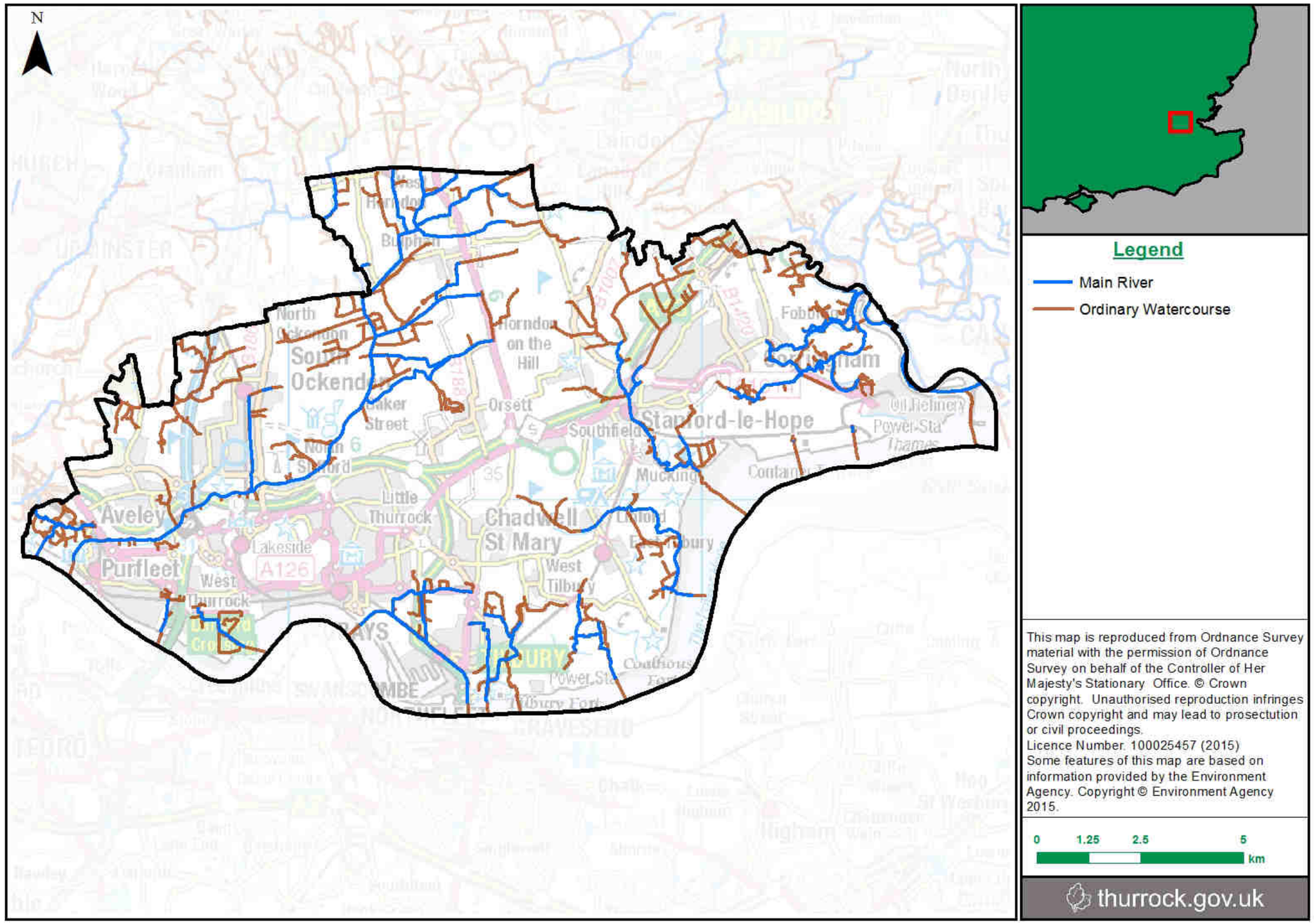
The uFMfSW indicates that the ordinary watercourses which are likely to have the biggest flood extents are primarily located in the Orsett Ward, forming the network of drains in the upper reaches of the Mar Dyke catchment. Also, the Homesteads ward where they flow through the north of Stanford-le-Hope, and in the Corringham and Fobbing Ward where they form a network of drains in the Fobbing Marshes. However, with the exception of Stanford-le-Hope, these wards are less densely populated and hence, fewer properties are likely to be at risk.

The responsibility for maintenance of ordinary watercourses falls to riparian owners who own land on either bank. Thurrock Council is only responsible for ordinary watercourses where land on either bank is in Council ownership or where historical agreements have been made.

Thurrock Council, as the LLFA, has certain permissive powers for enforcement on watercourses that have not been designated as Main River, as well as to undertake flood defence works under the Land Drainage Act 1991 and Public Health Act.

Further information on the Council's ordinary watercourse enforcement protocol is provided in Appendix F.

**Figure 3-2 Ordinary watercourse locations in Thurrock**



### 3.3.2 Surface water flooding

Surface water flooding is often referred to as 'pluvial' flooding. This flooding occurs when heavy rainfall exceeds the capacity of local drainage networks, resulting in water flowing across the ground or ponding in low lying areas and localised depressions. Thurrock has experienced localised pluvial flooding, particularly during episodes of summer extreme rainfall in 2007, 2008, 2009 and 2013/14. These events led to pluvial flooding and were a reminder of the fragility of local infrastructure and existing drainage systems to deal with heavy rainfall.

Whilst the Council in its capacity as LLFA has overall responsibility for leading on the management of surface water flood risk, no single organisation has responsibility for all surface water flooding infrastructure. Different aspects of the drainage system are the responsibility of a range of organisations including the Highway Authority (Thurrock Council), Anglian Water, riparian owners and Highways England.

Surface water drainage in the north of the Borough is directed to field and roadside drainage ditches that discharge into local watercourses. The maintenance of these networks falls primarily to riparian owners. Aveley, South Ockendon, Orsett and Horndon on the Hill are served by a separate surface water and foul water system. Bulphan has a formal foul water network.

The surface water system in the south of the Borough is discharged either through World's End Pumping Station (which serves Tilbury) or via gravity outfalls with non-return valves on the seaward side. The West Tilbury Marshes are an extensive system of drainage channels and ditches that temporarily store local surface water runoff prior to discharge through an outfall.

The Environment Agency, in partnership with LLFAs, has produced the updated Flood Map for Surface Water (uFMfSW) which shows the locations where surface water flooding is predicted to occur. This mapping is available to view on the EA's website.

In order to better understand surface water flooding in Thurrock we have undertaken further assessment through an update to the 2014 Surface Water Management Plan (SWMP). The results from the updated SWMP modelling have been used alongside the uFMfSW in our assessments and mapping during the preparation of our Flood Strategy. An overview map of surface water flood risk across the Borough is provided in Figure 3-3.

The mapping shown within this report is intended to identify broad areas which are more likely to be vulnerable to surface water flooding. Working with our partners we are able to undertake more detailed analysis in areas which are most vulnerable to surface water flooding. It should be noted that these maps only show the predicted likelihood of surface water flooding (this includes flooding from drains, small watercourses and ditches that occurs in heavy rainfall in urban areas)

for defined areas. Due to the coarse nature of the source data used, the maps are not detailed enough to define risk for individual addresses. Individual properties therefore may not always face the same chance of flooding as the areas that surround them.

Surface water flood risk is widespread across Thurrock, with the highest risk located in the more urbanised areas of the administrative area, and in areas where water ponds behind railway embankments such as at Balstonia in Stanford-le-Hope and the railway embankment as it runs through Grays Riverside and West Thurrock and South Stifford wards.

The surface water flooding shows a significant amount of transport infrastructure in Thurrock to be at risk from surface water flooding including the A126 (London Road), and the A13

A summary of the number of properties predicted by the modelling to be at risk from surface water flooding in each Thurrock ward is shown in Table 3-3.

**Aveley and Uplands ward:** surface water flood risk is mainly concentrated around Aveley and Purfleet Industrial Park. Risk of flooding to property is relatively low, in comparison with other wards, with flooding predominantly affecting roads including the A13, Purfleet Road, High Street and Stifford Road, as well as roads around Purfleet Industrial Estate.

**Belhus ward:** surface water flood risk is mainly concentrated around South Ockendon and the rural area to the east of the ward. Risk of flooding to property is relatively low in the 3.33% AEP and 1% AEP events; however, the number of properties at risk increases considerably in the 0.1% AEP event. In addition to property, surface water also affects roads in this ward including the B1335 (Stifford Road) and South Road as well as numerous residential streets in South Ockendon. The road leading to Arcadia is also at risk of surface water flooding which could lead to this area becoming cut off in a flood event.

**Chadwell St Mary ward:** surface water flood risk mainly affects property and smaller roads within Chadwell St Mary. The surface water mapping shows Brentwood Road to be at significant risk with flooding potentially affecting much of its length, as is the Chadwell By-Pass. Risk to property is higher in the north and the south east of the ward around residential roads located off of Brentwood Road, Heath Road and Linford Road. Flooding is also shown to affect the industrial estate off of Sandy Lane.

Surface water flooding in Orsett Heath is mainly confined to Parm Road and Gowers Lane.

**Chafford and North Stifford ward:** surface water flood risk predominantly affects the south of the ward at Chafford Hundred with many smaller roads affected. Properties are at risk throughout Chafford Hundred, with higher concentrations at Catalina Avenue and Bark Burr Road, and Frobisher Gardens and Sachfield Drive.

The A1306 is also affected along some of its length as it passes through this ward, particularly at the roundabout junction with the A1012.

**Corringham and Fobbing ward:** this ward is predominantly rural; although the mapping shows large areas of surface water flood risk, the majority of the risk is to rural land where there are a few isolated properties. The main urban area within this ward is the eastern areas of Corringham. Surface water flood risk to properties is concentrated around Lampits Hill, Fobbing Road and Giffords Cross Avenue, with other residential streets also affected.

The Stanford-le-Hope by-pass is significantly affected by flooding as it passes through this ward, particularly around the junction with the A176, B1464 and B1420.

**East Tilbury:** similarly to Corringham and Fobbing ward, this ward is predominantly rural, therefore much of the risk is to rural land and isolated properties. The main urban areas are East Tilbury and Linford, where a number of properties are shown to potentially be at risk. These properties are predominantly located in East Tilbury.

Although main road transport routes are shown to be largely unaffected by surface water flooding, the mapping does show surface water backing up behind the railway embankment in several locations in this ward.

**Grays Riverside ward:** Grays Riverside ward is shown to be at significant risk of surface water flooding with a large number of properties at risk. Risk of surface water flooding is widespread throughout the ward; however, there is a concentration of risk around London Road and Hathaway Road. The concentration of risk along London Road may potentially be a result of surface water flooding backing up behind the railway embankment.

**Grays Thurrock ward:** similar to Grays Riverside, the Grays Thurrock ward is also at significant risk of flooding, with surface water risk widespread throughout the ward. There is a noticeable risk to Hathaway Road and properties along its length. An area of surface water is also shown to build up behind the railway embankment near Bridge Road.

**Little Thurrock Blackshots ward:** the Little Thurrock Blackshots ward is less densely urbanised than the Grays Thurrock and Riverside wards hence less properties are shown to be at risk from surface water flooding. Surface water flooding is concentrated along residential roads. There is also some flooding shown to King Edwards Drive, Blackshots Lane and the A1013. The mapping also shows an area of land north of the Lodge Lane roundabout where surface water flooding ponds.

**Little Thurrock Rectory ward:** despite the urban nature of this ward the number of properties at risk from surface water flooding is relatively low. There is a band of surface water flood risk through the centre of the ward; however, this affects a relatively low number of properties.

The main areas of risk are areas off of Southend Road in the north of the ward, and Rectory Road in the south of the ward. Of the main transport routes, the B149 and A126 are shown to be affected by surface water flooding along much of their length.

**Ockendon ward:** the number of properties at risk from surface water flooding in Ockendon ward is relatively low due to the ward being predominantly rural. Much of the surface water risk in this ward is located to the east and west in the rural areas where it is mainly isolated properties at risk. The main urban area at risk is Ockendon where surface water flooding is fairly evenly distributed throughout the area.

Although surface water is not shown to significantly affect the M25, mapping shows ponding of surface water either side of the motorway embankment.

**Orsett ward:** one of the largest wards in Thurrock, Orsett ward is predominantly rural. The mapping shows surface water flooding is widespread throughout the ward due to the drainage network in the upper reaches of the Mar Dyke catchment. The main urban areas at risk from surface water flooding are Bulphan, Horndon on the Hill, Orsett and Southfields. Transport routes shown to be at risk from surface water flooding include the A128 and the Stanford-le-Hope bypass.

**South Chafford ward:** although quite densely urbanised, the risk of surface water flooding in this ward is relatively low. The majority of the risk is located in the west and the south of the ward.

**Stanford East and Corringham Town ward:** much of the surface water flood risk to this ward is located along the ward boundaries, particularly the boundary with The Homesteads ward along the entire length of Southend Road as it runs through the ward. Other areas shown to be at risk from surface water flooding is north of the A1014 by the roundabout junction with The Sorrells and near Gifford Cross.

**Stanford-le-Hope West ward**: with the exception of Stanford-le-Hope in the north-west, this ward is predominantly rural. The main surface water risk is to Stanhope Industrial Park and the town of Stanford-le-Hope. The surface water flood risk in Stanford-le-Hope is concentrated in the areas either side of the railway embankment where it runs through the town, along the Stanford Brook and areas around Corringham Road. At Stanhope Industrial Park, surface water is shown to build up either side of the railway embankment. The A1014 (The Manorway) is also shown to be at risk from surface water flooding along much of its length in this ward.

**Stifford Clays ward:** the majority of surface water flood risk to property is located in the south of the ward, south of the A13. North of the A13 is predominantly rural with a few isolated properties. The level of surface water flood risk to property in this ward is relatively low; whilst risk to roads is fairly widespread across the ward, the risk is

largely confined to the roads, with the majority of property risk located in the southern most extent of the ward in side roads off of Long Lane.

**The Homesteads ward:** the Homesteads ward has the highest number of properties at risk from surface water flooding of all the wards in Thurrock. Mapping shows the risk is concentrated in two bands running north east to south west through the ward. The first band runs along Southend Road, the second band runs from the Stanford-le-Hope bypass, through Balstonia towards the A1014. In addition to the properties at risk, transport routes including the A13 and A1014 are also shown to be at risk. The mapping also shows surface water ponding in a number of locations behind the railway embankment to the south of the A13.

**Tilbury Riverside and Thurrock Park ward:** Surface water flood risk in this ward is mainly located in Tilbury, Tilbury Docks and Thurrock Park. Tilbury Power Station is also shown to be at slight risk from surface water flooding.

Of the transport networks in the ward, the mapping shows some risk to the railway into Tilbury Docks. The main rail route is largely unaffected, but surface water is shown to pond either side of the railway embankment in a number of places. Dock Road and St Chads Road (A126) are largely unaffected.

**Tilbury St Chads ward:** despite this ward being quite rural, there is a large number of properties potentially at risk from surface water flooding. These properties are mostly located throughout Tilbury. Dock Road and St Chads Road (A126) are largely unaffected; however, mapping shows Marshfoot Road to be at risk from surface water flooding along the majority of its length.

**West Thurrock and South Stifford ward:** surface water flood risk in this ward is quite high due to the large number of residential and non-residential properties. Surface water is shown to pond around a number of the industrial units throughout the ward, as well as either side of the railway embankment along much of its length. Although the A282 is shown to be largely unaffected, other main routes including the A1090, A126 and the Purfleet Bypass are shown to be at risk from surface water flooding.

**Table 3-1 Number of properties at risk – surface water flooding***

| Ward | Surface water risk | | |
|---|---|---|---|
| | 1 in 30 year | 1 in 100 year | 1 in 1,000 year† |
| Aveley and Uplands | 36 | 36 | 129 |
| Belhus | 0 | 0 | 221 |
| Chadwell St Mary | 174 | 183 | 408 |

| Ward | Surface water risk | | |
|---|---|---|---|
| | 1 in 30 year | 1 in 100 year | 1 in 1,000 year† |
| Chafford and North Stifford | 87 | 93 | 216 |
| Corringham and Fobbing | 101 | 102 | 294 |
| East Tilbury | 118 | 122 | 201 |
| Grays Riverside | 375 | 386 | 818 |
| Grays Thurrock | 285 | 313 | 623 |
| Little Thurrock Blackshots | 29 | 30 | 158 |
| Little Thurrock Rectory | 197 | 207 | 319 |
| Ockendon | 0 | 0 | 385 |
| Orsett | 65 | 68 | 503 |
| South Chafford | 94 | 94 | 209 |
| Stanford-le-Hope West | 261 | 277 | 476 |
| Stanford East and Corringham Town | 107 | 112 | 383 |
| Stifford Clays | 35 | 35 | 128 |
| The Homesteads | 256 | 279 | 955 |
| Tilbury Riverside and Thurrock Park | 147 | 152 | 367 |
| Tilbury St Chads | 269 | 284 | 662 |
| West Thurrock and South Stifford | 542 | 552 | 901 |
| **Total** | **3,178** | **3,325** | **8,356** |

* property counts are based on results from the updated SWMP modelling. As the updated SWMP modelling did not cover the entire Thurrock area, the uFMfSW was used for property counts in the areas not covered by the SWMP results. Properties were counted based on the following criteria, in line with the property count methodology used with the uFMfSW.

- Flood depths are greater than 150mm and 50% or greater of the wetted perimeter of the property was flooded; or
- Flood depths are greater than 300mm and 25% or greater of the wetted perimeter of the property was flooded.

† The updated SWMP modelling was not undertaken for the 1 in 1,000 year; therefore the results from the uFMfSW were used for this probability event.

14 Areas of Critical Drainage (AoCD) were identified as part of the original SWMP (Figure 3-3).

AoCDs are a discrete geographical area where multiple sources of flood risk may cause flooding during severe weather, affecting people, property or infrastructure. The locations covered by AoCDs in Thurrock include Purfleet, West Purfleet, West Thurrock Lakeside,

Grays, Little Thurrock Marshes, Tilbury, East Tilbury, Stanford-le-Hope, Bulphan, Orsett, South Ockendon, Aveley and West Thurrock. Further details of these AoCD including maps and numbers of properties at risk are provided in Appendix B.

The South Essex CFMP provides details of past surface water flood events. Between December 2002 and January 2003, surface water flooding was recorded to have affected several houses in Bulphan in the upper Mardyke valley, as well as several houses in Tilbury.

**Figure 3-3 Surface water flood risk in Thurrock**

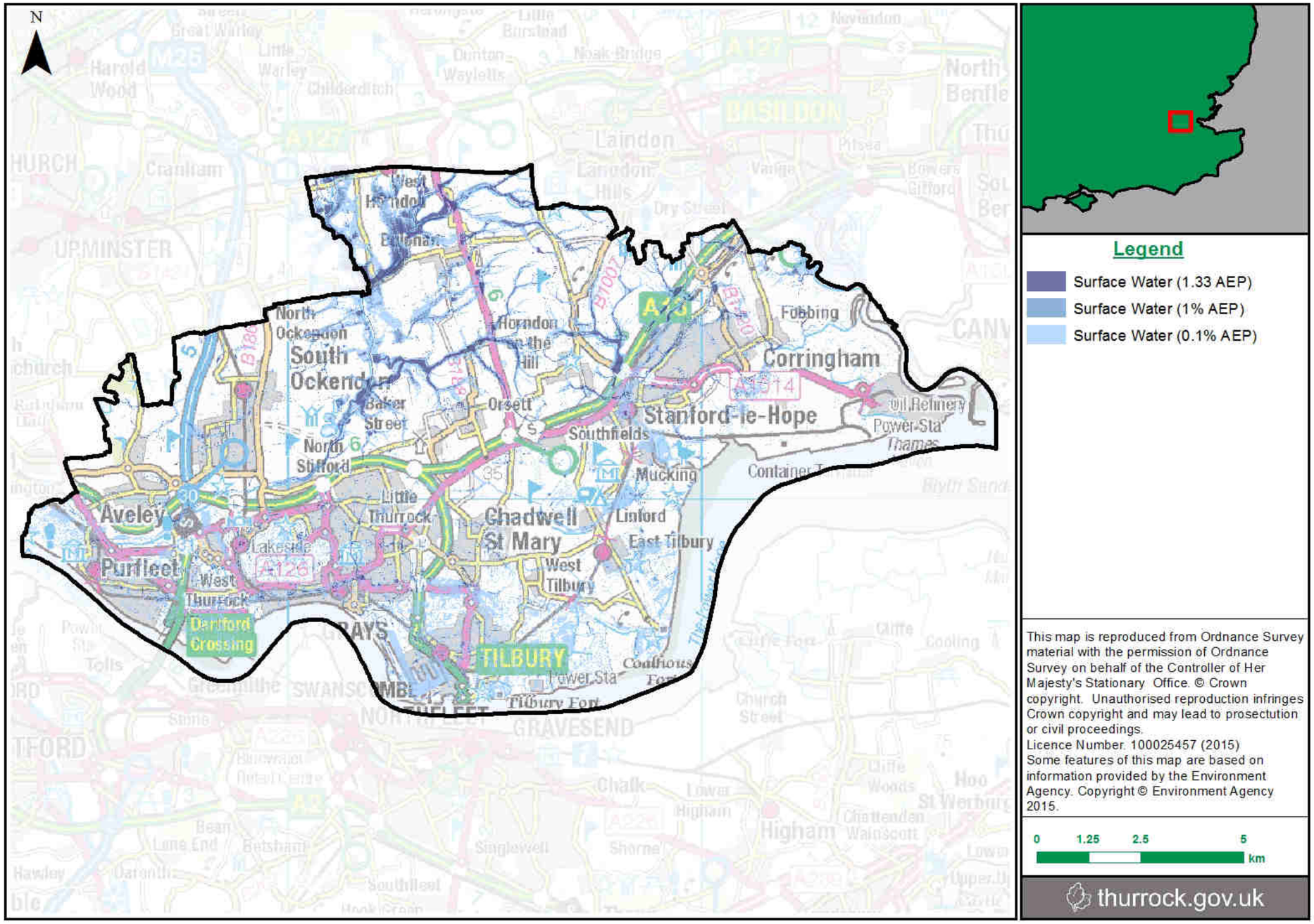


Figure 3-4 Areas of Critical Drainage (AoCD) in Thurrock

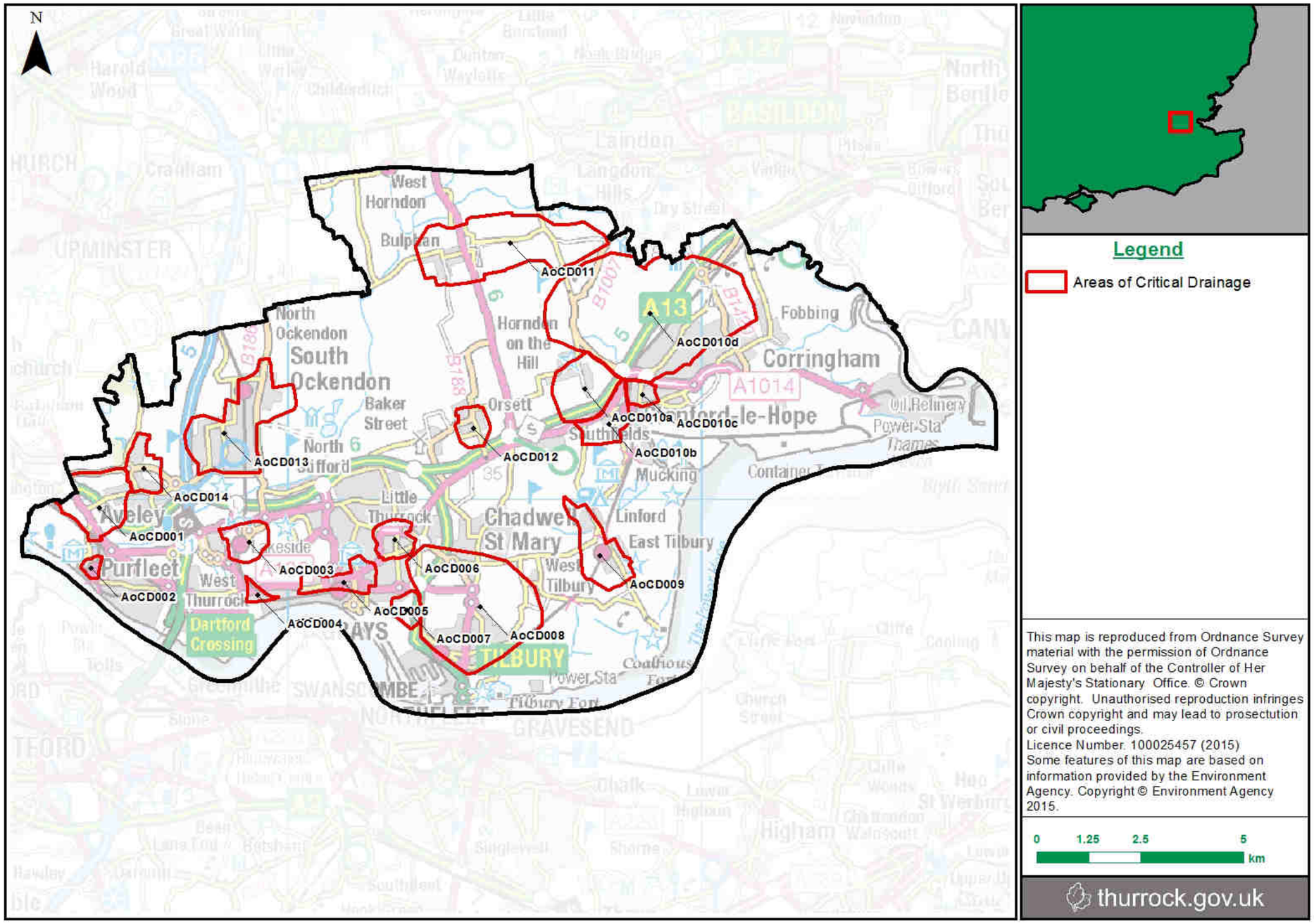
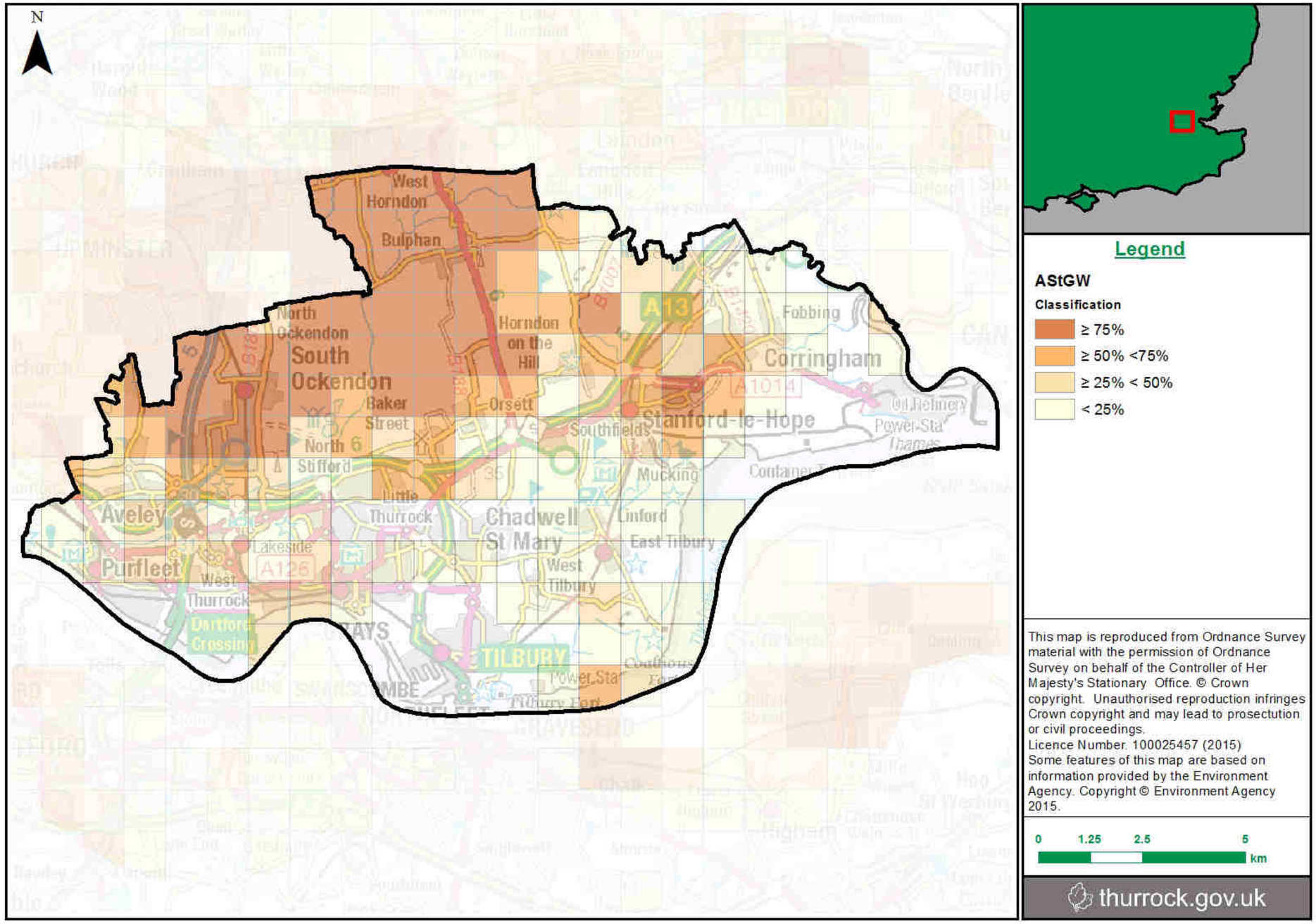


**Figure 3-5 Areas Susceptible to Groundwater (AStGW)**



### 3.3.3 Sewer flooding

For the purposes of the Flood Strategy, sewer flooding occurs when there is a lack of capacity in the sewer drainage network and it becomes overwhelmed by the volume and rate of rainfall which results in flooding on the ground.

In very bad weather conditions there is a risk that sewer systems can become overwhelmed and result in sewer flooding. In some instances, flooding from sewers can be a combined issue such as heavy rainfall resulting in surface water flooding that surcharges the underground pipe network. In this circumstance, it is the responsibility of several RMAs working together to resolve the problem. It can also be caused by high groundwater levels increasing the flow of groundwater into sewer systems and so reducing their capacity to discharge wastewater flows from houses and industry.

Sewer flooding can also be the result of blocked or damaged pipes. If these are owned by a water utility company then it is the company's responsibility. Private sewers are the responsibility of the landowner; the ownership and responsibility for surface water sewers, which can sometimes also be classified as Main River or ordinary watercourse (piped in watercourses), can be more complicated and sometimes difficult to determine.

There is also potential within Thurrock for drainage systems to surcharge due to outlets becoming submerged as a result of high river levels and this can also be the result of the effect of high tide levels. When this occurs, water is unable to discharge into the river and backs up along the sewer. Water will overflow onto streets and potentially into houses if the capacity of the sewer system is subsequently exceeded.

The South Essex CFMP highlights sewer flooding as a problem in Stanford-le-Hope, Purfleet and Tilbury due to inadequate maintenance of sewerage infrastructure leading to blockages, or systems being overwhelmed by the quantity of discharge. The Thurrock Water Cycle Study (2010) also identifies Grays and Bulphan as areas that have been affected by sewer flooding in the past.

### 3.3.4 Groundwater flooding

Groundwater flooding is the result of water rising up from the underlying aquifer or from water flowing from ephemeral springs. It tends to occur following periods of prolonged wet weather when the water table is high; areas most at risk are often low-lying where the water table is more likely to be at a shallow depth.

Groundwater levels may also impact on other types of flooding. Whilst high groundwater levels may not lead to widespread groundwater flooding, they have the potential to exacerbate the risk of pluvial and fluvial flooding by reducing capacity for rainfall infiltration and increasing surface runoff. The naturally high water table in the

reclaimed marshes in Tilbury may intensify flood risk due to the frequently saturated ground resulting in increased runoff.

Groundwater flooding is usually associated with chalk and limestone catchments that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. It can also occur in areas where 'made ground' has been deposited above impermeable subsoils, typically during ground raising or levelling works.

An assessment of areas susceptible to groundwater flooding was undertaken as part of our PFRA. The Areas Susceptible to Groundwater Flooding (AStGWf) map has been used in our assessments during the preparation of our Flood Strategy and is shown in Figure 3-5. The AStGWf map shows the area most likely to be susceptible to groundwater flooding is located in the north west of the catchment and in the area around Stanford-le-Hope, with the susceptibility decreasing moving southwards.

The South Essex CFMP describes the impact of commercial chalk quarrying may have had on groundwater levels in Thurrock. During excavation of the chalk, the quarried areas became de-watered. Since chalk quarrying has come to an end, de-watering activities have ceased and groundwater levels have risen again. Continual increases in groundwater levels could lead to local flooding for development located in close proximity to former quarries where restored ground levels are lower than the natural ground levels.

Responsibility for managing groundwater flood risk lies with LLFAs. No incidences of groundwater flooding have been reported to the Council or the Environment Agency.

### 3.3.5 Reservoir flooding

Flooding from reservoirs is the result of the partial or complete failure of a reservoir structure. It may be caused by erosion due to seepage; overtopping of the dam beyond its design level; or through accidental damage to the structure.

The responsibility for managing the risk is the reservoir owner (referred to as an 'Undertaker'); this may be a private landowner, the Environment Agency, local authority or Water Company.

Reservoirs shown to pose a risk to Thurrock on the Environment Agency's reservoir flood risk maps are Tilbury Flood Storage Reservoir and Sticking Hill Reservoir. The Tilbury Flood Storage Reservoir flood risk map shows the areas predominantly affected in the event of failure of the reservoir structure is Tilbury, the rural land to the north of Tilbury and some isolated properties. The Sticking Hill Reservoir flood risk map shows the area potentially affected in the event of failure of the reservoir structure is predominantly agricultural with a few isolated properties.

## 3.4 How flood risk may change in the future

Factors that may increase the probability of flooding in the future include

- Climate change and the effects may include
  - Warmer wetter winters
  - Hotter drier summers
  - Fewer days of ice, frost and snow
  - Higher likelihood of extreme weather events e.g. heatwaves, intense rainfall
- Urban creep (infill development and loss of green space)
- Aging infrastructure (deteriorating condition, increased pressure on drainage systems and other infrastructure)
- Population growth (increasing and/or higher density of populations increasing the number of people at risk of flooding)

This Flood Strategy considers how local flood risk may change in the future. The flood risk management measures we have identified must make allowances for climate change so proposed investment delivers longer term benefits.

### 3.4.1 Thurrock Climate Change Adaptation Strategy (2009)

Thurrock Council drafted a Climate Change Adaption Action Plan in 2009. In 2013 we updated our Environment Vision and Policy, recommitting to develop a climate change strategy under the Local Government Association (LGA) Climate Local Programme.

Climate Local is an initiative launched by the Local Government Association in 2012 and builds on the Nottingham Declaration on Climate Change. It enables local areas to make a national commitment to climate change whilst setting locally relevant targets.

Thurrock Council signed up to the Nottingham Declaration in 2007 and began work to reduce climate change emissions from 2005 levels both within the Council and across the Borough.

Climate change guidance can be found in the following two documents

- UK Climate Projections (UKCP09)
- Adapting to climate change: Advice for Flood and Coastal Erosion Risk Management Authorities (Environment Agency, 2011)

Climate change scenarios for surface water flooding were modelled as part of our SWMP to provide us with an indication on how the risk from surface water flooding may change in the future.

As we move through the Flood Strategy period and the actions in our Programme and Strategic Investment Plan are developed and taken further, we will assess the measures with regards to climate change, to

ensure they are sustainable and that they are consistent with both national and local policies and targets.

## 3.5 Other sources of flooding

### 3.5.1 Main Rivers and tidal (sea) flooding

Main Rivers are generally large rivers such as the Mar Dyke and Stanford Brook.

***Mar Dyke:*** the Mar Dyke flows south and then southwest through the Borough to its confluence with the River Thames at Purfleet. The Mar Dyke has been modified as part of a land drainage scheme, including channel widening and raised banks, by the Environment Agency's predecessor, the Essex River Authority, in the late 1970s. The outlet into the Thames Estuary is controlled by the Mar Dyke Sluices, a set of mitre gates that automatically close when the tide exceeds the river level. This is backed up by a vertical sluice. The Mar Dyke drains a large proportion of the west of Thurrock.

***Stanford Brook:*** the Stanford Brook flows southwards through Stanford-le-Hope and Mucking Marshes into the Thames Estuary. The Stanford Brook drains a small catchment in the east of Thurrock. The Victoria Road Brook joins the Stanford Brook in Stanford-le-Hope.

We have not prepared new mapping for flooding from Main Rivers within our Flood Strategy as the latest information is available from the Environment Agency's website.

The majority of the flood risk to urban areas is to those located along the Thames Estuary. However, the presence of flood defences mean the National Flood Risk Assessment (NaFRA) class for the majority of the urban area at risk is low. Areas of higher risk tend to be located in marshland, for example Aveley Marshes and East Tilbury Marshes or in the upper reaches and tributaries of the Mar Dyke, such as the New Mar Dyke and Stringcock Sewer which flow through Bulphan.

**Table 3-2 Number of properties at risk – fluvial and tidal flooding**

| Ward | NaFRA risk classification | | |
|---|---|---|---|
| | High | Medium | Low |
| Aveley and Uplands | 0 | 3 | 42 |
| Belhus | 0 | 0 | 0 |
| Chadwell St Mary | 0 | 0 | 5 |
| Chafford and North Stifford | 1 | 4 | 1 |
| Corringham and Fobbing | 0 | 0 | 4 |
| East Tilbury | 5 | 72 | 968 |
| Grays Riverside | 312 | 234 | 1,655 |

| Ward | NaFRA risk classification | | |
|---|---|---|---|
| | High | Medium | Low |
| Grays Thurrock | 0 | 0 | 34 |
| Little Thurrock Blackshots | 0 | 0 | 0 |
| Little Thurrock Rectory | 0 | 5 | 139 |
| Ockendon | 0 | 0 | 0 |
| Orsett | 26 | 12 | 45 |
| South Chafford | 0 | 0 | 0 |
| Stanford East and Corringham Town | 0 | 0 | 0 |
| Stanford-le-Hope West | 18 | 133 | 232 |
| Stifford Clays | 0 | 0 | 0 |
| The Homesteads | 16 | 11 | 440 |
| Tilbury Riverside and Thurrock Park | 96 | 275 | 2,197 |
| Tilbury St Chads | 82 | 696 | 1,522 |
| West Thurrock and South Stifford | 349 | 190 | 776 |
| **Total** | 905 | 1635 | 8060 |

**Table 3-3 NaFRA class definitions**

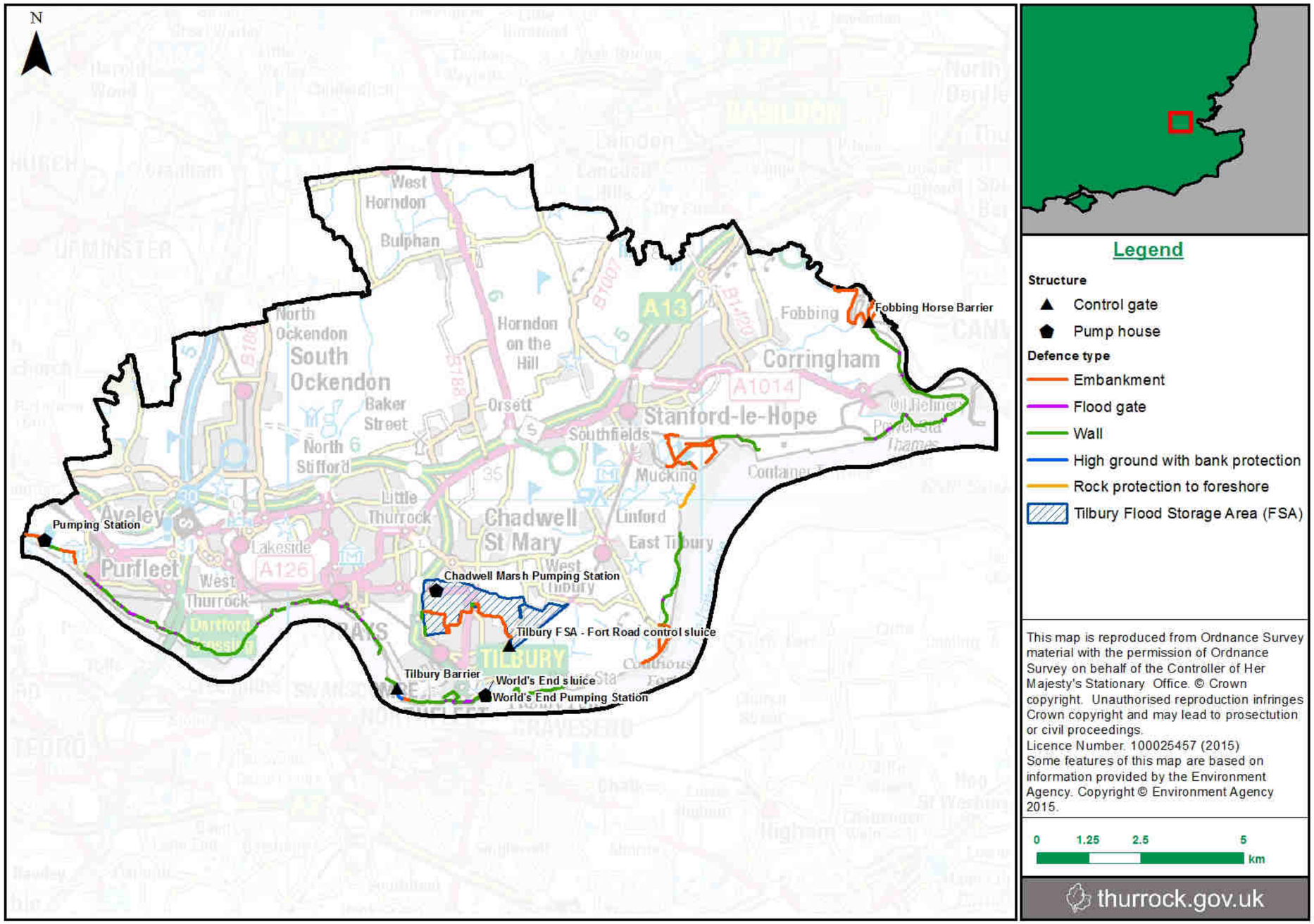
| NaFRA Class | Description |
|---|---|
| Low | These areas have a chance of flooding of between 1 in 1,000 (0.1%) and 1 in 100 (1%). |
| Medium | These areas have a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%). |
| High | These areas have a chance of flooding of greater than 1 in 30 (3.3%). |

### Flood defences

There are a range of flood defences in Thurrock, both tidal and fluvial. Tidal defences mainly consist of raised reinforced concrete walls, steel walls or earth embankments. Fluvial flood defences includes small watercourse channels that provide protection. The majority of flood defences are Grade 2 or 3 (Grade 1 being the best classification and Grade 5 the worst). Many of the defences that are in very poor condition (Grade 5) are close to Tilbury. Other defences of note are the Tilbury and Fobbing Barriers and Mardyke Sluice, along with the

Tilbury Flood Storage Area. These flood defences are important flood infrastructure reducing the risk of flooding to Thurrock.

**Figure 3-6 Flood defences and assets in Thurrock**



# 4 Objectives and Measures

## 4.1 National Objectives

The National Flood and Coastal Erosion Risk Management Strategy for England (the **National Strategy**) is developed by the Environment Agency who is responsible for its maintenance, application and monitoring in accordance with the requirements of the FWMA 2010. The overall aim of the National Strategy is to ensure the risk of flooding and coastal erosion is properly managed in a coordinated way.

The National Strategy sets out the following national objectives

- **N1: Understanding the risks** of flooding and coastal erosion, working together to put in place long-term plans to manage these risks, and making sure that other plans take account of them (N1)
- **N2: avoiding inappropriate development** in areas of flood and coastal erosion risk, and being careful to manage land elsewhere to avoid increasing risks (N2)
- **N3: reducing risk** by building, maintaining and improving flood and coastal erosion management infrastructure and systems to reduce the likelihood of harm to people and damage to the economy, environment and society (N3)
- **N4: increasing public awareness** of the risk that remains and engaging with people at risk to encourage them to take action to manage the risks that they face and to make their property more resilient (N4)
- **N5: Improved emergency planning and recovery** by improving the detection, forecasting and issue of warnings of flooding, planning for and co-ordinating a rapid response to flood emergencies and promoting faster recovery from flooding. (N5)

We have aligned our Flood Strategy and objectives with those outlined by the Environment Agency.

## 4.2 Our vision and objectives

### 4.2.1 Our vision (Thurrock Corporate Plan)

The Thurrock Corporate Plan outlines five priorities for Thurrock over 2013-2016. These priorities are:

- create a great place for learning and opportunity;
- encourage and promote job creation and economic prosperity;
- build pride, responsibility and respect;
- improve health and wellbeing; and
- protect and promote our clean and green environment;

These priorities contribute to the following vision for Thurrock:

***"Thurrock: A place of opportunity, enterprise and excellence, where individuals, communities and businesses flourish'***

### 4.2.2 Our Flood Strategy objectives

We have set out the following objectives for managing flood risk. These contribute to achieving the priorities set out in the Corporate Plan and are consistent with the objectives and principles of the National Strategy.

**OBJECTIVE ONE (L1):**

Reduce the likelihood and consequences of flooding, particularly from surface water, groundwater and ordinary watercourses

**OBJECTIVE TWO (L2):**

Identify any gaps where further studies are required so we can get a better understanding of the causes and effects of local flooding

**OBJECTIVE THREE (L3):**

Reduce the vulnerability of Thurrock, its residents and visitors to the detrimental effects of flooding

**OBJECTIVE FOUR (L4):**

Establish clear roles, powers and responsibilities for Thurrock RMAs and ensure RMAs are aware of each other's roles and responsibilities

**OBJECTIVE FIVE (L5):**

i) Provide improved communication of clear information on local flood risk, appropriate responses and the responsibilities for us and our partners.

ii) State what we and other RMAs cannot take responsibility for, and facilitate engagement of the public and stakeholders to take action

**OBJECTIVE SIX (L6):**

Improve co-operative working between all RMAs, including across administrative boundaries

**OBJECTIVE SEVEN (L7):**

Improve natural habitat and the social environment through flood management schemes to provide multiple benefits

**OBJECTIVE EIGHT (L8):**

Establish a strategic funding plan and programme so we identify priorities, secure funding for measures that are affordable and that wherever possible include provisions for contributions by those who benefit

Table 4-1 shows how our Local objectives align with the National objectives. Many of our Local objectives align with more than one of the National objectives.

**Table 4-1 Links between National and Local objectives**

| National Strategy objectives | Local Strategy Objective | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | L1 | L2 | L3 | L4 | L5 | L6 | L7 | L8 |
| N1 | | ✓ | | ✓ | ✓ | ✓ | | |
| N2 | ✓ | | ✓ | ✓ | | | | |
| N3 | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| N4 | | | ✓ | | ✓ | | | ✓ |
| N5 | | | ✓ | | ✓ | ✓ | | |

The National and Local objectives have been considered during the action planning process; the objectives that each action will work towards meeting have been identified within the Annual Action Plans.

## 4.3 Measures

A key output from our Flood Strategy is the Programme and Strategic Investment Plan, which covers the full 6 years of the Flood Strategy. Each year the plan is reviewed and an Annual Action Plan prepared to address the identified priorities. The details initially included in our Flood Strategy and Action Plans reflect the resolution of the data available at the time of plan preparation. In the coming years we intend to provide higher resolution information as our understanding and data is improved. The 6 year Flood Strategy and Annual Action Plans set out the actions that we plan on undertaking as we work towards meeting our local objectives.

The measures that have been considered as part of the action planning process can be categorised into the following strategic themes

- Communication & partnerships: actions designed to work with other RMAs and local communities to raise awareness of flood risk management and to develop partnerships to work towards meeting our objectives

- FWMA & Flood Risk Regulations: actions designed to ensure we meet the responsibilities assigned to us, as a LLFA, under the FWMA.
- Investigation, feasibility & design: actions aiming to further our understanding of flooding within the Thurrock area, investigating where flooding may be an issue and the potential solutions to local flooding problems, and implementing solutions once investigation and feasibility has been assessed
- Policy: actions with the aim of developing and strengthening flood risk policy within Thurrock
- Flooding mitigation: actions designed to mitigate against the risk of flooding

In addition to the themes outlined above, many of the options in our Programme and Strategic Investment Plan will also seek to support Water Framework Directive (WFD) objectives. Many of the proposed options are still in their early stages; however, as we develop these options we will seek opportunities to implement River Basin Management Plan measures, as well as focus on achieving wider environmental benefits to develop sustainable flood risk management. Furthermore, during the development of a scheme we will investigate potential for water body improvement or restoration, for example by improving water quality or hydromorphology. We will also ensure that our actions do not result in a deterioration to a water body.

The current Annual Action Plan is provided in Appendix A and the Strategic Investment Plan is provided in Appendix H.

As we progress through the Flood Strategy period the Programme and Strategic Investment Plan and Annual Action Plans will be under review as additional information becomes available. For example, as the feasibility of proposed schemes is investigated, whole life costs and benefits, timeframes for delivery and opportunities for partnership funding will be determined. Additionally, the future sustainability of the schemes will be investigated and the impact of climate change taken into account.

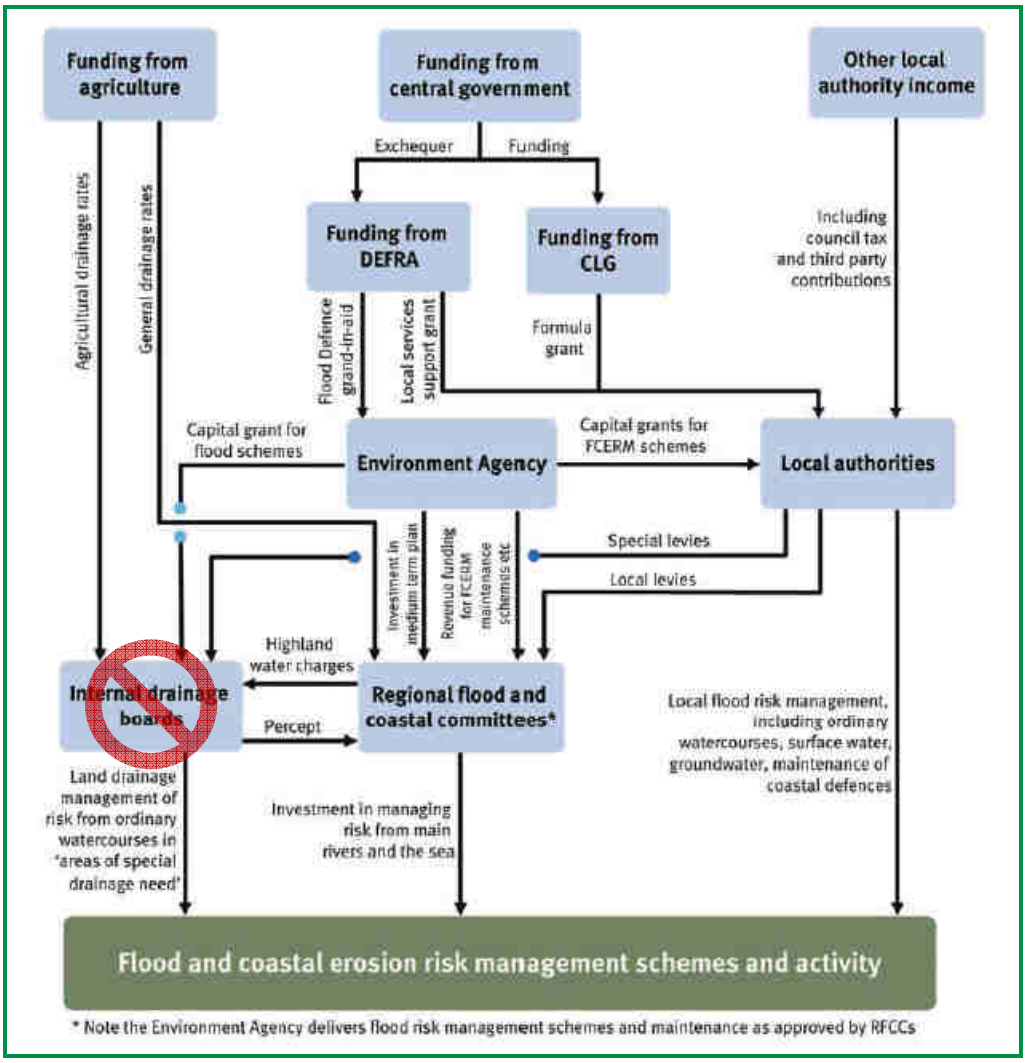
# 5 Funding

## 5.1 Funding sources

Figure 5-1 shows the current various sources of funding available to RMAs. These are described in more detail in the following sections. (Note: there are no Internal Drainage Boards within Thurrock, therefore this source of funding is not available and has been crossed out).

At this stage we have only identified possible options for measures. As we continue to investigate the potential for, and feasibility, of the schemes outlined in our Programme and Strategic Investment Plan, we will carry out cost-benefit ratio analysis of the measures, determine whole life costs and identify sources of funding, including opportunities to work with partner RMAs, local industry and business and the public

**Figure 5-1 Funding streams for RMAs**




Source: Environment Agency National Strategy

A good practice guide has been developed by DEFRA to support LLFAs – ***Partnership funding and collaborative delivery of local flood risk management: a practical resource for LLFAs (March 2012).***

### 5.1.1 Flood and Coastal Erosion Risk Management Grant in Aid (GiA)

Introduced in 2011, this funding is potentially available to all RMAs to meet the costs, partially or in full, of any scheme with an adjusted Partnership Funding scoring of 100% or greater (a worthwhile scheme). The level of funding that is potentially available for a scheme is based on Outcome Measures (OM) set by Defra for the Flood and Coastal Erosion Risk Management (FCRM) capital programme.

- **OM1 (Economic benefits):** The average benefit cost ratio across the capital programme based upon the present value whole life costs and benefits of projects delivering in the Government spending review period.

  Individual projects will need to estimate and report Present Value Benefits and Present Value Costs.
- **OM2 (Households at flood risk):** the number of households moved out of any flood probability category to a lower category
- **OM2b:** the number of households for which the probability of flooding is reduced from the very significant category to the moderate of low category
- **OM2c:** the number of households in the 20% most deprived areas moved from the very significant or significant flood probability category to the moderate or low category
- **OM3 (Households at erosion risk):** the number of households better protected from coastal erosion
- **OM3b:** the number of households protected against loss from coastal erosion in a 20-year period
- **OM3c:** the number of households in the 20% most deprived areas protected against loss from coastal erosion in a 20-year period
- **OM4a (Water dependent habitat):** the area (in hectares) of water-dependent habitat created or improved to help meet the objectives of the Water Framework Directive, Section 28 of the Wildlife and Countryside Act(1981), and the England Biodiversity Strategy)
- **OM4b (Intertidal habitat):** the area (in hectares) of intertidal habitat created to help meet the objectives of the EU Habitats/Birds Directives, Section 28 of the Wildlife and Countryside Act(1981), and the England Biodiversity Strategy)
- **OM4c (Protected rivers):** the length (in kilometres) of rivers protected under the EU Habitat Directive, EU Birds Directive or

Section 28 of the Wildlife and Countryside Act(1981) improved to meet the objectives of the Water Framework Directive

There are always more schemes proposed in any one year than there is Government funding available. Whilst some schemes may be fully funded, others may only be partly funded by GiA. Any shortfall in the amount of funding will need to be found from elsewhere. Schemes are more likely to receive GiA funding where additional Partnership Funding can be found to support their delivery.

### 5.1.2 Local Levy

Local Levy funding is available through the Regional Flood and Coastal Committees (RFCCs) and can be used, with the approval of the RFCC, to support flood risk management projects that do not receive full national funding through GiA. Local Levy is raised by RFCCs from within their area of representation. The amount of levy is agreed and approved annually.

### 5.1.3 Partnerships with other RMAs

By working in partnership with other RMAs schemes can be developed to provide multiple benefits as well as increasing the likelihood of the scheme attracting GiA funding. Potential partners include

- Anglian Water:
- Environment Agency:
- Highways Authority:
- Neighbouring LLFAs:

### 5.1.4 Council funds

Local authority funding for flooding projects have to compete with a wide range of other Council priorities. Investment that can provide more than one benefit will strengthen the case for funding allocation. By looking, wherever possible, to include or integrate flood risk management projects, or influence the designs to ensure projects or schemes reduce or mitigate flood risk, multiple benefits can be delivered.

### 5.1.5 Community Infrastructure Level (CIL) and Section 106

**Section 106** (S106) of the Town and Country Planning Act allows a local planning authority to enter into an agreement with a developer or landowner in association with granting planning permission. An agreement under S106 is used to address off site and linked issues that are required in order to make a development acceptable.

S106 agreements should be used by local planning authorities to ensure a strong planning policy to ensure any flood risk caused by, or exacerbated by, new development is resolved and funded by the developer.

The Council currently levies a contribution from new development in the borough towards the provision of facilities that can mitigate the

impact of the development or make it locally acceptable. The Council has identified a list of infrastructure improvements across the Borough that could be introduced or funding contributions collected for as highlighted on the Council's **website**.

S106 provides only partial and variable response to capturing funding contributions for infrastructure. As such, the 2008 Planning Act included provision for the Community Infrastructure Levy (CIL).

**CIL** is levied by local authorities in England and Wales on new developments in their area. The money raised by CIL can be used to support development by funding infrastructure, for example construction of new infrastructure, increase the capacity of existing infrastructure, or repair failing infrastructure. Infrastructure that can be covered by this scheme includes flood defences, transport, schools, hospitals and parks. Flood defences that only affect current development cannot be included in this scheme.

The Council is currently developing its CIL strategy and it is expected that it will supersede the infrastructure requirements identified in the S106 list when it is adopted. This is expected to happen in 2017.

### 5.1.6 Defra grants

Defra grants are allocated directly to support the introduction of new legislation and practices, or are made available for local authorities to submit grant applications for funding for specific Government schemes.

### 5.1.7 Private / local funding

Contributions from local communities and business that would benefit from measures delivered through the Local Strategy could increase the likelihood of schemes attracting GiA funding in line with the existing Partnership Funding policy.

### 5.1.8 Other sources

- European funding – European Regional Development Fund (ERDF)
- The Growing Places Fund
- Green Investment Bank
- The Catchment Restoration Fund
- Business Rate Retention
- Big Lottery Fund (Communities Living Sustainably)
- Heritage Lottery Fund
- Network Rail
- HS1 (Channel Tunnel Rail Link)
- Highways England (Lower Thames Crossing)

# 6 Delivery

The Actions identified in the Programme and Strategic Investment Plan (Appendix H) have been used to prepare the annual Action Plan, and will also be the basis for future annual Action Plans throughout the Flood Strategy period. The Actions have been prioritised based on the availability of funding, how they contribute to the aims and objectives set out in the Flood Strategy and on the number of additional benefits that they may provide. The prioritisation seeks to capture benefits that can be obtained from committed investment on schemes that potentially deliver multiple outcomes and is not just based on the severity of risk. In this way it is possible to bring forward measures that might otherwise take much longer to deliver.

Areas that have an historical record of flooding have also been prioritised.

The ability to deliver our Action Plan is dependent on the availability of funding. Funding availability is anticipated to change over time and consequently our prioritisation may change to reflect the variability in funding opportunities, as well as any significant flooding events, changes in development pressures and plans, or shifts in local priorities.

Many of our actions are still at the investigation stage, looking at potential options for flood risk management. As we move through the Flood Strategy period, these actions will be developed and assessed in more detail. It is at that stage that we will establish when the measures will be implemented, the costs and benefits of the measures and the timeframe for delivery. To seek to improve the resolution of the information in our Programme and Strategic Investment Plan we will initially review these annually and adjust our Annual Action Plans accordingly.

## 6.1 Borough-wide actions

Borough-wide actions have been identified with the aim of following the objectives of the Flood Strategy outlined in section 4 as well as the Environment Agency's national objectives. Full details of borough wide actions in the Action Plan are provided in Appendix A

### 6.1.1 Improving understanding of flood risk

**Recording and investigating flood incidents**

One of Thurrock Council's responsibilities under the FWMA is to investigate flooding incidents and publish details of the investigation. The aim of flood investigation reports is to collate all useful information relating to the flood together in one place, to provide an understanding of why the situation is the way it is, as well as outline possible causes of flooding and potential solutions.

The investigation report identifies the RMAs that have relevant roles and responsibilities and whether those responsibilities were exercised adequately in the response to the flood.

Although it is not possible to investigate all instances of flooding across the borough, Thurrock Borough Council will undertake a formal investigation if:

- There has been internal flooding of a property on more than one occasion
- There has been internal flooding of five or more properties during a single incident
- The source or responsibility of a flooding incident in uncertain

Note: internal flooding means water entering a habitable building. It does not include the flooding of gardens and garages

Flood investigations are reported on Thurrock Council's **website**.

**Quebec Road, Tilbury – Flood Investigation**

In November 2013 Thurrock Council published a Section 19 Flood Investigation report into the repeated flooding of properties and roads in and around Quebec Road in Tilbury. The investigation involved a number of partners including Anglian Water, the Environment Agency, Port of Tilbury and Thurrock Council in its capacity as Lead Local Flood and Highways Authority.

The investigation determined that the flooding was being caused by surcharging of sewers on Quebec Road resulting from difficulties with the sewer system discharging to the Main River.

A number of actions were identified to mitigate the flood risk and reduce the frequency and impact of future floods. The Environment Agency undertook extensive vegetation and silt clearance to improve flow and capacity in the Main River resulting in improved discharge from the sewer. This was further improved by culvert clearing works by Thurrock Council and a sewer cleanse in and around Ottawa Road.

Further work is ongoing to establish an Integrated Flood Strategy for Tilbury to identify future priorities for flood risk management.

### Surface Water Management Plan

The Thurrock Surface Water Management Plan (**SWMP**) was published in July 2014 to increase knowledge of local flood risk and to support the establishment of feasible measures to mitigate surface water flooding where possible.

### Implement a standardised asset register

As an LLFA, Thurrock must establish and maintain a register of assets (physical structures or features e.g. culverts, weirs, and pumps) that, in our opinion, are likely to have an impact on flood risk in Thurrock. We must record information such as ownership and condition about each asset. We are continuing to develop our asset register.

The asset register will also assist us in identifying the ownership and, responsibilities of ordinary watercourses and assets across Thurrock and review maintenance to ensure it is carried out regularly to reduce the likelihood of any adverse impact on flooding.

### 6.1.2 Regulating works on ordinary watercourses

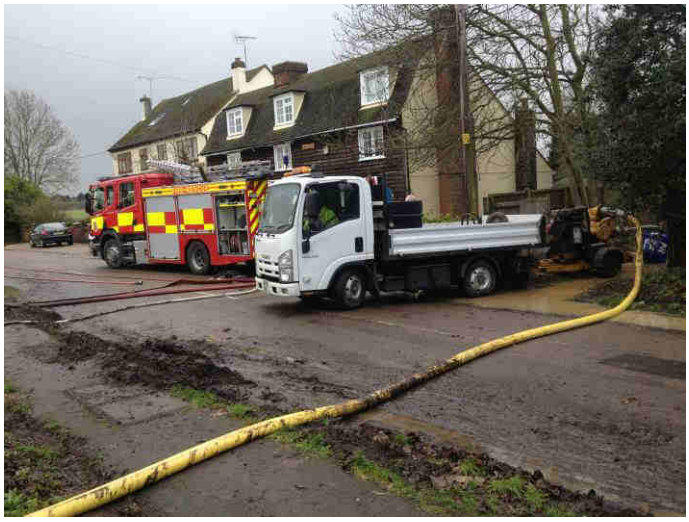
On the 6 April 2012, the powers of ordinary watercourse consent and enforcement were transferred from the Environment Agency to LLFAs. The purpose of ordinary watercourse regulation is to control activities that may have an adverse impact on flooding. Regulation of works includes consenting of works before they are constructed and enforcement actions to remediate or remove unconsented structures or obstructions.

Further information on the consenting process and enforcement is provided in Appendix F.

### 6.1.3 Improve co-operative working between all RMAs

Thurrock Borough Council is continuing to work with all RMAs through the Thurrock Flood Partnership as well as through sharing of information and collaborative working.

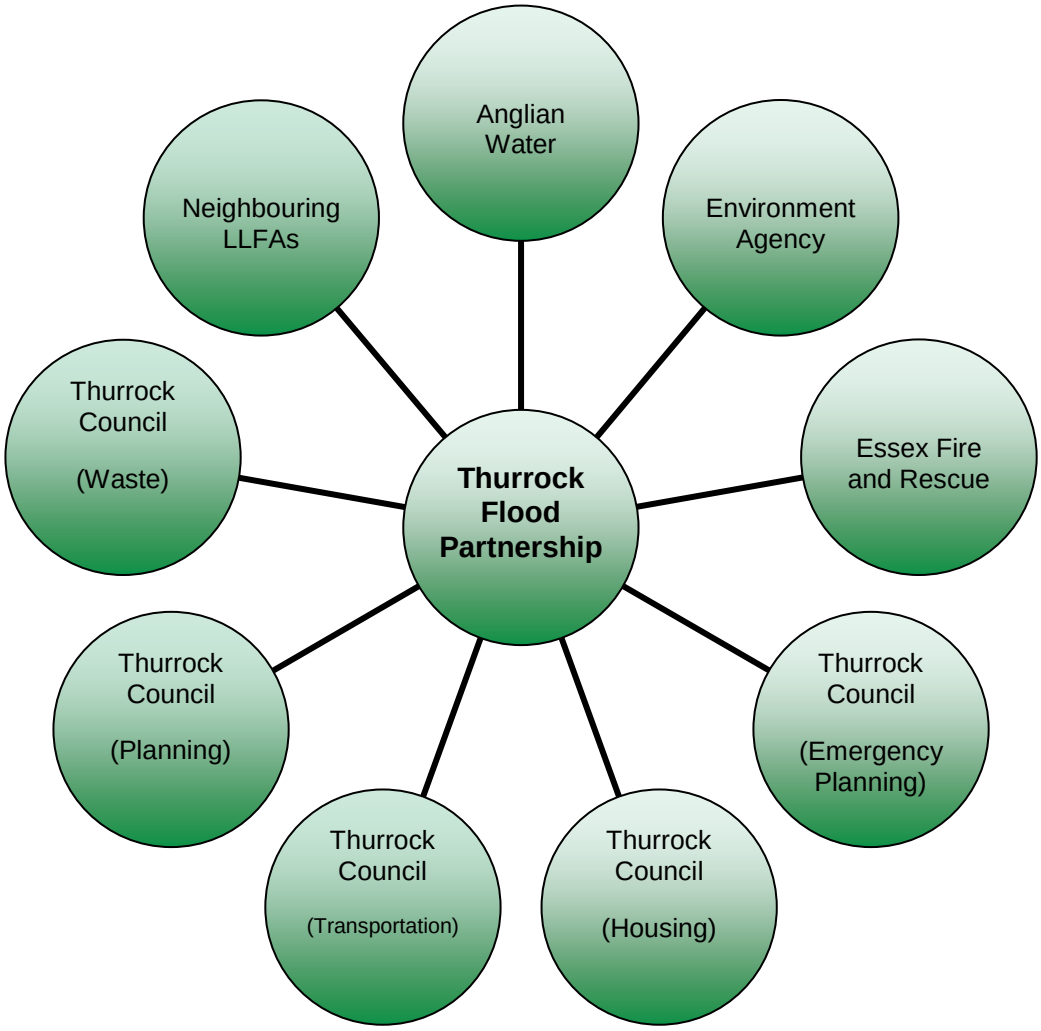
**Pump Street, Horndon on the Hill – Flood Alleviation**



Flooding of properties on a number of occasions in 2013 and 2014 resulted in a call from the local community for help in identifying solutions to the problem. Through the Council's investigations, it was found that the flooding was primarily being caused by an undersized culvert and lack of maintenance to the watercourse downstream of the properties, preventing water from flowing away.

Working with local landowners, extensive vegetation clearance was undertaken to the watercourse in January 2014 and computer modelling was undertaken to determine potential flood alleviation options. These investigations culminated in a bid to the Environment Agency to replace the existing culvert with a twin 600mm culvert and a flood wall around the properties to provide added protection. The works are due for completion in 2016.

The Thurrock Flood Risk Partnership meets twice a year, providing the means to coordinate flood risk management amongst RMAs. This gives RMAs within Thurrock, as well as neighbouring LLFA's, an opportunity to discuss flood risk issues and discuss potential solutions. It will encourage partnership working between RMAs as well as ensuring a consistent approach to sustainable flood risk management which is consistent with policies in other plans and strategies for Thurrock, such as the Thames RBMP, CFMP and FRMP and the South Essex CFMP. The Thurrock Flood Risk Partnership devised and agreed the local objectives set out in Section 4.2.2 and will have responsibility for review of the Local Strategy and monitoring its progress.



### 6.1.4 Spatial planning / land use policy

Local planning decisions need to consider flood risk, particularly from surface water, ordinary watercourse and groundwater during the planning process. This is to ensure that inappropriate development is avoided in areas where there is significant local flood risk.

**Sustainable drainage systems (SuDS)**

On 18 December 2014 a Written Ministerial Statement laid by the Secretary of State for Communities and Local Government set out changes to the planning process that would apply for major development from 6 April 2015. In considering planning applications, local planning authorities should consult the LLFA on the management of surface water, satisfy themselves that the proposed minimum standards of operation are appropriate and ensure, through use of planning conditions or obligations, that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

In March 2015 the LLFA was made a statutory consultee which came into effect on 15 April 2015.

As a result, Thurrock Council in its capacity as LLFA, is to provide technical advice to planners on surface water drainage strategies and designs put forward for new major developments.

Major developments are defined as

- Residential development: 10 dwellings or more, or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known
- Non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more or, where the floor area is not yet known, a site area of 1 hectare or more.

Thurrock Council has produced a draft SuDS policy (see Appendix G) to be used by developers, consultants and designers to support them in their understanding of Thurrock Borough Council's SuDS design requirements.

***Runoff rates for new major developments in AoCD***

For all new developments the peak runoff rate for the 1 in 1 year and 1 in 200 year runoff must not exceed the peak greenfield runoff rate for the same event. The runoff volume for the development site in the 1 in 200, 6 hour rainfall event must not exceed the greenfield runoff volume for the same event.

***Runoff rates for previously developed sites in AoCD***

For previously developed sites the peak runoff rate (1 in 1 and 1 in 100 year) and volumes (1 in 100 year, 6 hour rainfall event) must not exceed the equivalent greenfield rates.

### 6.1.5 Community awareness and engagement

During the development of our LFRMS we conducted an online questionnaire to get an appreciation of the level of awareness of flood risk within Thurrock. Of the 12 respondents, 90% of respondents had been affected by flooding in some form and only 10% of respondents knew that Thurrock Council was a Lead Local Flood Authority. Over 80% of respondents to the questionnaire would like more information and advice on which organisation to contact during flooding, and over 65% would like more information and advice on flood warning services and how to access them, and on how households can prepare for flooding.

The results of the questionnaire highlight the need to communicate effectively and engage with local communities and members of the public to set realistic and achievable expectations and outcomes for local flood risk management.

A number of measures have been identified in our Programme and Strategic Investment Plan so we work towards improving communication and involvement, including:

- Increasing awareness within communities at risk through newsletters, website, drop-in surgeries etc.
- Highlighting to communities the impact of flytipping on flood risk
- Target communication with riparian landowners and communities to inform them of their responsibilities under the Land Drainage Act (1991) and the importance of good drainage practice and drainage maintenance.

In addition to the measure identified above, we will be consulting with and involving communities with potential responses to flood risk as scheme options in our Action Plan are identified and are being developed.

We have developed a Communications and Engagement Plan (CEP) for use in the delivery of the Flood Strategy so that the community can be appropriately involved during all stages of the planning and implementation process. We will review the CEP during the course of the Local Strategy period so that we engage and communicate appropriately with the local community.

## 6.2 Area of Critical Drainage (AoCD) specific actions

AoCD specific actions have been identified to achieve the Flood Strategy and national objectives on a local scale in identified locally important flood risk areas. Details of AoCD specific actions in the Action Plan are provided in Appendix A.

AoCD specific actions may include

- Working with RMAs to improve drainage capacity and infrastructure in areas currently shown to be at risk of flooding

- Implementing preferential maintenance regimes to ensure flow enters drainage channels rather than ponding on the surface
- Investigation of potential for storage areas to alleviate the risk of flooding in known risk areas
- Confirmation of ownership and maintenance of specific assets known to be important in flood risk management
- Encouraging implementation of flood resilience measures and property protection schemes for areas known to be at risk of flooding

## 6.3 Wider environmental benefits

### 6.3.1 Protected areas

Thurrock supports internationally designated nature conservation sites; there is one Ramsar and SPA site within the Borough and three Ramsar sites and SPAs within 15km of Thurrock's boundary. The borough does not support any SACs but there are three within 15km. The sites within the borough are summarised below:

- Thames Estuary and Marshes SPA
- Thames Estuary and Marshes Ramsar

The sites within 15km of the borough are the following

- Benfleet and Southend Marshes SPA
- Benfleet and Southend Marshes Ramsar
- Medway Estuary and Marshes SPA
- Medway Estuary and Marshes Ramsar
- North Down Woodlands SAC
- Crouch and Roach Estuaries SPA
- Crouch and Roach Estuaries Ramsar
- Essex Estuaries SAC
- Peter's Pit SAC

### 6.3.2 Water Framework Directive (WFD)

A key objective of the WFD is the requirement to prevent deterioration in the current status of water bodies, whilst Heavily Modified Water Bodies (HMWBs) must achieve good ecological potential within a set deadline. If an activity has the potential to impact on the ecology or morphology of a water body, the risk of causing deterioration in the status must be assessed.

Thurrock is covered by the Thames River Basin Management Plan (RBMP), which identifies the current quality of water bodies in the borough and sets objectives for making further improvements to the ecological and chemical quality.

The Mar Dyke is generally not designated as a HMWB and has an overall status of moderate under the WFD. However, the Mar Dyke (West Tributary) and Mar Dyke (East Tributary) have a poor overall status and poor ecological status, although it is not designated as a HMWB. The Mar Dyke and Fobbing water body is designated as a HMWB and has moderate ecological potential under the WFD.

The section of Thames south of Thurrock extending east to Stanford-le-Hope is classed as the 'Thames Middle' water body, and is designated as a HMWB, with a current overall potential of moderate. The Thames Lower water body runs east from Stanford-le-Hope and is also designated as a HWMB, with an ecological and overall status of moderate.

### 6.3.3 How we have taken account of protected areas and WFD in the preparation of this Flood Strategy

A Strategic Environmental Assessment (SEA) and a Habitat Regulations Assessment (HRA) have been undertaken alongside the development of the Flood Strategy to ensure environmental consequences are considered during its preparation. Further information on the SEA and HRA are provided in Section 8 and Appendix D.

Actions identified in the Flood Strategy have the potential to balance social, economic and environmental aims and objectives to achieve wider environment benefits.

The implementation of sustainable flood risk management options and measures provides a good opportunity to improve the environment across Thurrock. The Flood Strategy will contribute to the achievement of wider environmental objectives through the following actions:

- As flood risk management projects, schemes and initiatives identified within our Programme and Strategic Investment Plan are developed, we will ensure compliance with wider environmental objectives and targets (e.g. those set out by WFD and the RBMP) by ensuring water bodies and protected areas are suitably protected and that the implementation of any scheme does not cause any deterioration of waterbodies. This will be through use of site-specific environmental assessments. In addition the impacts, both positive and negative, of any actions on the internationally designated conservation sites identified above will be assessed at an early stage to ensure there are no detrimental impacts on the sites. We will also consider the impacts on local designated sites, the historic environment and air quality.
- Enhancement of biodiversity and habitat creation within any future capital schemes. Our Programme and Strategic Investment Plan contains a number of potential options for flood storage areas that we will investigate over the Local Strategy period. As these options are developed further, the

opportunities to enhance biodiversity and habitat creation will be explored and implemented.

- Improvement of water quality through use of source control measures such as SuDS. The Thames RBMP sets out a potential action for local and regional government for the promotion of the use of SuDS. Appendix G sets out our SuDS guidance for Thurrock. Source control measures can help with improve water quality through reducing runoff and, therefore, reducing diffuse pollution entering watercourses and drainage systems, helping to meet WFD targets for water quality within Thurrock.
- Working with key partners to ensure sustainable land use planning and safeguarding green open spaces to help reduce flood risk. This also ensures protection for habitats as well as providing a flood risk management function. Our Flood Strategy includes actions to work with development control and planners to seek opportunities from new and redevelopment. This is in line with the action set out in the Thames RBMP for local and regional government to ensure planning policies and spatial planning documents take into account wider environmental objectives. For example spatial planners can ensure proposed development does not lead to any deterioration of water bodies and that sustainability appraisals and SEAs provide due consideration of the potential impact of the development on water bodies and the wider environment.
- Safeguarding ordinary watercourses from inappropriate works. Appendix F sets out Thurrock's ordinary watercourse enforcement protocol. Proposals for alterations to an ordinary watercourse will be closely scrutinised to ensure there is no environmental deterioration of the watercourse, and the proposal is consistent with wider environmental aims and objectives, before consent will be granted.

The relevant RBMP actions have been identified, where possible, for each option identified in our Programme and Strategic Investment Plan.

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# 7 Reviewing the Local Strategy

Our Local Strategy is a dynamic strategy that we, and other RMAs, will use to support the management of local flood risk now and into the future. The following sections outline how we intend to monitor and update the Local Strategy:

**Figure 7-1 Local Strategy Review Process**


## 7.1 Review

The Local Strategy has been developed to provide a short to medium term (six year) plan. We will formally review the main Flood Strategy document in 2021, and update it where necessary, and thereafter every six years. The responsibility for reviewing the Flood Strategy will sit with the Thurrock Flood Partnership.

However, we also recognise that it is difficult to plan for, or commit to, actions that extend into the future; therefore we may need to be reactive and update sections of the Flood Strategy more frequently. Possible triggers that may prompt a more frequent review include

- A significant flood event
- Significant changes to available datasets or understanding or nature of flood risk in Thurrock
- Changes to legislation or policy that may affect roles and responsibilities
- Changes to funding availability

We will review and update the Action Plan annually. This will ensure the Action Plan reflects the variability in Council and external budgets and funding opportunities, any significant flooding events, changes in development pressures and plans, or shifts in local priorities.

## 7.2 Annual monitoring

We propose to monitor the Flood Strategy annually by reviewing the Action Plan to assess which actions have been delivered and how we are meeting the national and local objectives set out in our Flood Strategy. We will also review whether there has been any change in the prioritisation of actions. The responsibility for reviewing the Programme and Strategic Investment Plan and Annual Action Plans will sit with the Thurrock Flood Partnership.

As the actions identified in our Programme and Strategic Investment Plan are assessed and developed further the plans will be updated, and the program for delivery will be established and included in the annual updates. This will allow us to monitor the progression of the action through delivery and implementation. At the end of each year we will be able to review these actions against their programme of delivery to check progress. Where no timeframe for delivery of an action is available, due to the action not being at a stage to develop a timeframe, we will assess what stage the action is at and what still needs to be done in order to determine when it may be possible to provide a delivery programme.

# 8 Environmental Assessment

## 8.1 Background

The FWMA requires the Flood Strategy to demonstrate how it contributes to the achievement of wider environmental objectives.

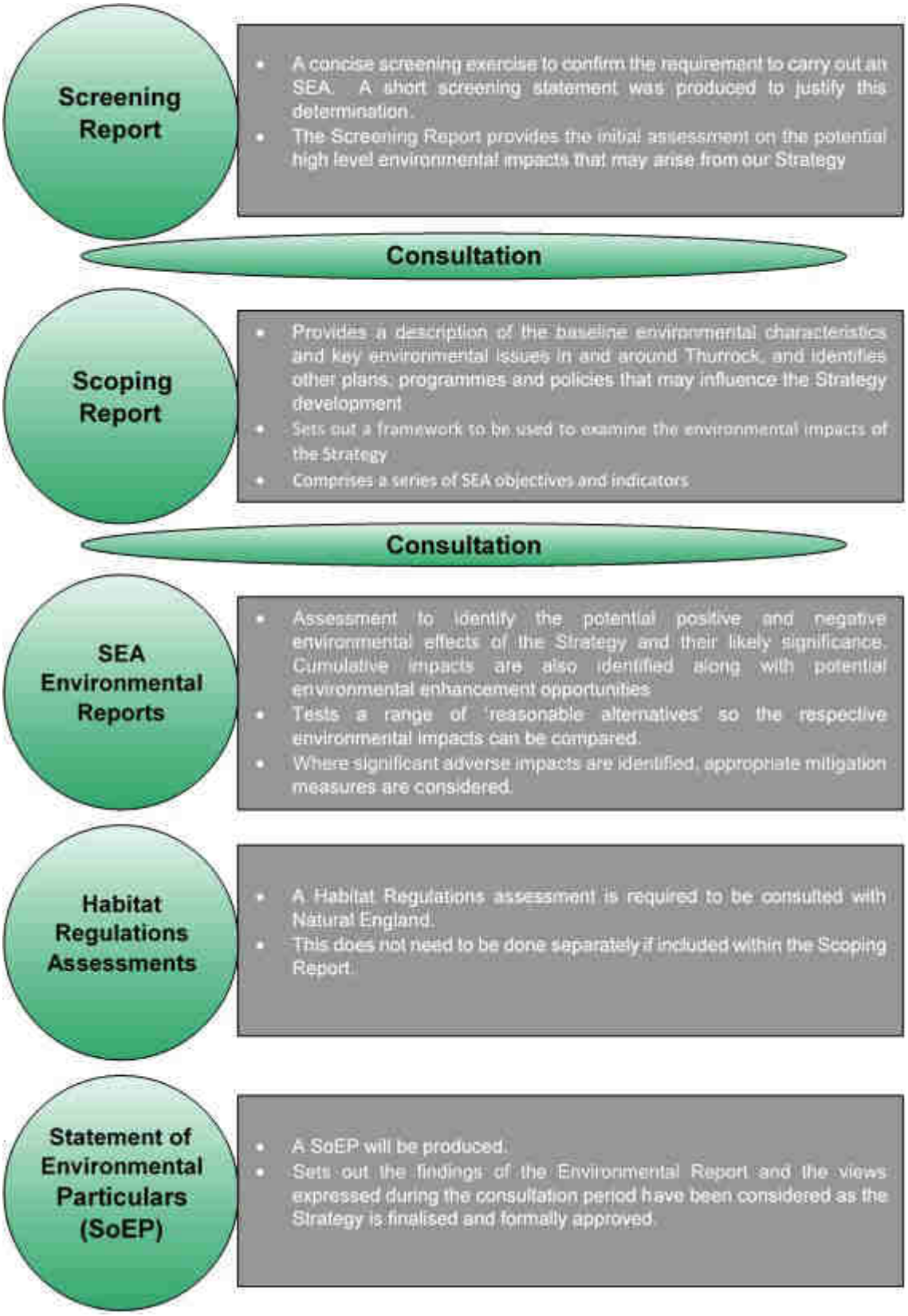
To fulfil our legislative requirements a Strategic Environmental Assessment was required to assess how our Flood Strategy might impact or contribute to the achievement of wider environmental objectives (SEA Directive) alongside consideration of the Conservation of Habitats and Species Regulations 2010 (HRA) and Water Framework Directive (WFD).

The SEA aims to identify potentially significant environmental effects that are likely to be created as a result of the implementation of a plan or programme on issues including the following

- Biodiversity
- Population
- Human health
- Fauna
- Flora
- Soil
- Water
- Air
- Climate
- Material assets (including architectural and archaeological heritage)
- Landscape

The process we have followed in the SEA is set out in Figure 8-1.

**Figure 8-1 Environmental Assessment Process**



## 8.2 SEA Screening

The consultation on the SEA Screening Report was undertaken during December 2014 / January 2015. The Screening Report can be found in Appendix D.1.

The Screening Report concluded that a Strategic Environmental Assessment (SEA) would be required for the LFRMS.

## 8.3 SEA Scoping

We consulted with the statutory consultees on the SEA Scoping Report for a five week period during March / April 2015. The Scoping Report was submitted to the designated consultation bodies for consultation – Natural England, Historic England and the Environment Agency. The Scoping Report can be found in Appendix D.2.

All three statutory consultees provided a consultation response, these can be found in Appendix D.3.

At the end of the scoping period, an Environmental Assessment Report was produced.

## 8.4 Environmental Assessment Report

The SEA framework is used to identify and evaluate the potential environmental issues associated with the implementation of the LFRMS. The framework comprises a set of SEA objectives that have been developed to reflect the key environmental issues identified through the baseline information review. These objectives are supported by a series of indicators, which are used as a means to measure the potential significance of the environmental issues and can also be used to monitor implementation of the LFRMS objectives. The LFRMS objectives were tested against the SEA assessment framework to identify whether each option will support or inhibit achievement of each objective.

The full Environmental Assessment Report is provided in Appendix **Error! Reference source not found.**.

**Table 8-1 SEA objectives and indicators**

| Receptor | Objective | | Indicator |
|---|---|---|---|
| Landscape | 1 | Protect the integrity of the Borough's urban and rural landscapes, and promote the key characteristics of the SLAs and Green Belt. | Changes in the condition and extent of existing characteristic elements of the landscape.<br>The condition and quality of new characteristics introduced to the environment.<br>Percentage of open countryside. |
| Biodiversity, flora and fauna | 2 | Protect and enhance designated and BAP habitats and species in the borough. | Area of designated sites adversely affected by flooding.<br>Monitoring of reported status of designated nature conservation sites.<br>Percentage of land designated as nature conservation sites as a result of LFRMS measures.<br>Area of habitat created as a result of implementation of the LFRMS (e.g. flood storage areas creating wetland habitat). |
| | 3 | Maintain and enhance habitat connectivity and wildlife corridors within the borough. | |
| | 4 | Maintain existing, and where possible create new, riverine and estuarine habitat to benefit migratory and | |

| Receptor | Objective | | Indicator |
|---|---|---|---|
| | | aquatic species and fisheries, and maintain upstream access. | Number of barriers to fish migration removed. |
| Water environment | 5 | Improve the quality and quantity of the water and morphology in the borough's rivers. | Water quality and morphology of the borough's watercourses.<br>Number of pollution incidents.<br>Number of SuDS (Sustainable Drainage Systems) schemes installed as part of the LFRMS.<br>Number and volume of Environment Agency licensed abstractions.<br>Numbers of sites with high pollution potential (e.g. landfill sites, waste water treatment works) at risk from flooding. |
| | 6 | Do not inhibit achievement of the WFD objectives and contribute to their achievement where possible. | Achievement of WFD objectives.<br>Percentage of water bodies achieving 'Good' ecological status/potential.<br>No deterioration in WFD status. |
| Soils and geology | 7 | Reduce the risk of soil erosion and pollution. | Area of agricultural, rural and greenfield land affected by flooding or LFRMS measures.<br>Numbers of sites with high pollution potential (e.g. landfill sites, waste water treatment works) at risk from flooding. |
| Archaeology and Cultural Heritage | 8 | Conserve and enhance the historic environment, heritage assets and their settings. | Number of heritage assets at risk from flooding, and assessment of impact.<br>Number of vulnerable heritage assets protected from flooding by implementation of the LFRMS.<br>Proportion of conservation area ground at risk of flooding.<br>Number of designated and non-designated heritage assets harmed by FRM measures, including impacts on their settings. |
| Population | 9 | Increasing the resilience of people, property and businesses and critical infrastructure within Thurrock to the risk of flooding. | Number of residential properties at risk of flooding.<br>Number of key services (e.g. hospitals, health centres, residential/care homes, schools etc.) at risk from flooding. |
| | 10 | Increase the use of SuDS, particularly in all new developments. | Number of SuDS schemes installed as part of the LFRMS. |
| Material assets | 11 | Minimise the impacts of flooding to the borough's transport network and key critical infrastructure. | Length of road and rail infrastructure at risk from flooding.<br>Number of key infrastructure assets at risk from flooding. |
| Climate | 12 | Reduce vulnerability to climate change impacts and promote measures to enable adaptation to climate change impacts. | Number of residential properties at risk of flooding.<br>Number of key services (e.g. hospitals, health centres, residential/care homes, schools etc.) at risk from flooding.<br>Area of habitat created as a result of implementation of the LFRMS (e.g. flood storage areas creating wetland habitat).<br>Number of barriers to fish migration removed. |

### 8.4.1 Appraisal of Flood Strategy Objectives

Assessment of the Flood Strategy objectives against the SEA objectives has been undertaken.

No negative environmental effects have been identified from the Flood Strategy objectives. Many of the proposed objectives have the potential for both direct and indirect environmental benefits.

### 8.4.2 Appraisal of Local Strategy Actions

Assessment of the Flood Strategy actions against the SEA objectives was undertaken.

Some negative and positive environmental effects have been identified, with the majority having a neutral effect. The negative effect identified is minor, and arises from the action that requires drainage infrastructure improvements along rural roads.

## 8.5 Habitat Regulations Assessment

The European Council Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC, 'the Habitats Directive') as implemented through the Conservation of Habitats and Species Regulation 2010 (as amended) ('the Habitats Regulations') requires a competent authority to carry out a Habitats Regulations Assessment (HRA) of a plan or project to establish whether it will have a 'likely significant effect' on sites designated for their nature conservation interest at an international level (known as European sites, which include Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and by UK Government policy, Ramsar sites). The LFRMS for Thurrock Borough, as a statutory plan, is subject to the requirements of the Habitats Directive.

Assessing the impacts of a plan under the Habitats Regulations is a separate process to SEA. However, there is overlap between these two types of assessment. A Test of Likely Significant Effect (TLSE) (Screening Assessment) was undertaken in accordance with the requirements of the Habitats Regulations to determine whether the LFRMS is likely to adversely affect the integrity of a European site (alone or in combination with other plans, policies and projects). Consultation on the outcome of the screening assessment was undertaken as part of the SEA scoping consultation process.

All European sites lying partially or wholly within 15km of the borough boundary were included in the assessment in order to address the fact that measures in the Thurrock LFRMS may affect European sites which are located outside the administrative boundary of the strategy.

Thurrock does support one SPA and Ramsar site; the Thames Estuary and Marshes. There are also six more European sites within 15km of the borough boundary:

- Benfleet and Southend Marshes SPA and Ramsar
- Medway Estuary and Marshes SPA and Ramsar
- Crouch and Roach Estuaries SPA and Ramsar
- North Downs Woodlands SAC
- Peters Pit SAC
- Essex Estuaries SAC

The screening assessment concluded that the LFRMS is not likely to have a significant effect on any of the European sites.

Consultation with Natural England on the outcomes of the screening assessment was undertaken as part of the SEA scoping consultation exercise. Natural England confirmed that the LFRMS is not likely to have a significant effect on the European sites.

Following development of the draft strategy objectives and measures, the screening assessment was reviewed to determine whether the LFRMS would be likely to have a significant effect on the European sites.

## 8.6 Post Adoption Statement

A Post Adoption Statement has been prepared following consultation on the draft Flood Strategy and SEA Environmental Report with statutory consultees, stakeholders and the public.

The Statement sets out how the findings of the Environmental Report and the views expressed during the consultation period have been taken into account as the LFRMS has been finalised and formally approved. It also sets out any additional monitoring requirements needed to track the significant environmental effects of the Flood Strategy.

The Post Adoption Statement can be found in Appendix **Error! Reference source not found.**.

# Appendices

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# A Action Plan

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# B Areas of Critical Drainage

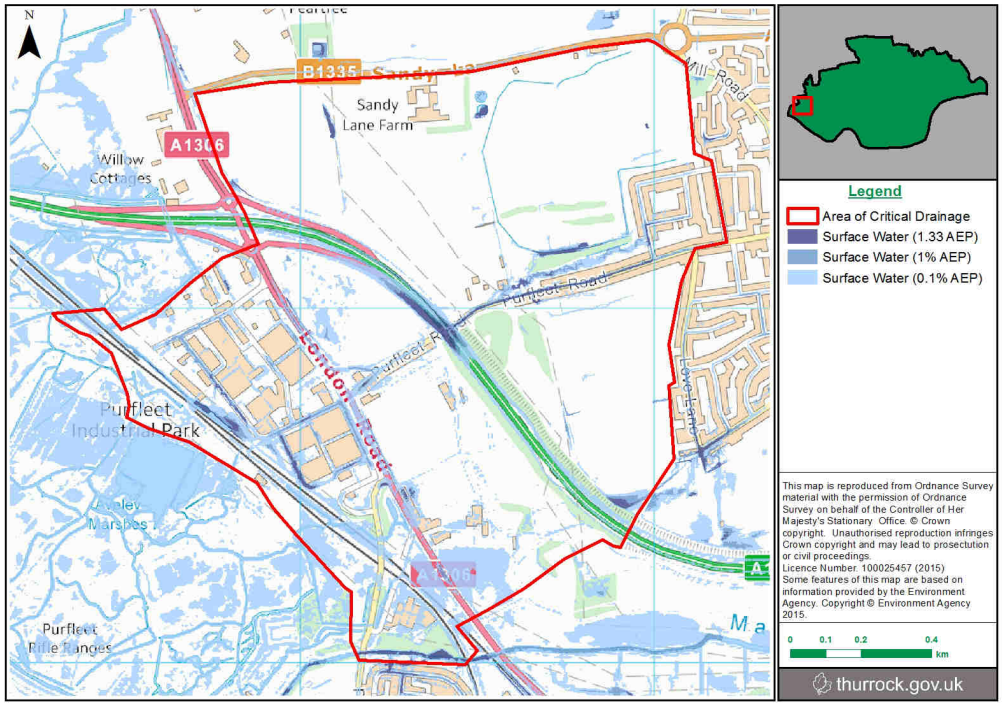
Surface water property counts are based on results from the updated SWMP modelling. As the updated SWMP modelling did not cover the entire Thurrock area, the uFMfSW was used for property counts in the areas not covered by the SWMP results. Properties were counted based on the following criteria, in line with the property count methodology used with the uFMfSW.

- Flood depths are greater than 150mm and 50% or greater of the wetted perimeter of the property was flooded; or
- Flood depths are greater than 300mm and 25% or greater of the wetted perimeter of the property was flooded.

The updated SWMP modelling was not undertaken for the 1 in 1,000 year; therefore the results from the uFMfSW were used for this probability event.

## B.1 Purfleet (AoCD01)

**Purfleet (AoCD001)**




### Description:

Located in the west of the Borough, this AoCD largely comprises industrial uses related to port activity. There are also some residential areas to the west, adjacent to the Rainham Marshes. Three local flood risk zones have been identified: the A13, Purfleet Industrial Park and Mileham's Trading Estate.

**A13:** the highway at this location is maintained by Highways England with Anglian Water providing a discharge point for surface water drainage. Pumps are used to connect a rising main which discharges to the private network at Purfleet Industrial Park and on to Aveley Marshes.

**Purfleet Industrial Park & Mileham's Trading Estate:** surface water outfalls to drainage ditches at the toe of the rail embankment near Purfleet Industrial Park then passes via a series of 300mm and 225mm diameter pipes into the Aveley Marshes. Flood risk is believed to be due to a combination of factors including rising water levels in the receiving watercourses, local alteration of ground levels leading to failure of local gravity drainage systems and obstructions caused by local infrastructure such as the rail line.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 3 | 32 | 14 | 14 | 17 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:3 | 0:0:32 | 0:0:14 | 0:0:14 | 0:0:17 | 0:0:0 | 0:0:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 10 | 31 | 146 | 14 | 14 | 22 | 0 | 38 |
| **IMD split (H:M:L)** | 0:010 | 0:0:31 | 0:0:136 | 0:0:14 | 0:0:14 | 0:0:22 | 0:0:0 | 0:0:38 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 2 | 9 | 0 | 0 | 0 | 0 | 0 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | 9 | **Thames CFMP Policy** | 4 |

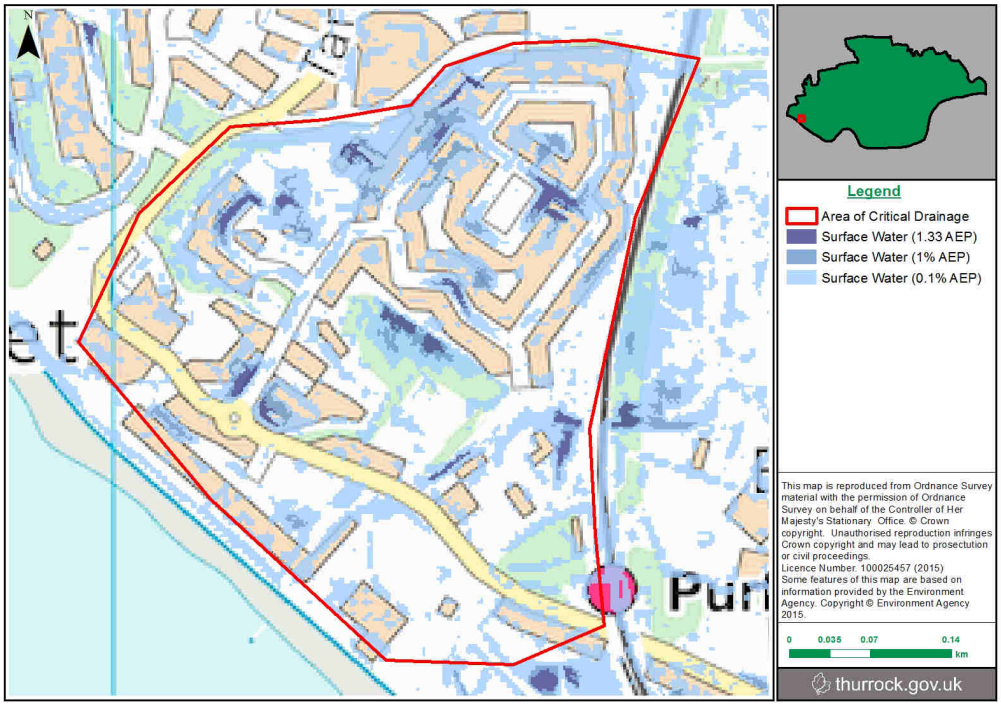
| Purfleet (AoCD001) | | | |
|---|---|---|---|
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | 5 | **TE2100 Policy** | 4 |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M4 – Preparedness & M2 - Prevention |
| **Thames RBMP Catchment** | South West Essex | **RBMB Identified Actions** | No key actions identified |

### AoCD Specific Actions:

- Highways England/Anglian Water to carry out a check on the pumps and network at this location to confirm their condition. This should be reported back to Thurrock Council. The maintenance regime at this location should be confirmed to Thurrock Council who as LLFA can then chase up with stakeholders if maintenance is not completed.
- Highways England should also liaise with Thurrock Council to confirm emergency diversion procedures, e.g. signage, resources etc
- Network Rail should carry out a survey of the series of 300mm and 225mm diameter culvert crossings at this location within the next 6 months including a maintenance regime.
- Liaise with Aveley Marshes RSPB to discuss water levels within the Marshes. Have these been raised, and if so to what extent? RSPB to show that works undertaken are not having a negative effect on local flood risk.
- Commission a simple drainage study and survey of ground levels to confirm where there are alterations in ground levels which may be causing the local gravity system to fail, assuming the culvert crossings of the rail embankment are sufficient for expected volumes of surface water and the condition of the existing drainage network is satisfactory. The results of this survey will be used to inform a way forward, be it maintenance of the existing system, or installation of a new drainage network at this location.
- Planning policy measures should be used to ensure that any development at the Ponds Farm Development provides betterment on the drainage provision which exists. Any future applications should be consulted with Thurrock highways team and details of on-going funding of maintenance should be provided by the developer to Thurrock Council.

## B.2 West Purfleet (AoCD002)

**West Purfleet (AoCD002)**




### Description:

Located in the west of the Borough, this AoCD covers the residential area of Purfleet on the western extent of London Road. Surface water drainage is provided by Anglian Water via a pumped drainage system.

Although the Council has no recorded incidents of surface water flooding at this location, pluvial modelling has identified the area as being at risk of surface water flooding at the toe of the quarry sides along Tank Lane.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 16 | 34 | 34 | 71 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 16:0:0 | 33:1:0 | 33:1:0 | 69:2:0 | 0:0:0 | 0:0:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 7 | 8 | 11 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 7:0:0 | 8:0:0 | 11:0:0 | 0:0:0 | 0:0:0 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | 9 | **Thames CFMP Policy** | 4 |
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | 5 | **TE2100 Policy** | 4 |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M4 – Preparedness & M2 - Prevention |
| **Thames RBMP** | South Essex | **RBMB Identified** | No key actions |

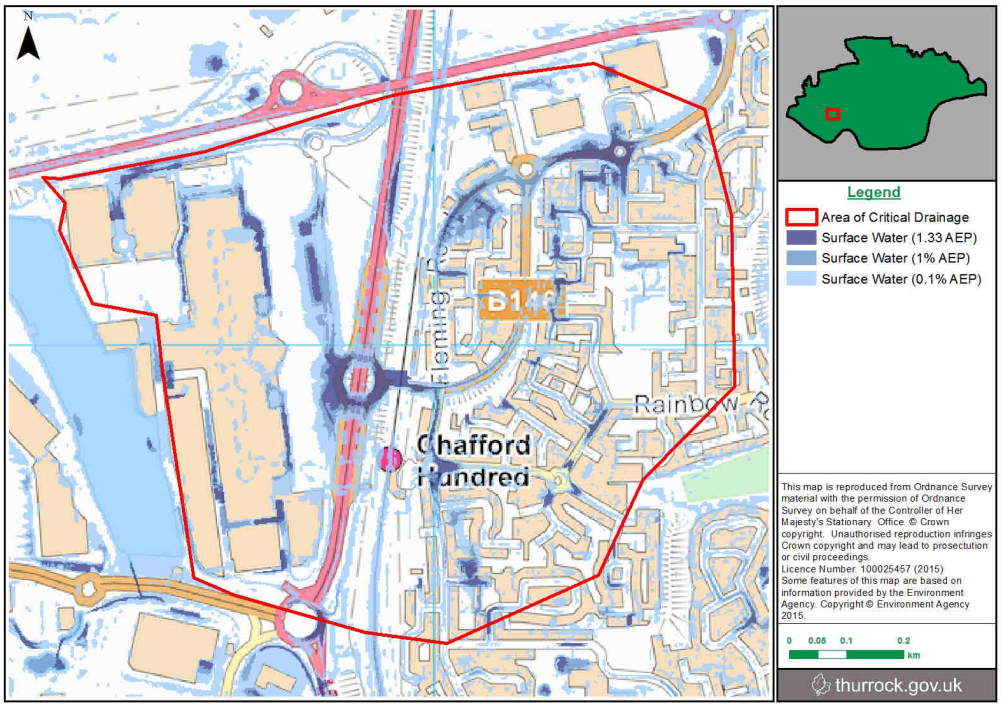
| West Purfleet (AoCD002) | | | |
|---|---|---|---|
| **Catchment** | Catchment | **Actions** | identified |

**AoCD Specific Actions:**

- Anglian Water to confirm the sizing of the surface water drainage network, including pumps, to inform the need for any increases required to the drainage capacity.
- Anglian Water to confirm their maintenance regime within this AoCD

## B.3 West Thurrock Lakeside (AoCD003)

**West Thurrock Lakeside (AoCD003)**




### Description:

West Thurrock is identified as an area of regeneration in the Thurrock Core Strategy. Although the Council has no recorded incidents of surface water flooding at this location, pluvial modelling has highlighted potential isolated areas at risk, for example the existing access to the Lakeside development along Fenner Road and underneath the A126.

No record of sewer flooding for this AoCD has been recorded on Anglian Water's register of flooded properties.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 73 | 41 | 41 | 110 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:73:0 | 0:1:40 | 0:1:40 | 0:2:108 | 0:0:0 | 0:0:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 203 | 28 | 28 | 36 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:203:0 | 0:23:4 | 0:23:4 | 0:29:7 | 0:0:0 | 0:0:0 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 1 | 2 | 2 | 2 | 0 | 0 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | N/A | **TE2100 Policy** | N/A |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M4 – Preparedness & M3 - Protection (High priority) |

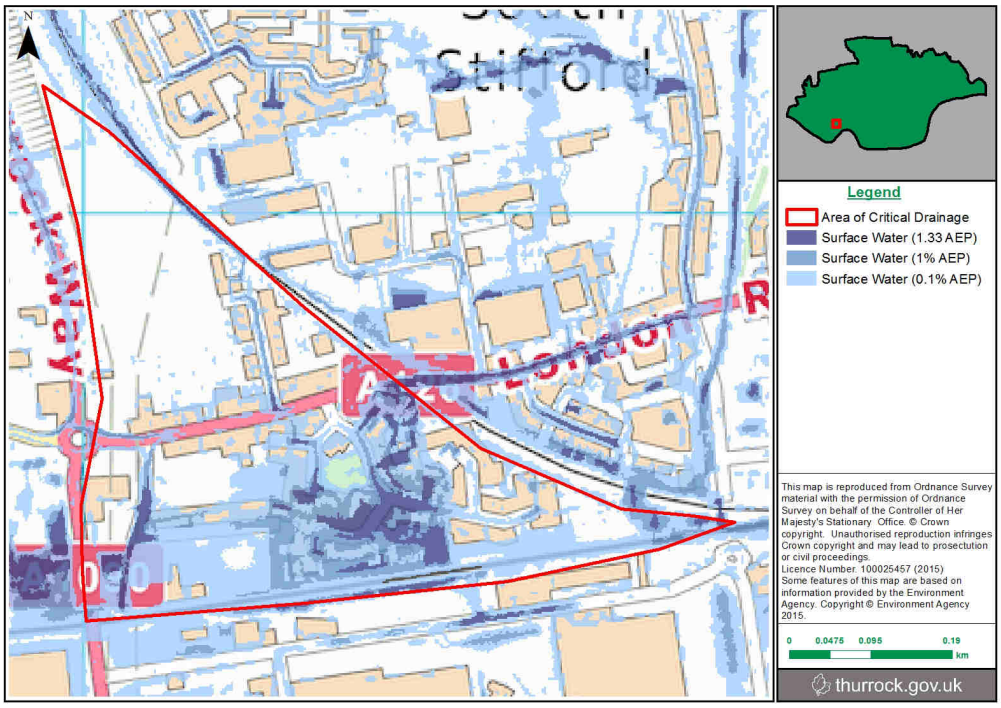
| West Thurrock Lakeside (AoCD003) | | | |
|---|---|---|---|
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

### AoCD Specific Actions:

- Council Highways team to liaise with Emergency Planning team to ensure there is a road closure plan in place in case of flooding at the A126 junction
- Thurrock Council to liaise with Anglian Water and Lakeside to confirm the drainage network at the A126 junction. If the network is found to be under capacity, investigate options to install pumps or soakaways to alleviate flood risk

## B.4 West Thurrock Residential East (AoCD004)

**West Thurrock Residential East (AoCD004)**




### Description:

Pluvial modelling has shown that surface water flows from surrounding residential areas to the south of the AoCD and pools behind the railway embankment. Thurrock Council also has records of flooding in this location.

Anglian Water has a pumped system in this location which outfalls to a Network Rail maintained ditch south of Parsonage Road. Thurrock Council currently undertakes checks in this area to ensure local drainage ditches are maintained.

No record of sewer flooding for this AoCD has been recorded on Anglian Water's register of flooded properties.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 93 | 105 | 231 | 62 | 64 | 98 | 0 | 0 |
| **IMD split (H:M:L** | 0:93:0 | 0:105:0 | 0:231:0 | 0:62:0 | 0:64:0 | 0:98:0 | 0:0:0 | 0:0:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 1 | 19 | 10 | 10 | 15 | 0 | 0 |
| **IMD split (H:M:L** | 0:0:0 | 0:1:0 | 0:19:0 | 0:10:0 | 0:10:0 | 0:15:0 | 0:0:0 | 0:0:0 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 1 | 0 | 6 | 2 | 2 | 3 | 0 | 0 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |

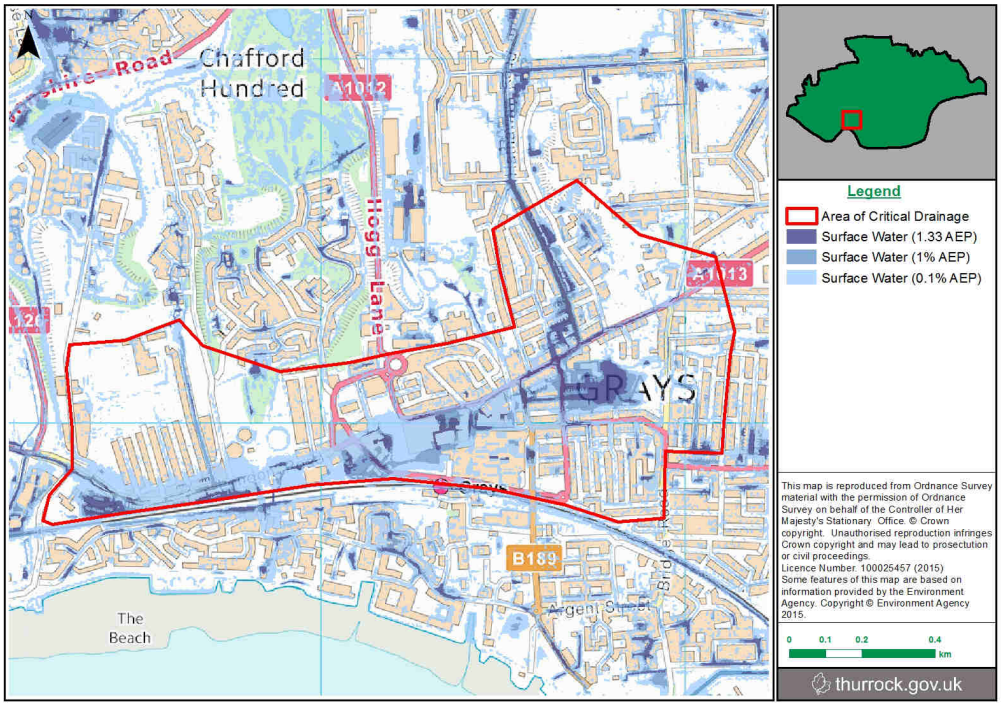
| | | | |
|---|---|---|---|
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | 5 | **TE2100 Policy** | 4 |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M2 – Prevention (High priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

### AoCD Specific Actions:

- Use planning policy to ensure that nay development to the south of the embankment at Hadley Avenue does not add pressure to the existing drainage network and, if possible, provides betterment on the existing system.
- Liaise with Anglian Water to confirm network capacity within this AoCD. If there is capacity, Thurrock Council to consider adding more gullies to increase the volume of water entering the network during a storm event.
- Thurrock Council to liaise with Network Rail regarding maintenance programmes of Network Rail drainage ditches alongside the railway embankment.

## B.5 Grays (AoCD005)

### Grays (AoCD005)




### Description:

Grays is located on the north bank of the River Thames.

Pluvial modelling has shown a number of isolated areas could be liable to surface water flooding including Florence Close, London Road, Maidstone Road, George Street and the Grays Park area. Modelling also shows surface water flows from the north into this AoCD and pools at low points in the catchment behind the railway line. Anglian Water operates a pumped network in this location.

Anglian Water's register of flooded properties includes properties within this AoCD.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 39 | 141 | 269 | 245 | 265 | 506 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:39 | 0:0:141 | 3:168:98 | 2:139:104 | 2:153:110 | 2:276:228 | 0:0:0 | 0:0:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 31 | 141 | 94 | 96 | 201 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:31 | 19:88:34 | 21:55:18 | 22:55:19 | 36:121:44 | 0:0:0 | 0:0:0 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 1 | 8 | 7 | 7 | 8 | 0 | 0 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |

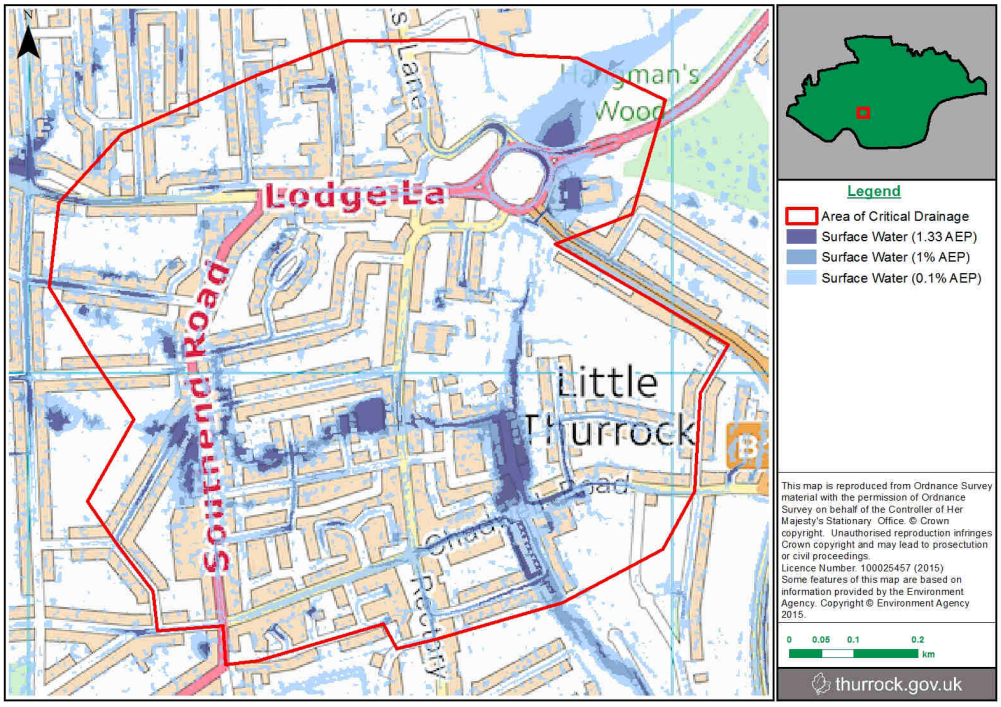
| | | | |
|---|---|---|---|
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | 5 | **TE2100 Policy** | 4 |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M2 – Prevention & M3 – Protection (High priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

## AoCD Specific Actions:

- Thurrock Council to liaise with Anglian Water to investigate potential to increase capacity of local drainage network in the vicinity of Florence Close by increasing gully numbers. Need to confirm if there is capacity within the network and preferred approach to the scheme.
- Undertake a detailed drainage study at Grays Park to confirm if there is potential to create preferential flow paths and water storage in the park.
- Investigate the potential use of swales/French drains to attenuate and infiltrate runoff along Hathaway Road in a storm event, and reduce the volume of water ponding behind the rail embankment.
- Undertake feasibility study investigate the potential to create a small storage area on recreation ground near to Stifford Primary School to help reduce flows to the south that pool behind the railway embankment.
- Implement a preferential maintenance regime along roads to the west of the AoCD (including Roseberry Road, Castle Road & Belmont Road) to ensure that all flow is entering the drainage channels and not flowing over the road surface

## B.6 Little Thurrock (AoCD006)

**Little Thurrock (AoCD006)**




### Description:

Little Thurrock is situated in the centre of the Borough and has experienced surface water flooding in the past at Hollowfield Avenue and Rectory Road. The area is located in a topographical low and historic mapping indicates it was built where there was once a pond.

Water flows down Toft Avenue, Nunns Way and along Hollowfield Avenue to the junction with Chadwell Road where it pools. Surface water at this located is served by a series of gullies to a piped Anglian Water system which passes under Chadwell Road flowing south.

Pluvial modelling shows there is a flow path travelling from the sports ground in the north towards the allotments in the south.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 102 | 109 | 180 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:102 | 0:0:109 | 0:0:180 | 0:0:0 | 0:0:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 20 | 20 | 23 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:20 | 0:0:20 | 0:0:23 | 0:0:0 | 0:0:0 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |

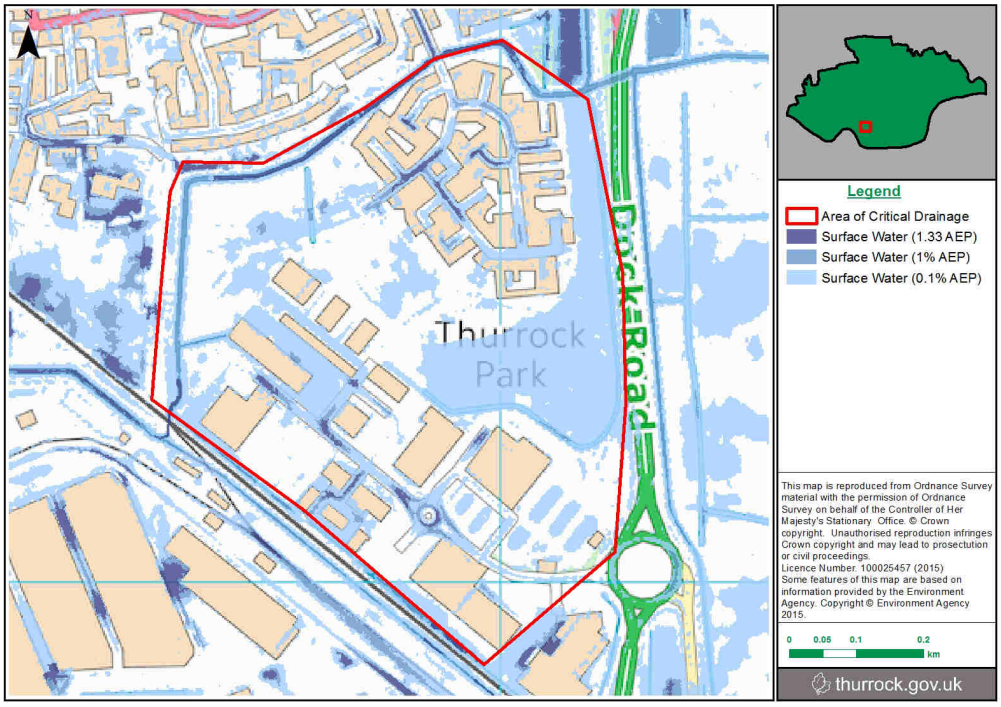
| | | | |
|---|---|---|---|
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | N/A | **TE2100 Policy** | N/A |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M3 – Protection (High priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

## AoCD Specific Actions:

- Increase the number of gullies connecting to Anglian Water Drainage network (there is a 1350mm diameter pipe in this location which may have the potential to alleviate flooding.
- Create preferential flow routes by re-grading the road, raising kerb heights etc.
- Investigate the potential to create storage areas on land in the north of the AoCD located within a school playing field and sports ground.

## B.7 Little Thurrock Marshes (AoCD007)

**Little Thurrock Marshes (AoCD007)**




### Description:

Little Thurrock Marshes is located to the west of Tilbury in the south of Thurrock. The Council has records of Thurrock Park Way trading estate suffering from surface water flooding of both the highways and private land.

Highways drainage is provided by a series of pipe and gullies connecting to a ditch located to the south west of the trading estate and adjacent to the railway line. This ditch has, historically, not been well maintained due to ownership issues, which has led to issues with highways drainage. In addition, the low gradient on the system means water collects in low points, rather than flowing away, and the soft ground conditions of the area leads to movement in the local networks, causing further drainage problems.

Anglian Water only operates a foul network at this location; surface water drainage is privately owned with Thurrock Council providing highway drainage. There is the possibility that the private surface water drainage network has been connected to the highway system which is not adequately sized to take this additional flow.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 16 | 224 | 0 | 1 | 1 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:16:0 | 0:224:0 | 0:0:0 | 0:1:0 | 0:1:0 | 0:0:0 | 0:0:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 51 | 28 | 2 | 2 | 12 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:51:0 | 0:28:0 | 0:2:0 | 0:2:0 | 0:12:0 | 0:0:0 | 0:0:0 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 1 | 5 | 1 | 1 | 1 | 0 | 0 |

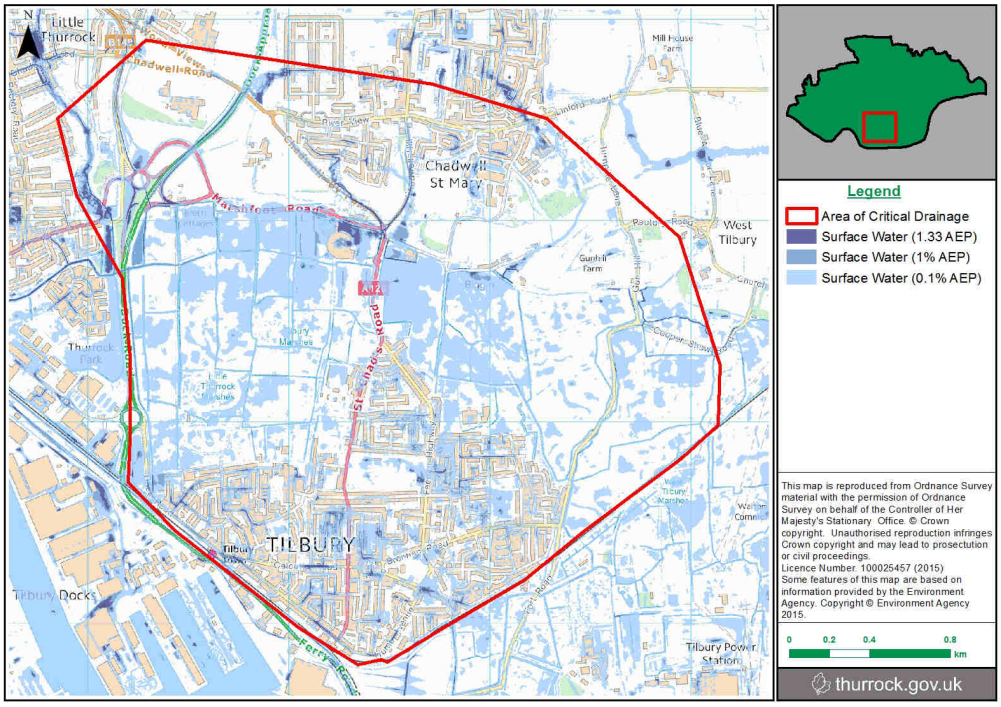
| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | 5 | **TE2100 Policy** | 4 |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M2 – Prevention (High priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

## AoCD Specific Actions:

- Thurrock Council to liaise with Anglian Water to investigate possibilities of connection to 1500mm diameter pipe to alleviate standing water problems.
- Confirm and map ownership and maintenance, and identify 'mis-connections' to the highways drainage with reference to Council records, liaison with Environment Agency, Anglian Water and landowners. The process will be used to obtain information and potentially enforce maintenance of drainage assets

## B.8 Tilbury (AoCD008)

**Tilbury (AoCD008)**




### Description:

Tilbury is located in an area which has very flat topography and was at one time marshland associated with the River Thames. A railway line located to the south of Tilbury potentially acts as a barrier to flow. Surface water issues in the area stem from poor maintenance of local drainage channels; lack of surface water drainage outfalls; issues with tide-locking or existing drainage outfalls; the design of outfalls to the Thames and localised settling of properties. Some modelling studies looking into local drainage issues have been completed by Anglian Water who is responsible for much of the surface water sewer network in this area.

There are two distinct sections to the surface water drainage in Tilbury, split east and west by a small ridge of 'high ground' along St Marys Road

- The eastern section is pumped to tide via the Main River Chadwell Cross Sewer at World's End Pumping Station.
- The western section drains to tide via gravity at Botney Sluice and Chadwell Sluice which drains East Dock Sewer. This is a Main River watercourse that receives surface water sewer flow from Tilbury.

The EA maintain Main River watercourses using permissive powers afforded by the Water Resources Act 1991; however, the primary responsibility for maintenance activities rests with the riparian (land) owner.

Surface water runoff from the Tilbury urban area drains south to connect to the St Andrews Ferry Road system. The watercourse has a very shallow fall and splits at Hairpin Bridge, flowing north and south. Historically, there have been issues with the maintenance of local ditches due to conflicts of ownership and on-going problems with fly-tipping. This causes surface water to back up through the local drainage system and flood local highways and property.

Tilbury Flood Storage Area: The Tilbury Flood Storage Area was constructed in 1972 and is located to the north of Tilbury. It is designed to reduce surface water flood risk by storing water from the marshland and upstream areas. The 1971 engineer's report states it was designed to contain a 1 in 50 year rainfall event. Discharge from the storage area is controlled by World's End Pump and prevailing tide-locked conditions at Botney Sluice. An earth embankment borders the storage area and the northern side of Tilbury. In 1997 the storage area was designated a raised reservoir under the Reservoirs Act.

## Tilbury (AoCD008)

In 2008 the Environment Agency commissioned a study of the flood storage area to improve their understanding of the catchment, including existing flood risk and future flood risk management opportunities[2].

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 139 | 851 | 3267 | 366 | 390 | 982 | 0 | 0 |
| **IMD split (H:M:L)** | 84:55:0 | 592:166:93 | 1900:845:522 | 262:62:42 | 279:66:45 | 698:189:95 | 0:0:0 | 0:0:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 31 | 56 | 285 | 57 | 57 | 107 | 0 | 0 |
| **IMD split (H:M:L)** | 6:25:0 | 56:0:0 | 172:96:17 | 20:17:20 | 20:17:20 | 40:34:33 | 0:0:0 | 0:0:0 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 1 | 7 | 30 | 3 | 3 | 7 | 0 | 0 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | 5 | **TE2100 Policy** | 4 |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M3 – Protection (High priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

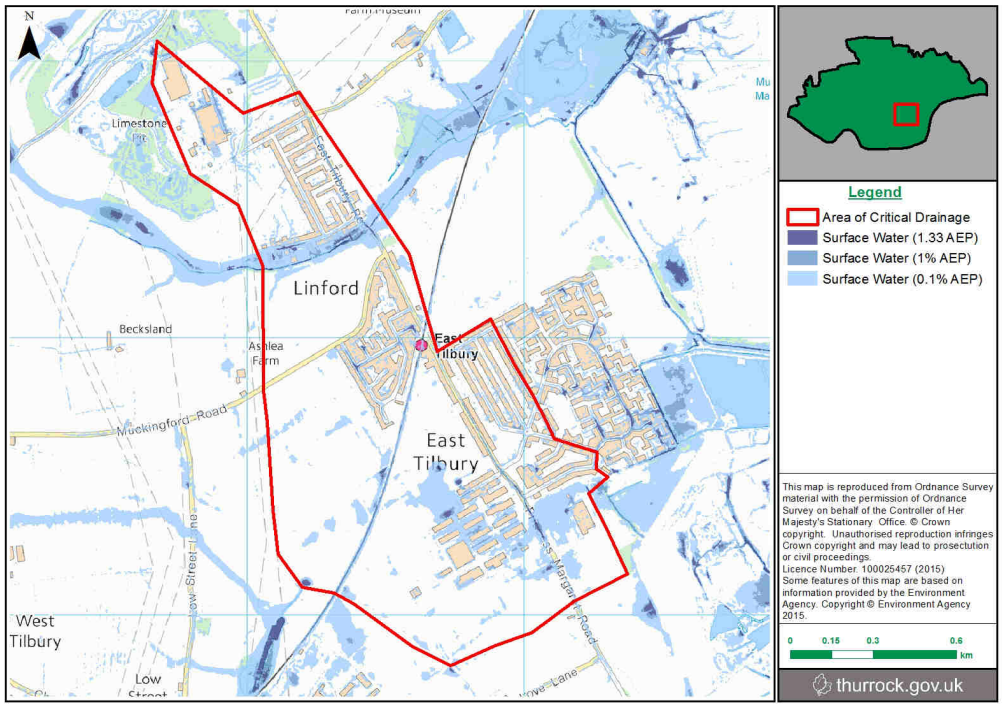
### AoCD Specific Actions:

- Undertake assessment of drainage infrastructure outfalling to local drainage ditches. If there is not sufficient capacity within the system the potential for on-line attenuation prior to outfall into the watercourses should be investigated. Reference should be made to previous Environment Agency studies.
- Liaise with Network Rail to ensure culvert crossings are appropriately sized and are being maintained
- Thurrock Council to provide support to residents through creation of preferential flow paths or property level protection where local ground levels have altered and changed the flow regime
- Undertake Tilbury Integrated Flood Study to determine the interactions and interdependencies of flood risk sources and develop a strategy to mitigate

*2 JBA Consulting (2010) Appraisal of Flood Risks and Management Strategy for Tilbury: Final Report.*

## B.9 East Tilbury (AoCD009)

**East Tilbury (AoCD009)**




### Description:

East Tilbury is a village located in the east of Thurrock.

Anglian Water only provide a separate foul and surface water system in the north western corner of East Tilbury; the rest of the area has an un-adopted surface water system. This system was never adopted by Anglian Water and if there are issues they are reported to the Council's Environmental Health team.

Surface water drainage discharges via a pumped system to a ditch in the south eastern corner of the area. The ditch is not well maintained and ownership and responsibility for this ditch is not currently known.

Pluvial modelling has shown that small sections of the industrial estate located to the south west of East Tilbury may be inundated in a severe rainfall event and a flow path exists between the two urban centres.

Access to East Tilbury should be considered when planning for development in this area if the road were to flood.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 119 | 35 | 38 | 49 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:119 | 0:0:35 | 0:0:38 | 0:0:49 | 0:0:0 | 0:0:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 55 | 13 | 14 | 20 | 0 | 0 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:55 | 0:0:13 | 0:0:14 | 0:0:20 | 0:0:0 | 0:0:0 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |

| East Tilbury (AoCD009) | | | |
|---|---|---|---|
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | 6 | **TE2100 Policy** | 3 |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | N/A |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

### AoCD Specific Actions:

- Thurrock Council and Anglian Water to meet to discuss adoption of both foul and surface water sewer network in this AoCD.
- Ensure a separate surface water and foul water system is provided as part of any new development and is adopted by Anglian Water
- Surface water ditch in the south eastern corner of East Tilbury contains all of the town's surface water drainage; ownership and maintenance responsibilities are unknown.

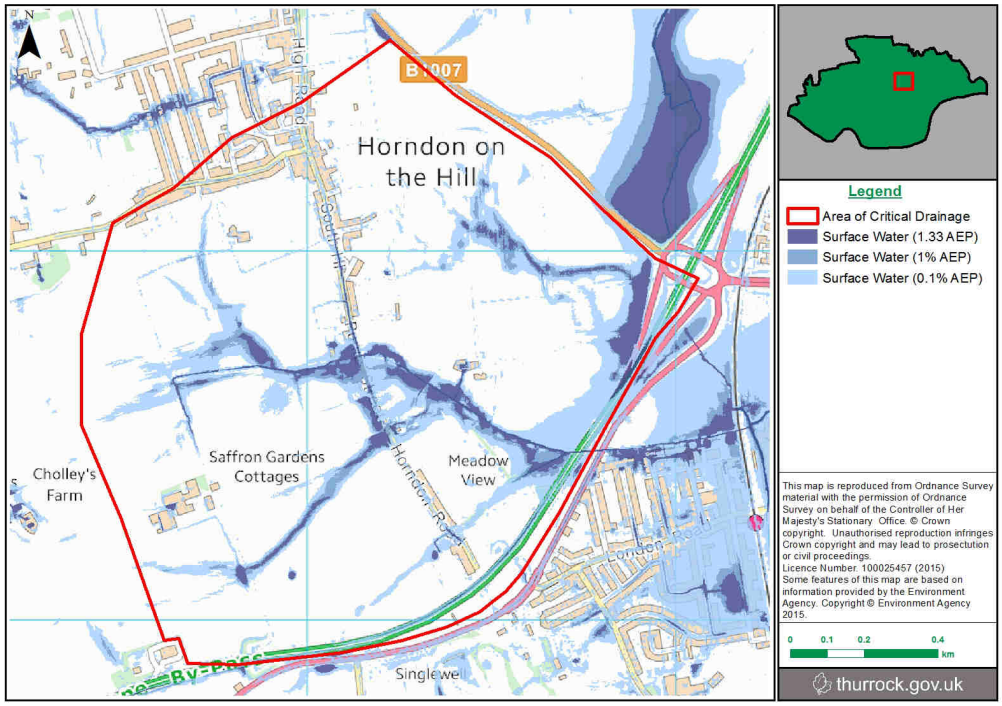
## B.10 Stanford-le-Hope

Stanford-le-Hope is located in the east of Thurrock, bordered by the A13 to the north and the Thames Estuary to the south. The northern boundary is located in a topographical depression and surface water flooding in this location has been through a combination of overloading of foul systems and ownership/maintenance issues with records to local drainage ditches.

Areas at most risk of surface water flooding are located along the north western fringe of the urban area along the A13.

### B.10.1 North West Stanford-le-Hope (AoCD010a)

**North West Stanford-le-Hope (AoCD010a)**




### Description:

Surface water modelling shows pooling of surface water from agricultural land behind the highway embankment. At this point there is a culvert which passes flow to the Butts Lane area of Stanford-le-Hope. The Council do not have any records of flooding at this location as the flooding would occur in farmland. However, surface water from this location contributes to flooding in the centre of Stanford-le-Hope.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 11 | 13 | 15 | 0 | 67 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:11 | 0:0:13 | 0:0:15 | 0:0:0 | 0:0:67 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 8 | 8 | 12 | 0 | 23 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:8 | 0:0:8 | 0:0:12 | 0:0:0 | 0:0:23 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

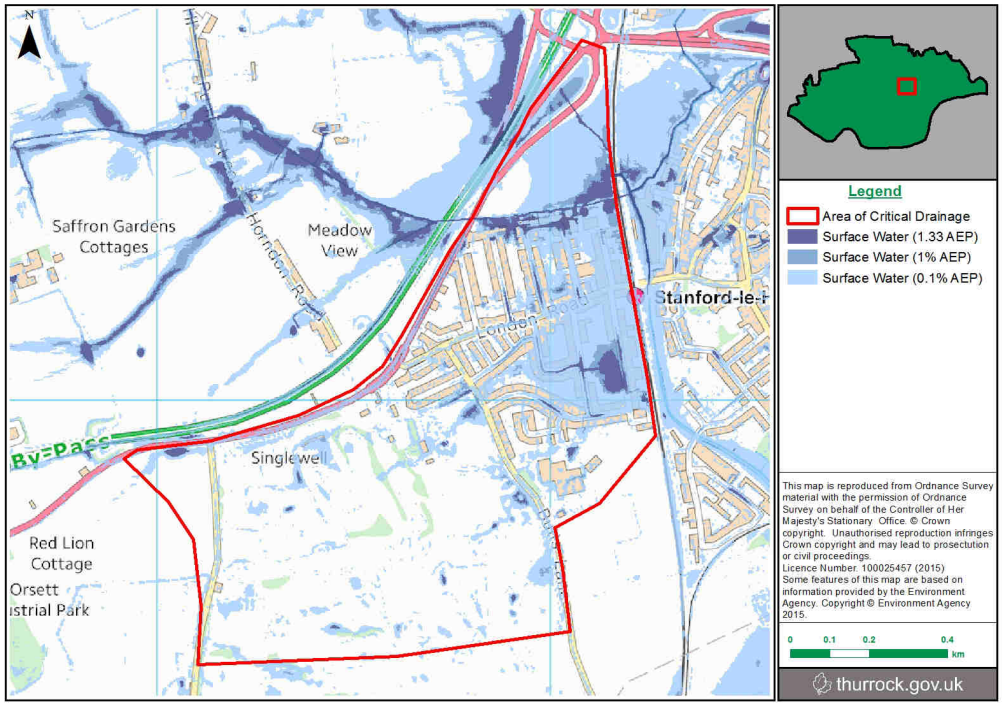
| North West Stanford-le-Hope (AoCD010a) | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | N/A | **TE2100 Policy** | N/A |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M3 – Protection (High priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

### AoCD Specific Actions:

- There may be potential for installation of a detention basin on farmland to the north of the A13. Further investigation into the size of the catchment at this location would be required to assess the potential impact that this option could have on the downstream catchment.

## B.10.2 South East Stanford-le-Hope (AoCD010b)

**South East Stanford-le-Hope (AoCD010b)**




### Description:

This AoCD is located in a topographical low and there is a large catchment for surface water flowing along Buckingham Hill Road and Stanford Road. Surface water from the highway drainage system enters a small drainage ditch which flows to the rear of properties along Valmar Avenue and Prospect Avenue, which is in part open channel and part culverted. There is no access for maintenance of the drainage ditch and it is suspected that the watercourse is blocked by garden waste leading to overland flow following the topographical low. Thurrock Council has now diverted inflows to the highway system as a result of the recent development on Butts Lane.

Surface water outfalls to the local watercourse known as 'The Hope'. Historically there has been issued with regards to maintenance of this watercourse and it is prone to silt build up.

Open land to the south of the A13 roundabout (east/west of the railway line) is identified as being at risk of surface water flooding.

The Council has records of flooding at Runnymede Road.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 13 | 209 | 121 | 133 | 172 | 0 | 351 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:13 | 0:0:209 | 0:0:121 | 0:0:133 | 0:0:172 | 0:0:0 | 0:0:351 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 1 | 6 | 9 | 16 | 16 | 0 | 0 | 44 |
| **IMD split (H:M:L)** | 0:0:1 | 0:0:6 | 0:0:9 | 0:0:16 | 0:0:16 | 0:0:19 | 0:0:0 | 0:0:44 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 3 | 2 | 2 | 3 | 0 | 4 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |
| **South Essex CFMP** | 5 | **South Essex CFMP** | 4 |

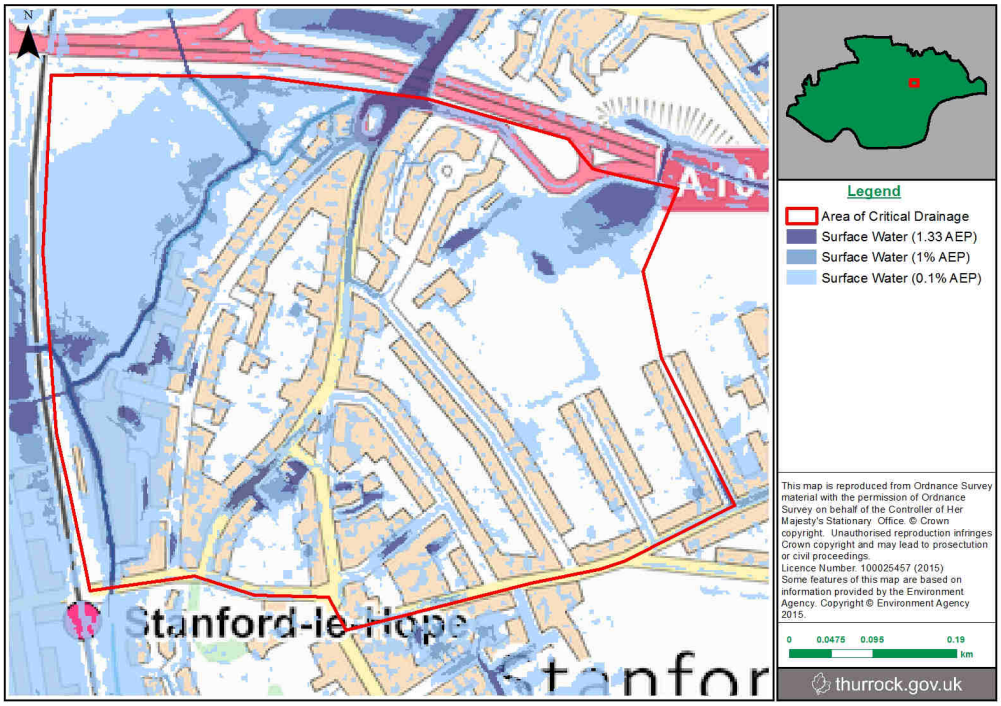
| South East Stanford-le-Hope (AoCD010b) | | | |
|---|---|---|---|
| **Policy sub area** | | **Policy** | |
| **TE2100 Action Zone** | 6 | **TE2100 Policy** | 3 |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M2 – Prevention (High priority); M4 – Preparedness (Very high priority) & M6 – Other (Moderate priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

## AoCD Specific Actions:

- Identify recreation ground as a surface water flood storage area in asset register. Complete condition survey of the outfall from the recreation ground and confirm how it reconnects to the Stanford Brook. Undertake any required remedial action.
- Open land in Stanford-le-Hope and Runnymede recreation ground act as flood storage areas; these should be identified as such in the asset register and highlighted to development control teams. Any development in these areas would require level for level floodplain compensation.
- Ensure that new development invests in the local surface water network. The network is currently at capacity.

## B.10.3 Eastern Stanford-le-Hope (AoCD010c)

### Eastern Stanford-le-Hope (AoCD010c)




### Description:

Surface water from the Victoria Road brook causes flooding in the north western corner of this AoCD. In addition, overland flow from Fetherston Road in the east flows towards this watercourse.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 6 | 45 | 0 | 41 | 42 | 78 | 0 | 622 |
| **IMD split (H:M:L)** | 0:0:6 | 0:0:45 | 0:0:0 | 0:0:41 | 0:0:42 | 0:0:78 | 0:0:0 | 0:0:622 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 7 | 12 | 2 | 31 | 32 | 42 | 0 | 161 |
| **IMD split (H:M:L)** | 0:0:7 | 0:0:12 | 0:0:2 | 0:0:31 | 0:0:32 | 0:0:42 | 0:0:0 | 0:0:161 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 10 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | N/A | **TE2100 Policy** | N/A |

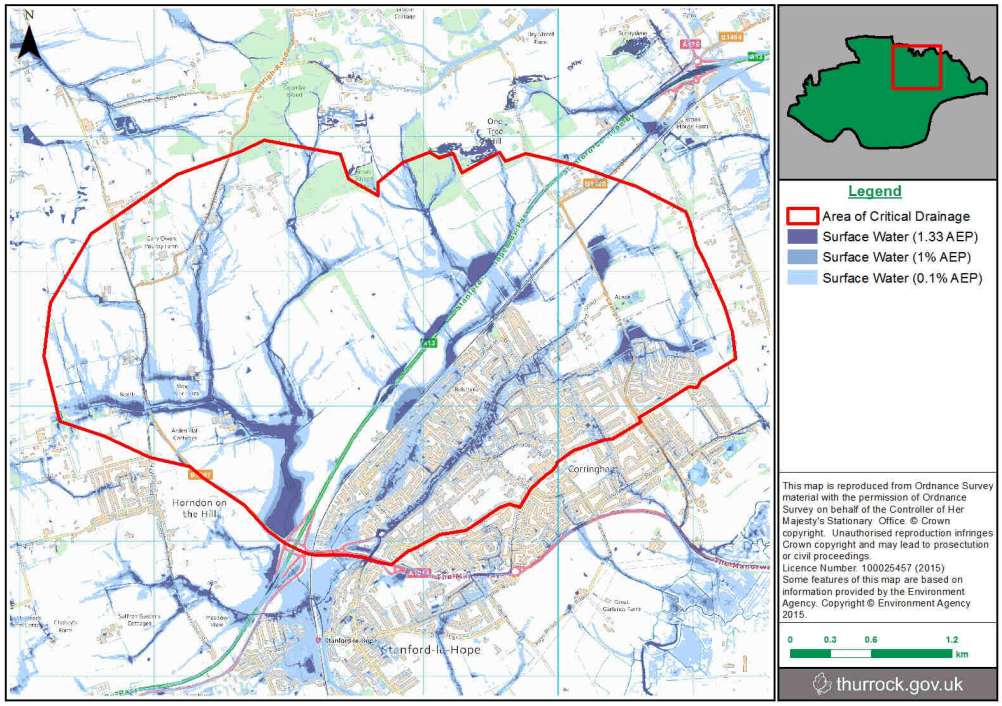
| | | | |
|---|---|---|---|
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M2 – Prevention (High priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

## AoCD Specific Actions:

- Thurrock Council should confirm with EA the maintenance regime for Victoria Road brook. If it is a low priority, the Council should work with local community to help maintain the brook.

## B.10.4 North East Stanford-le-Hope (AoCD010d)

### North East Stanford-le-Hope (AoCD010d)




### Description:

North East Stanford-le-Hope is located in a topographical depression. Surface water flooding in this location has been caused by a combination of overloading of foul systems, and ownership/maintenance issues with regard to local watercourses.

Wharf Road has been highlighted by the Council as an area where surface water flooding has been experienced in the past due to pump failure. This has now been addressed by the Council.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 3 | 8 | 395 | 430 | 458 | 1360 | 3 | 3278 |
| **IMD split (H:M:L)** | 0:0:3 | 0:0:8 | 0:0:395 | 0:83:347 | 0:86:372 | 0:168:1192 | 0:1:2 | 0:284:2994 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 8 | 51 | 53 | 115 | 11 | 131 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:8 | 0:7:44 | 0:8:45 | 0:8:107 | 0:0:11 | 0:8:123 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 3 | 3 | 3 | 5 | 0 | 25 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | N/A | **TE2100 Policy** | N/A |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M3 – Protection (High priority) & M4 – Preparedness (Very high priority) |

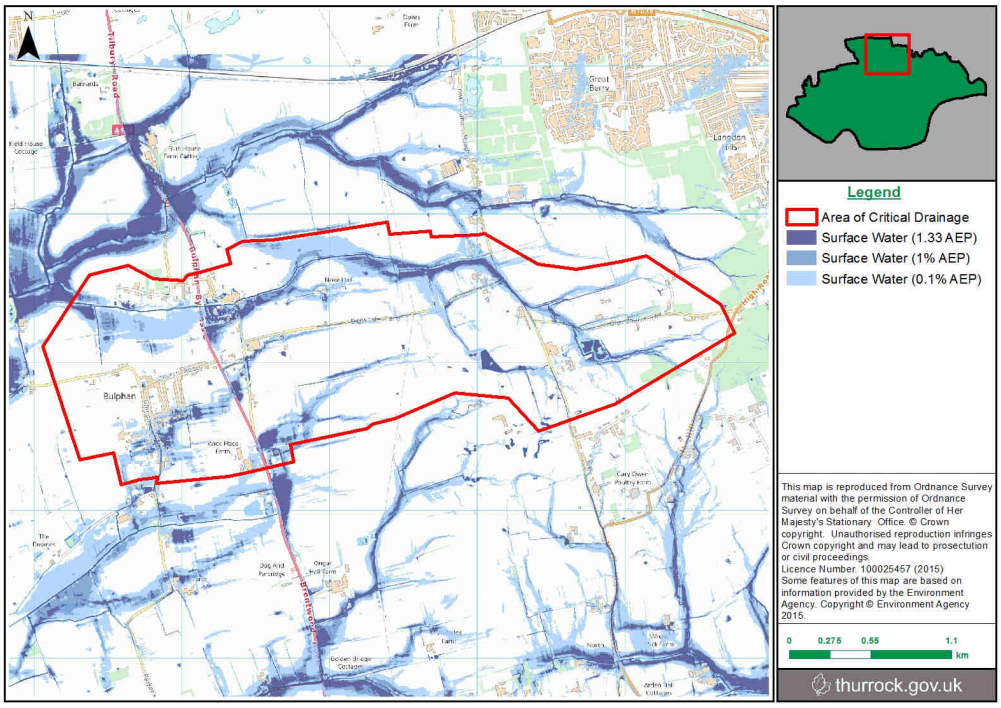
| North East Stanford-le-Hope (AoCD010d) | | | |
|---|---|---|---|
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

## AoCD Specific Actions:

- Pluvial modelling identifies the Southend Road as a major flow path for surface water. There is potential to provide extra gully connections to Anglian Water's system along Southend Road where a 1450mm diameter sewer is located. More water entering this system will result in less pooling of water at the Bypass junction at Manorway.
- Thurrock Highways team to ensure an emergency plan and traffic management plan is in place for Southend Road underpass during flood events.
- Pluvial modelling shows two flow paths from farmland in the north and northeast of the AoCD that flow into Hassen Brook. Further investigation should be undertaken to determine the effects of providing storage in the north of the catchment.
- Feasibility study into the potential creation of a storage area between the A13 and railway line with a flow control limiting surface water flow entering the Hassen Brook from the north of the catchment
- Investigate potential for flood storage in Balstonia Recreation Ground to reduce the impact of flooding on Bramley.

## B.11 Bulphan (AoCD011)

**Bulphan (AoCD011)**




### Description:

Bulphan is located in the north of the Borough within the Mar Dyke catchment.

Flooding has been attributed to short, intense periods of rainfall. The village is located in a fenland area with a naturally flat topography which may result in ponding of surface water. In addition, surface water will flow from high ground in the east towards Bulphan, exacerbating the surface water flooding issue.

Environment Agency surface water mapping and local knowledge has highlighted 'hot spots' within the AoCD where surface water flooding has a greater potential, China Lane and Fen Close.

Flooding in China Lane and Fen Close was primarily due to surcharging of the foul water system during rainfall events. This then backflowed into property. The foul water system is a pumped system and is located in a natural low point. Houses were historically served by soakaways but it is believed that, over time, these had been connected to the foul water system leading to overloading of the system.

Anglian Water completed improvement works in 2014/2015.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 5 | 0 | 31 | 0 | 0 | 57 | 272 | 13 |
| **IMD split (H:M:L)** | 0:0:5 | 0:0:0 | 0:0:31 | 0:0:0 | 0:0:0 | 0:0:57 | 0:0:272 | 0:0:13 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 36 | 0 | 13 | 0 | 0 | 69 | 257 | 26 |
| **IMD split (H:M:L)** | 0:0:36 | 0:0:0 | 0:0:13 | 0:0:0 | 0:0:0 | 0:0:69 | 0:0:257 | 0:0:26 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |

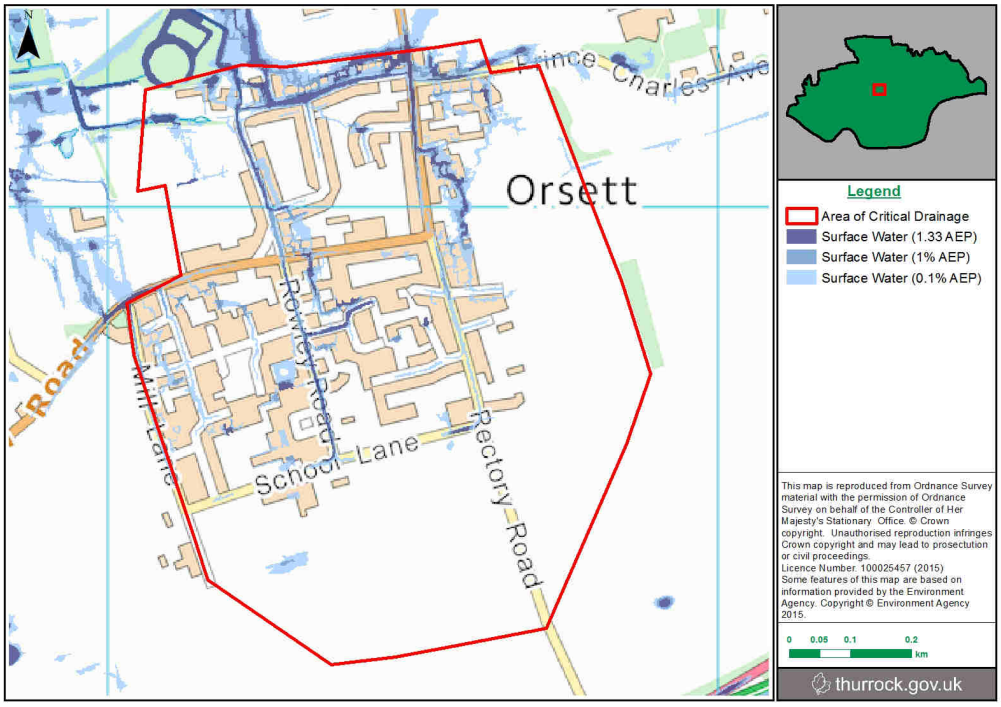
| Bulphan (AoCD011) | | | |
|---|---|---|---|
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |
| **TE2100 Action Zone** | N/A | **TE2100 Policy** | N/A |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M4 – Preparedness (Very high) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

### AoCD Specific Actions:

- Investigate 'misconnections' and educate homeowners on responsibilities regarding property drainage
- Liaise with EA regarding need and opportunities for flood defence schemes, such as flood storage areas, on Main Rivers located across the AoCD

## B.12 Orsett (AoCD012)

**Orsett (AoCD012)**




### Description:

Located in the centre of the Borough, the Environment Agency's updated Flood Map for Surface Water shows that surface water flows to the north where it pools on Malting Lane.

Thurrock Council has records of flooding on Rectory Road.

Anglian Water operate separate foul and surface water sewer networks in this location. The surface water sewers outfall to drainage ditches to the north of Orsett.

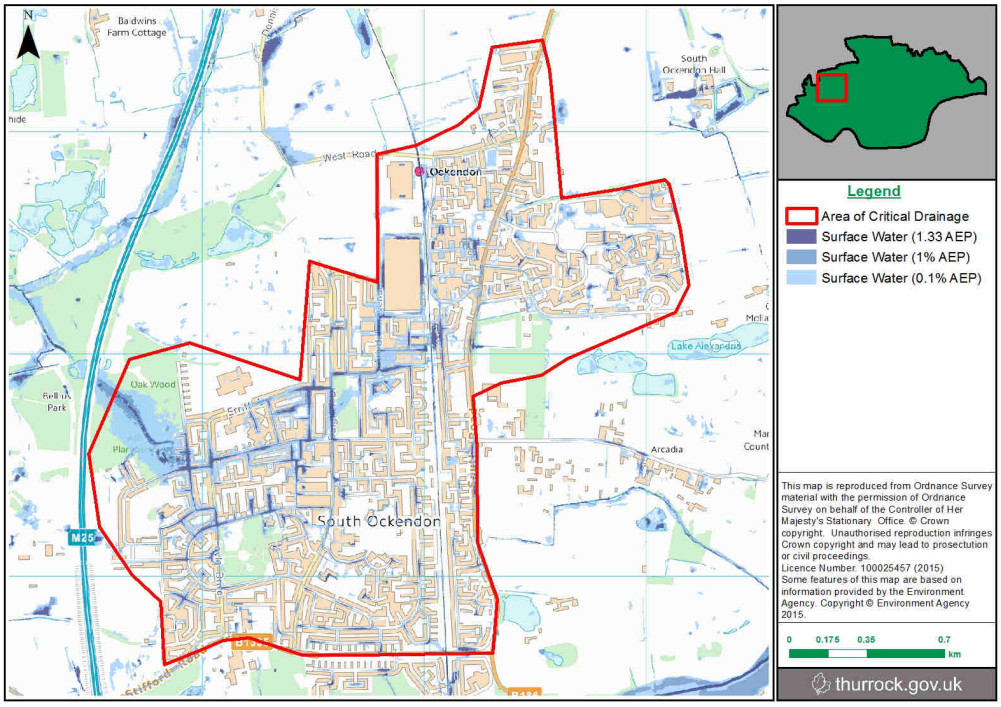
| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 174 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:38 | 0:0:0 | 0:0:174 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 29 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:14 | 0:0:0 | 0:0:29 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

### AoCD Specific Actions:

None

## B.13 South Ockendon (AoCD013)

**South Ockendon (AoCD013)**




### Description:

Thurrock Council has records of sewer flooding at Buckles Lane in South Ockendon. Local knowledge suggests that the lane was created as access to a mineral site which has subsequently been developed into Grangewaters Outdoor Activity Centre by Thurrock Council.

The highways were, historically, served by drainage ditches on either side of the lane and a small gulley/pipe carrier system which conveyed surface water to the ponds and Grangewaters. Over time local ground profiles have been altered and roadside ditches filled in without planning permission. This has resulted in failure of the local drainage system causing surface water to flow down the highway rather than alongside it.

Anglian Water operate a separate foul and surface water system with positive drainage to outfalls to the Mar Dyke in the south, to local drainage ditches in the north, and to an existing system in the Ford Factory site.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 503 | 5916 | 1104 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 123:205:175 | 2177:2151:1588 | 302:539:263 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 44 | 459 | 28 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 8:24:12 | 125:217:117 | 4:19:5 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 4 | 40 | 6 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 3 |

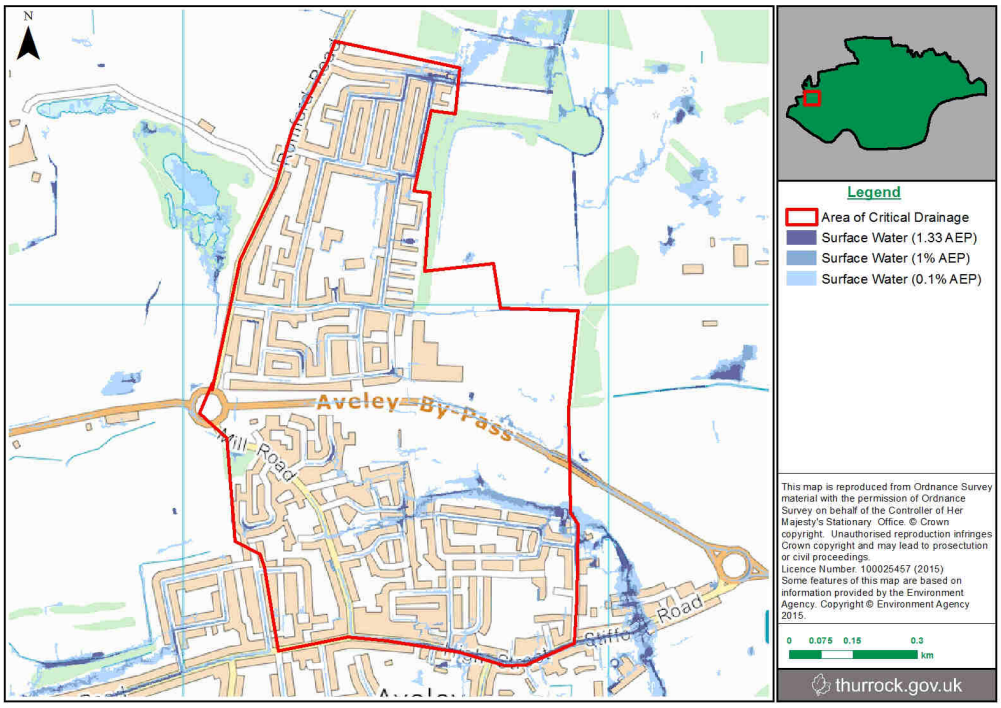
| South Ockendon (AoCD013) | | | |
|---|---|---|---|
| **TE2100 Action Zone** | N/A | **TE2100 Policy** | N/A |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M3 – Protection (High priority) & M6 – Other (High priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

## AoCD Specific Actions:

- Development at the Ford site needs to be controlled. Currently the Anglian Water system connects to a separate system but re-joins a combined system which has insufficient capacity. Any redevelopment of this site will need developers to provide a new separate drainage system.
- Thurrock Council should consider adopting the highway drainage from Buckles Lane, which is currently privately owned. The drainage ditches need to be reinstated and maintained. If new drainage is damaged by illegal development, the Council should take measures to pursue through the legal system.

## B.14 Aveley (AoCD014)

**Aveley (AoCD014)**




### Description:

Surface water runoff south of the Aveley Bypass flows in a southerly direction towards local drainage ditches where there have been records of flooding. Anglian Water surface water sewers outfall to local drainage ditches at Aveley Primary School which then flows towards the Mar Dyke.

Thurrock Council has records of flooding on Stanford Gardens.

| | NaFRA (fluvial and tidal) | | | Surface Water | | | Groundwater | |
|---|---|---|---|---|---|---|---|---|
| | High Risk | Medium Risk | Low Risk | 3.33% AEP | 1% AEP | 0.1% AEP | High Risk | Medium Risk |
| **Residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 760 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:32:2 | 0:0:0 | 0:760:0 |
| **Non-residential Properties** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 18 |
| **IMD split (H:M:L)** | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:0:0 | 0:1:0 | 0:0:0 | 0:18:0 |
| **Critical Infrastructure** | | | | | | | | |
| **Total** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 |

| | | | |
|---|---|---|---|
| **Thames CFMP Policy sub unit** | N/A | **Thames CFMP Policy** | N/A |
| **South Essex CFMP Policy sub area** | 5 | **South Essex CFMP Policy** | 4 |

| | | | |
|---|---|---|---|
| **TE2100 Action Zone** | N/A | **TE2100 Policy** | N/A |
| **Thames FRMP management catchment** | South Essex | **FRMP Measure / Priority** | M2 – Prevention (High priority) |
| **Thames RBMP Catchments** | South West Essex | **RBMB Identified Actions** | No key actions identified |

## AoCD Specific Actions:

- Thurrock Council to undertake asset survey and consider adopting maintenance of ditches that fall into 'no-man's land' to ensure future maintenance responsibilities
- Investigate drainage capacity due to increased pressure from future development in this area. Where there is limited capacity, development policy should ensure development invests in the surface water drainage network

# C Communication and engagement

During the development of this Local Strategy, we have prepared and issued a local flooding questionnaire. The objective of the questionnaire was to gather local flooding knowledge and to understand the public views and experiences of flooding so this could inform the preparation of our Flood Strategy.

The responses to key questions asked in the questionnaire are outlined below

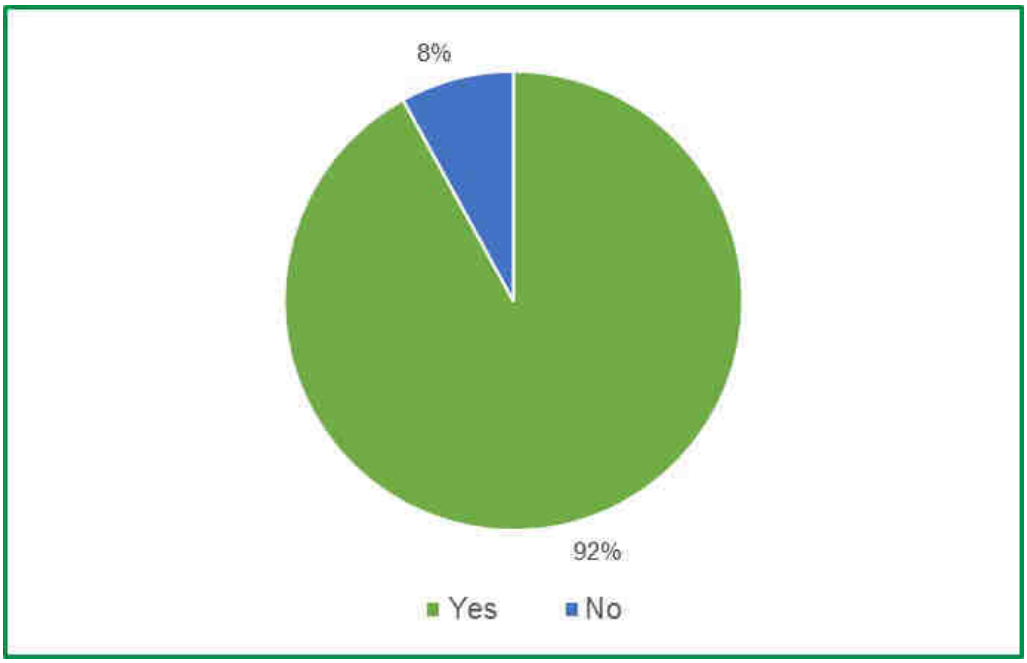
## C.1 Questionnaire responses

The results displayed are those recorded directly from the questionnaire. They have had no additional interpretation and present the public perception of flood risk in Thurrock. It has been assumed the questionnaire responses are representative of Thurrock Borough as a whole.

Note: not all respondents provided a response to all questions.

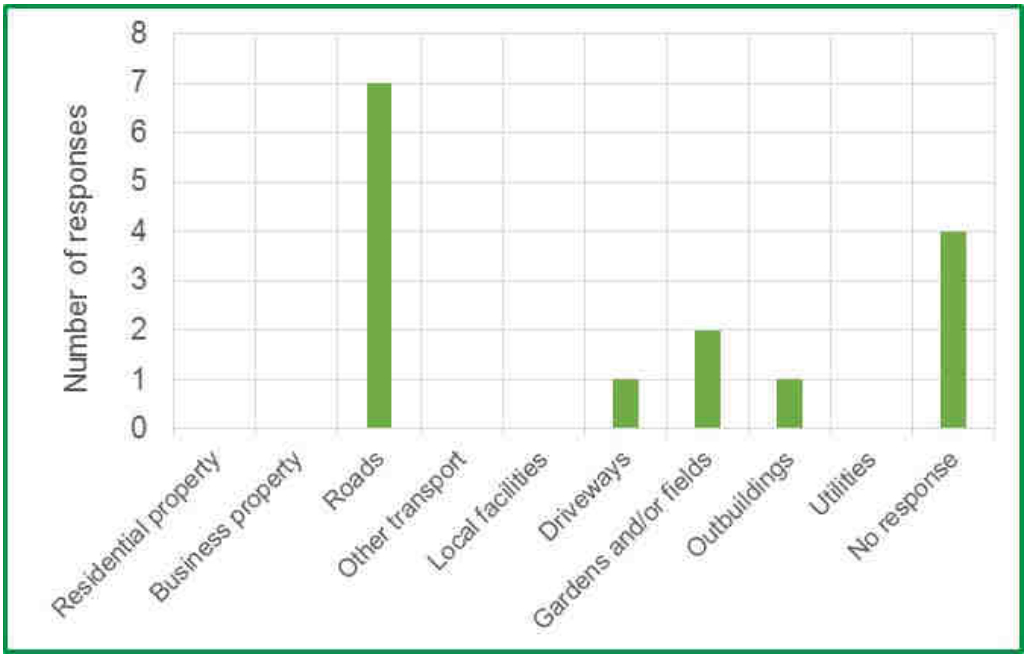
### C.1.1 Have you been affected by flooding?

The majority of respondents have been affecting by flooding in the past (92%)



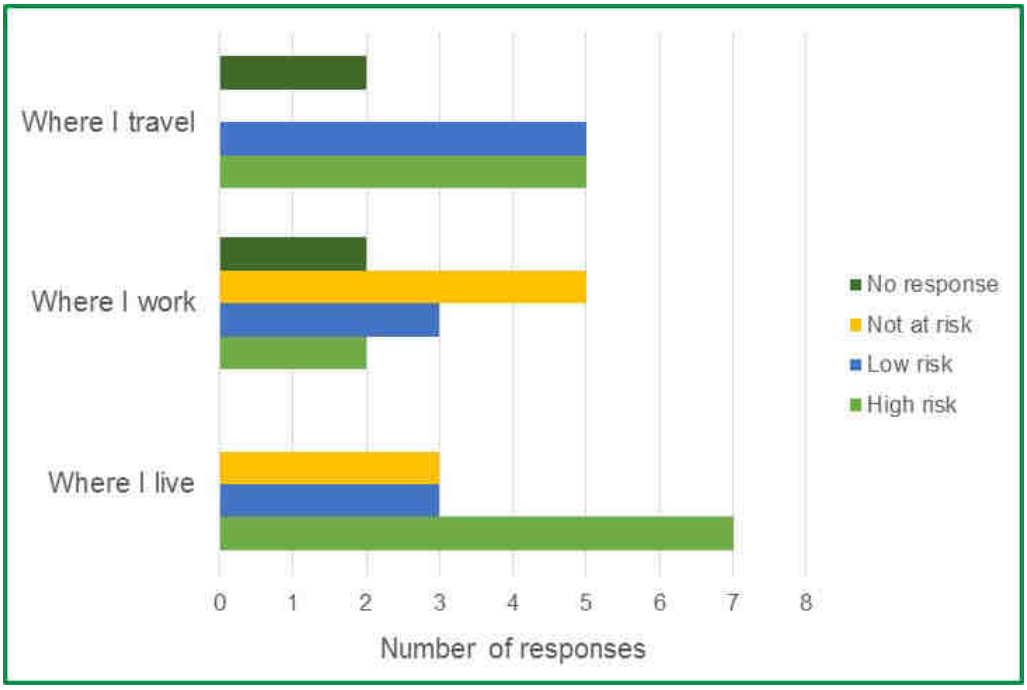
### C.1.2 What was flooded?

Of the respondents the majority had been affected by flooding to roads. None of the respondents had been affected by flooding to residential or business property.



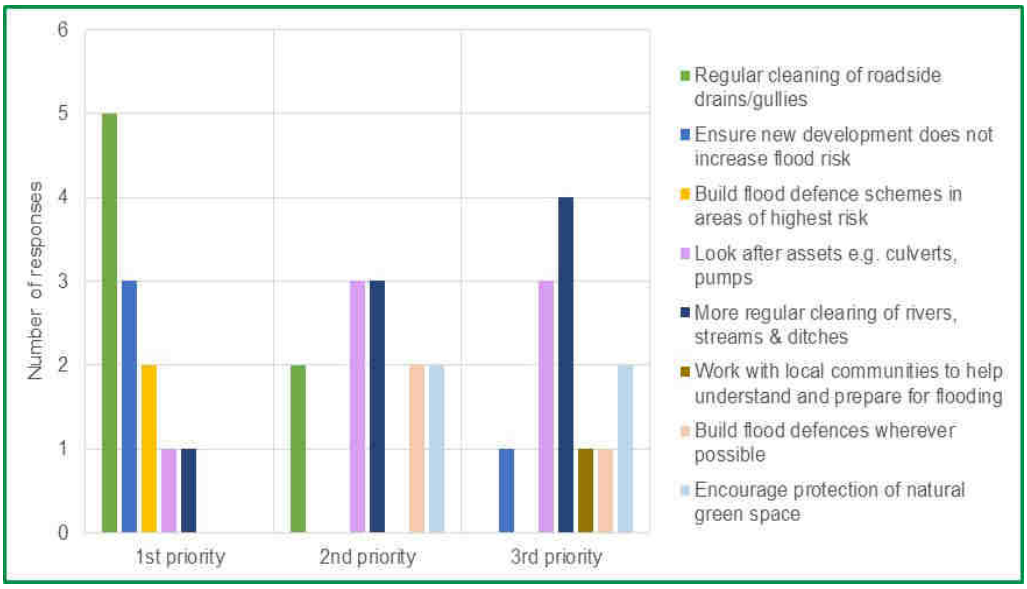

### C.1.3 Do you consider that you are in an area of high, low or no flood risk?

Of the respondents, over half considered where they lived to be at high risk of flooding. The majority of respondents considered where they work to not be at risk, whilst the risk to where respondents travel was split evenly between low and high risk.



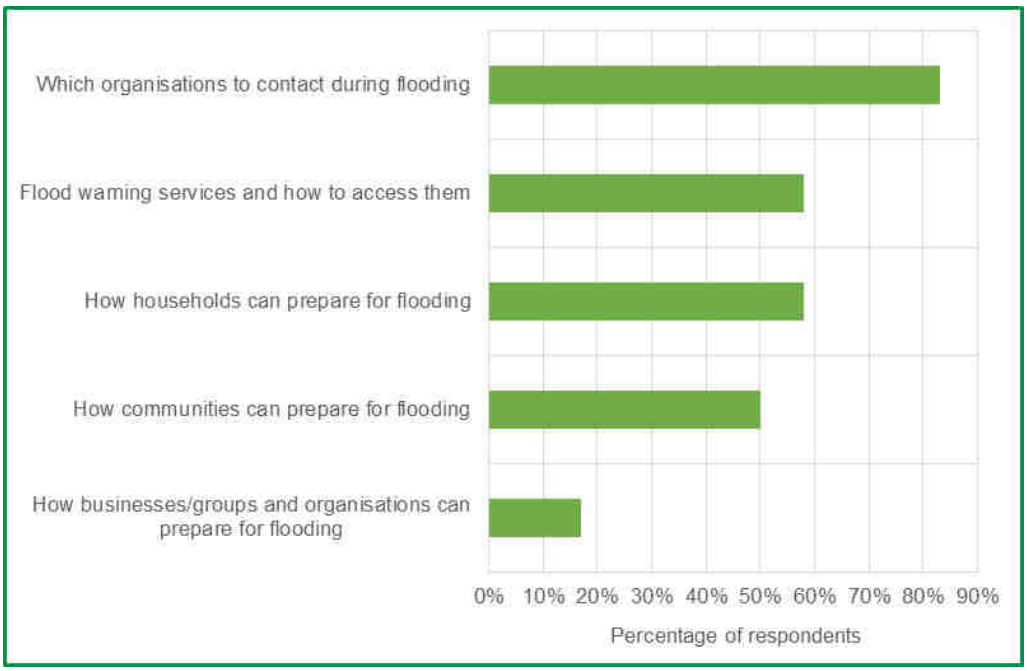
### C.1.4 What do you think the Council and its partners should be doing to manage flood risk in the area?

Of the respondents, almost half thought regular cleaning of roadside drains and gullies should be the Council and its partner's highest priority.



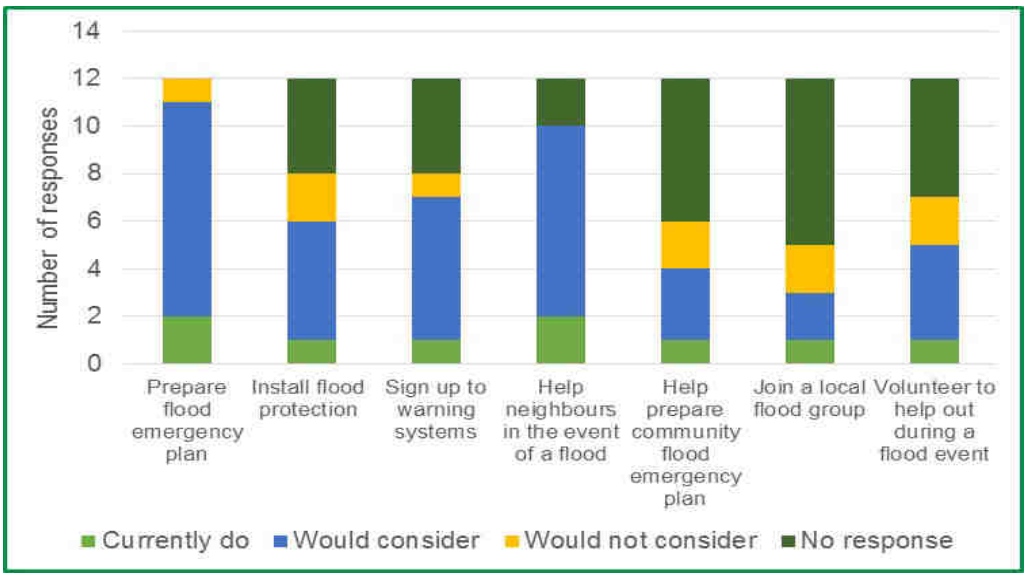

### C.1.5 Which of the following topics would you like information and advice to be more easily available?

Over 80% of respondents to the questionnaire would like more information and advice on which organisation to contact during flooding, and over 65% would like more information and advice on flood warning services and how to access them, and on how households can prepare for flooding.



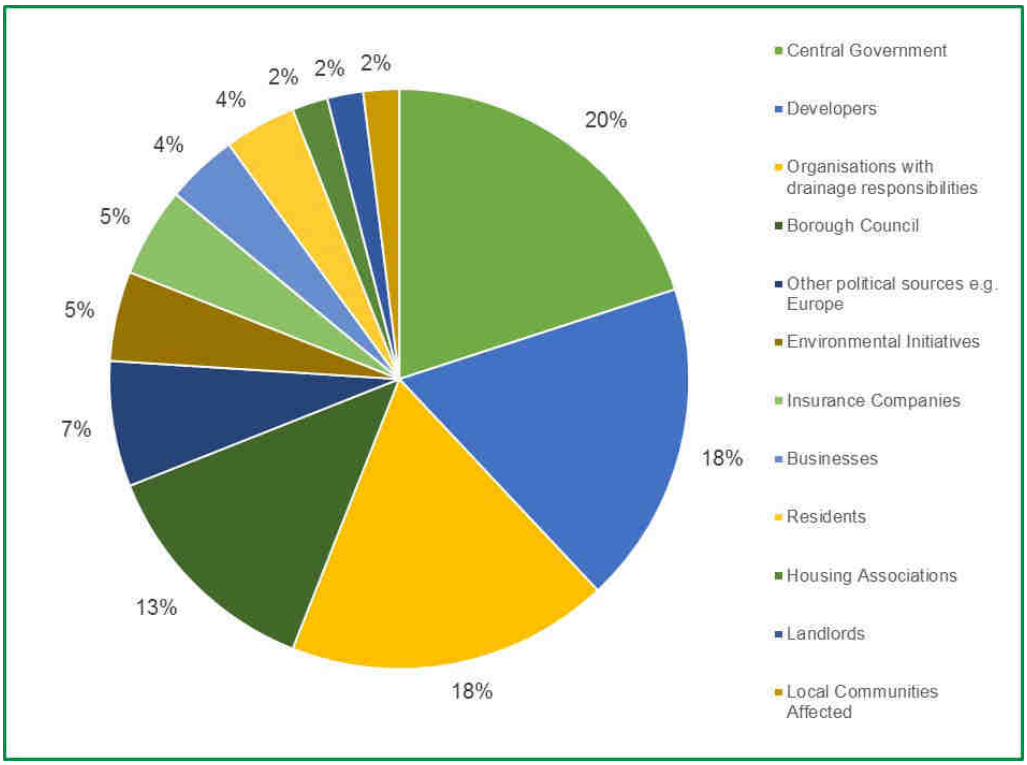
### C.1.6 Which of the following things do you do now or would consider in the future to prepare for flooding?

Of the respondents, the majority would consider preparing a flood emergency plan as well as helping neighbours in the event of a flood. Few respondents would consider joining a local flood group or help prepare a community flood emergency plan.



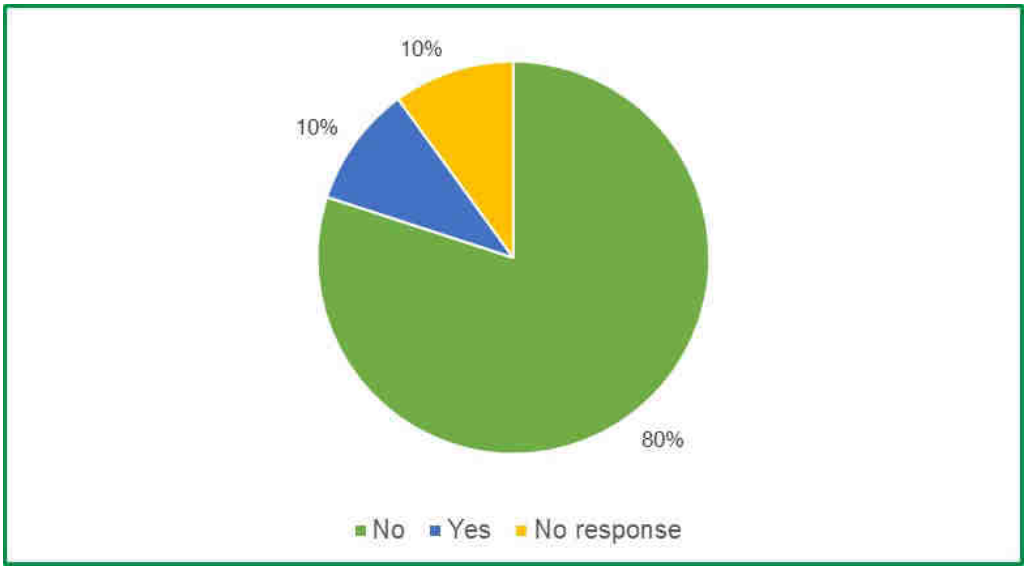

### C.1.7 Where do you think money should be found to pay to manage flood risk?

The majority of respondents believed money to pay to manage flood risk should come from Central Government (20%), developers (18%), organisations with drainage responsibilities (18%) and the local council (13%).



### C.1.8 Did you know Thurrock Council was a Lead Local Flood Authority before this survey?

Of the respondents, the majority (80%) did not know Thurrock Council was a Lead Local Flood Authority.



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# D Strategic Environmental Assessment

## D.1 SEA Screening Report

## D.2 SEA Scoping Report

## D.3 SEA Scoping Report – consultation response

## D.4 Environmental Assessment Report

## D.5 Post Adoption Statement

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# E Legislative context

**Table E-2 Legislative context for the Local Strategy**

| Legislation | |
|---|---|
| Flood and Water Management Act (2010) | The Act makes provision for better, more sustainable, management of flood risk for people, homes and businesses establish strategic responsibility in managing flood risk and protect water supplied to the consumer.<br>The FWMA sets out the role of Thurrock Council as LLFAs and sets out a range of powers and responsibilities such as the duty for all RMAs to co-operate with each other, and provides Lead Local Flood Authorities (LLFA) and the Environment Agency with a power to request information required in connection with their flood risk management functions.<br>Section 9 of the FWMA requires LLFAs to develop, maintain, apply and monitor a strategy for local flood risk management in its area. This document is the South East London Local Flood Risk Management Strategy. |
| Flood Risk Regulations (2009) and EU Floods Directive (2007) | The Flood Risk Regulations (FRR) transposes the European Floods Directive into UK Law. Its purpose is to establish a framework for assessing and managing flood risk, aimed at reducing the negative impact of flooding on human health, the environment, cultural heritage and economic activity across the European Community. The Directive was developed in response to a number of extreme flooding events suffered across the EU and aims to establish effective cross-border flood risk management to address this.<br>The Directive required Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. This is defined as “Flood Risk Area” in the FRR.<br>For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU. |
| The Land Drainage Act (1991 and amended in 1994) | The Land Drainage Act 1991 requires that a watercourse be maintained by its owner in such a condition that the free flow of water is not impeded. The riparian owner must accept the natural flow from upstream but need not carry out work to cater for increased flows resulting from some types of works carried out upstream, for example a new housing development.<br>If a riparian owner fails to carry out his responsibilities under the Land Drainage Act, or if anyone else causes a watercourse to become blocked or obstructed, the County and District Councils have powers of enforcement by serving a notice under the Act. If this is ignored, the Council concerned may carry out the necessary itself and then recharge the person responsible for the full cost incurred.<br>The 1994 Act amends the Land Drainage Act of 1991 in relation to the functions of internal drainage boards and local authorities. |
| Water Resources Act (1991) | This Act aims to prevent and minimise pollution of water. The policing of this act is the responsibility of the Environment Agency. Under the act it is an offence to cause or knowingly permit any poisonous, noxious or polluting material, or any solid waste to enter any controlled water.<br>Silt and soil from eroded areas are included in the definition of polluting material. If eroded soil is found to be polluting a water body or watercourse, the Environment Agency may prevent or clear up the pollution, and recover the damages from the landowner or responsible person. |
| EU Water Framework Directive (2000) | This Directive sets out to establish a Community framework for the protection of surface waters and groundwater across the EU. It aims to provide a common approach with common objectives, principals and basic measures designed to prevent any further deterioration of surface and ground waters and to protect and enhance the quality and quantity of aquatic eco-systems and, with regard to their water needs, terrestrial systems. |

| Legislation | |
|---|---|
| Strategic Environmental Assessment Directive (2001) | The SEA Directive applies to a wide range of public plans and programmes (e.g. on land use, transport, energy, waste, agriculture, etc.). The SEA Directive does not refer to policies. Plans and programmes in the sense of the SEA Directive must be prepared or adopted by an authority (at national, regional or local level) and be required by legislative, regulatory or administrative provisions. An SEA is mandatory for plans/programmes which:<br>• Are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste/ water management, telecommunications, tourism, town & country planning or land use and which set the framework for future development consent of projects listed in the EIA Directive.<br>OR<br>• Have been determined to require an assessment under the Habitats Directive.<br>Broadly speaking, for the plans/programmes not included above, the Member States have to carry out a screening procedure to determine whether the plans/programmes are likely to have significant environmental effects. If there are significant effects, an SEA is needed. The screening procedure is based on criteria set out in Annex II of the Directive. |
| Civil Contingencies Act (2004) | The Civil Contingencies Act establishes a new legislative framework for civil protection in the United Kingdom. It imposes a clear set of roles and responsibilities on those organisations with a role to play in preparing for and responding to emergencies. Local authorities are a Category 1 responder under the Act, and have a key role to play in respect in discharging their duties in the legislation. The Act, and accompanying Regulations and guidance, delivers a single framework for civil protection in the United Kingdom capable of meeting the challenges of the twenty first century. |
| Climate Change Act (2008) | The Act sets up a framework for the UK to achieve its long-term goals of reducing greenhouse gas emissions and to ensure steps are taken towards adapting to the impact of climate change. Its main elements are:<br>• Setting emissions reduction targets in statute and carbon budgeting.<br>• A new reporting framework.<br>• The creation of an independent advisory body.<br>• Trading scheme powers<br>• Adaptation<br>• Policy measures which reduce emissions. |
| Conservation of Habitats and Species Regulations (2010) | The objective of the Habitats Directive is to protect biodiversity through the conservation of natural habitats and species of wild fauna and flora. The Directive lays down rules for the protection, management and exploitation of such habitats and species. The Habitats Regulations transpose the Habitats Directive in England, Wales and to a limited extent Scotland by ensuring that activities are carried out in accordance with the requirements of the Directive. |
| The Localism Act (2011) | The Localism Act contains a wide range of measures to devolve more powers to councils and neighbourhoods and give local communities greater control over local decisions like housing and planning. |
| National Planning Policy Framework (2012) | The National Planning Policy Framework sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities. |
| The Water Act (2014) | Water Act will, for the first time, mean businesses, charities and public sector customers will have the freedom to switch supplier from 2017.<br>The Act will:<br>• Address growing pressure on water resources by making our supply more resilient;<br>• Help join up the national water network, by making it easier for water companies to buy and sell water from each other;<br>• Increase competition and encourage new entrants to the market who can offer alternative sources of water or innovative ways of treating sewerage; and<br>Ensure that hundreds of thousands of households in the highest flood risk areas will be able to access affordable flood insurance from 2015. |

# F Ordinary Watercourse Enforcement Protocol

## F.1 Introduction

Under the Land Drainage Act 1991 Thurrock Council Land Drainage Consents are required for the following activities on an ordinary watercourse.

Land Drainage Act Section 23 (and as amended by the FWMA 2010)

- The erection or alteration of any mill dam, weir or other obstruction to the flow of any watercourse
- The erection of any culvert
- The alteration of a culvert in a way that would be likely to affect flow

Consent is required regardless of whether work is permanent or temporary.

Ordinary watercourse **consent application forms and guidance** for completing the forms can be found on our website.

Under Section 24 of the Land Drainage Act Thurrock Council can serve a legal notice requiring a person to abate the nuisance, with regards to ordinary watercourses, within a specified time. Failure to conform by a notice can result in Thurrock Council carrying out the required remedial work and seek to recover associated costs.

## F.2 Procedure for Written Consent Under Section 23 Land Drainage Act

The following approach will be adopted upon receipt of an application for consent to alter an ordinary watercourse by erecting or altering any mill, dam, weir or other structure, or to erect or alter a culvert.

1. Upon receipt of a correct application and fee, officers will consider if the proposed work is likely to affect the flow of an ordinary watercourse

   Officers will undertake a desk study to evaluate the ordinary watercourse and the proposed works

2. If the proposed work does not alter the flow of an ordinary watercourse then consent will not be required
3. If the proposed work does alter the flow of an ordinary watercourse then the officer will consider whether reasonable conditions can be imposed to prevent the alteration

   The officer will detail any conditions proposed and the reasons for them.

4. If the Officer is satisfied the conditions are appropriate and reasonable, the application will be granted subject to the conditions
5. If the Officer believes the works will alter the flow of an ordinary watercourse, and no conditions can be imposed to prevent alteration of the flow, then the application will be refused and recorded in the refusal letter along with the reasons for the rejection.

## F.3 Procedure for Contraventions of Prohibitions on Obstructions under Section 24 of the Land Drainage Act

The following procedure will apply upon discovery of a nuisance caused by any obstruction erected, raised or altered, or any culvert erected or altered in contravention of Section 23.

1. Officers will visit the site to investigate and establish whether a nuisance has occurred. If the officer is unable to properly assess the situation without gaining entry onto private property, they are referred to the Powers of Entry Guidance.

   Officers will record the facts from their initial investigation.

   - If officers are able to ascertain that a nuisance has occurred they will record that fact.
   - If the officer deems there to be an imminent and serious risk of harm to a receptor then the officer should take reasonable action to minimise the risk
   - If the officer deems a nuisance to have occurred they will ascertain the identity of the person to whom they may consider issuing the notice. That person will be any of the following
     - Any person having control of the part of the watercourse where any impediment occurs
     - Any person owning or occupying the land adjoining the part of the watercourse where the impediment occurs
     - Any person whose act or default has impeded the condition of the watercourse
2. Once the relevant person has been identified, officers will record this fact alongside information on how they were identified
3. Following establishment of the identity of the land owner / controller, the officer will write to the riparian landowner to outline the reason for concern and to request a meeting to discuss the issue
   - If a meeting is agreed, a meeting will take place, giving officers a chance to explain how the breach may be

remedied and an action plan and associated timeframes agreed upon.

- If the riparian landowner fails to respond to the meeting request, a reminder will be sent. If they fail to cooperate then the officer will consider whether a formal notice should be served. The reason for any decision to enforce will be recorded. The notice will allow reasonable time in which the riparian landowner can remedy the breach.

4. If after the time specified, the work remains outstanding, the officer must prepare an updated report for consideration of either prosecution or for work to be carried out and the cost of the work recovered from the riparian landowner.
5. If it is decided to prosecute, the officer will forward the file to the legal department who will draft the document to be laid before the court.
    - Any person in contravention of, or failure to comply with, any notice served shall be guilty of an offence and liable on summary conviction to a fine. For every day after conviction, the riparian landowner will be liable to a daily fine.
6. If it is decided to undertake such as action that may be necessary to remedy the effect of the contravention or failure, the decision will be recorded
    - Before taking this action, officers will write to the riparian landowner informing them of the decision and detailing the likely work and associated costs that are likely to be incurred and recovered by the council should the work take place.
    - Officers will inform the riparian landowner to remedy the breach themselves, allowing a reasonable period of time to allow the riparian landowner to obtain alternative quotations for the work.
7. If the contravention or failure still exists after this period has elapsed, the officers may remedy the breach.
    - Once the breach is remedied, the Council may seek to recover the expenses incurred as a result of remedying the situation.

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# G Sustainable Drainage Systems Guidance

## G.1 Introduction

The use of Sustainable Drainage Systems to manage surface water run-off is an approach which seeks to mimic natural drainage systems. SuDS aim to retain water on or near the site as opposed to traditional drainage approaches which involve piping water off site as quickly as possible. SuDS provide opportunities to:

- reduce the causes and impacts of flooding;
- remove pollutants from urban run-off at source; and,
- combine water management with green space with benefits for amenity, recreation and wildlife.

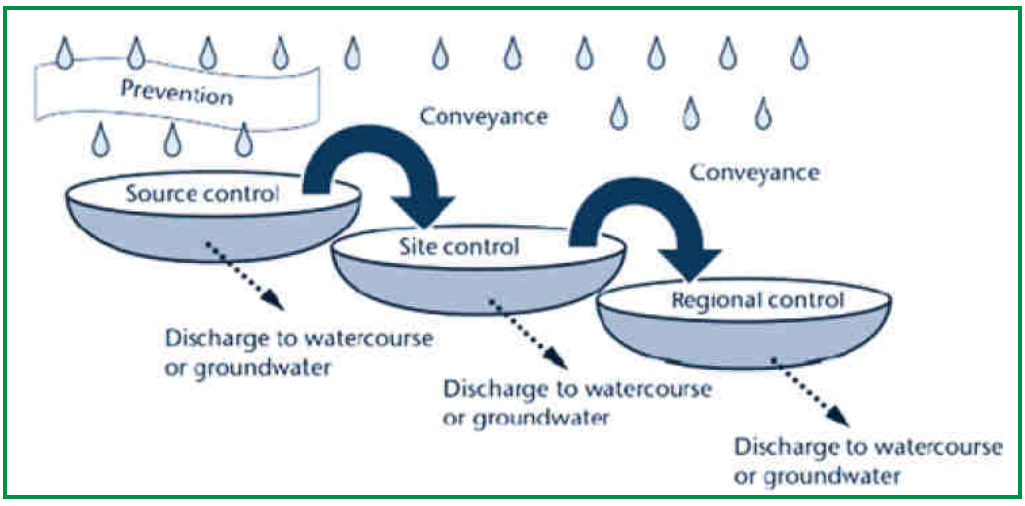
SuDS involve a range of techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands.

The variety of SuDS techniques available means that virtually any development should be able to include a scheme based around these principles. This should not be a piecemeal use of a few techniques. A fully integrated system is essential.

Some SuDS options could require significant land take so it is essential that they are considered early on in the design process. SuDS solutions are also available for high density urban environments where space is at a minimum. It can be difficult to incorporate some options once the detailed development design is underway.

Figure G-shows the SuDS management train which demonstrates managing water at source and provides a hierarchy of techniques for improving quality and quantity. Techniques closer to source are preferable.

**Figure G-1 SuDS Management Train[3]**




[3] Environment Agency, *Sustainable Drainage Systems (SUDS)*. [WWW] http://publications.environment-agency.gov.uk/pdf/GEHO0308BNST-e-e.pdf?lang=_e

Figure G- shows the SUDS hierarchy with the most sustainable solutions at the top of the table. These meet all 3 of the SUDS criteria.

**Figure G-2 SuDS Hierarchy**[4]

More sustainable


Least sustainable

| SuDS technique | Flood reduction | Pollution reduction | Landscape & Wildlife benefit |
|---|---|---|---|
| **Living roofs** | ✓ | ✓ | ✓ |
| **Basins and ponds**<br>- constructed wetlands<br>- balancing ponds<br>- detention basins<br>- retention ponds | ✓ | ✓ | ✓ |
| **Filter strips and swales** | ✓ | ✓ | ✓ |
| **Infiltration devices**<br>- soakaways<br>- infiltration trenches and basins | ✓ | ✓ | ✓ |
| **Permeable surfaces and filter drains**<br>- gravelled areas<br>- solid paving blocks<br>- porous paviors | ✓ | ✓ | |
| **Tanked systems**<br>- over-sized pipes/tanks<br>- storm cells | ✓ | | |

## G.2 Surface water drainage guidance

### G.2.1 *Why do I need to submit a surface water strategy?*

Government's expectation is that sustainable drainage systems will be provided in new developments wherever this is appropriate. According to the NPPF the expectation is that 'local planning policies and decisions on planning applications relating to major development - developments of 10 dwellings or more; or equivalent non-residential or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010)) to ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate[5],

In order to meet these new requirements developers must demonstrate that the proposals for the management of surface water satisfy minimum standards of operation according to Defra's Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems, and that there are clear arrangements in place for

[4] Source: Environment Agency Thames Region, 2006, *SUDS A Practical Guide*

[5] Written Statement made by: The Secretary of State for Communities and Local Government (Mr Eric Pickles) on 18 Dec 2014

ongoing maintenance over the lifetime of the development. The following sections outline the information that you are required to submit to Thurrock Council as part of your planning application in order for the Council to assess whether your design meets these requirements

### G.2.2 *What information on surface water drainage needs to be provided with my application?*

The following checklists (Checklist A: Outline Application or Checklist B: Full Application/Discharge of Condition) outline the information that must be submitted for the Council to assess the suitability of the proposed surface water strategy.

For further information on how to complete your drainage design and a pro-forma to assist in the development of your application see the Sustainable Drainage section of the Council's website: www.thurrock.gov.uk/flood.

## G.3 Further information

- **National Planning Policy Framework (NPPF)**
- **Defra's Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems** and
- CIRIA 523 (SUDS Best Practice Manual)
- CIRIA 609 (SUDS – hydraulic, structural and water quality advice)
- CIRIA 697 (SUDS Manual)
- CIRIA R156 (Infiltration Drainage – Manual of Good Practice)
- Sustainable Drainage Systems (SUDS) – Environment Agency (see **www.environment-agency.gov.uk/suds** for details)

**Figure G-3 CHECKLIST A: Outline Application**

| Outline Drainage Design | | |
|---|---|---|
| **Ref.** | **Information required** | **Supplied Y/N** |
| **1.** | Demonstrate an understanding of the natural drainage characteristics within and adjoining the site. | |
| **2.** | Provide an outline assessment of existing geology, ground conditions and permeability through desk-based research e.g. a review of geology maps and catchment information and site visit observations. Infiltration tests should be carried out at this stage wherever possible. | |
| **3.** | Prepare a Conceptual Drainage Plan to show:<br>a) Development layout with indicative location of proposed attenuation storage<br>b) Site discharge point | |
| **4.** | Provide a Conceptual SuDS Design Statement describing:<br>c) The SuDS Design Criteria applicable to the site<br>d) Indicative runoff rate calculations and attenuation volumes for the lifetime of the development<br>e) Initial thoughts on how the site will be maintained<br>f) Preferred point of connection.<br>g) Proposed method of flow control<br>h) Information regarding the proposed number of treatment stages to be applied to each element of the site<br>i) Demonstration that surface water/groundwater entering the development from adjacent land has been taken into account. | |

**Figure G-4 CHECKLIST B: Full Application or Discharge of Drainage Conditions**

| Detailed Drainage Design | | |
|---|---|---|
| **Ref.** | **Information required** | **Supplied Y/N** |
| **1.** | An assessment of suitability for infiltration based on soil types and geology, which should account for:<br>j) The presence of constraints that must be considered prior to planning infiltration SuDS<br>k) The drainage potential of the ground<br>l) Potential for ground instability when water is infiltrated<br>m) Potential for deterioration in groundwater quality as a result of infiltration<br>n) Evidence of infiltration tests, particularly at the location of any intended infiltration device<br>o) Groundwater level monitoring results | |
| **2.** | A Detailed Drainage Plan identifying:<br>a) The proposed 'management train' and total land take<br>b) Location and type of source control<br>c) Site controls with storage locations<br>d) Conveyance and exceedance flow routes<br>e) The destination of runoff and any runoff rate restrictions | |
| **3.** | A Detailed SuDS Design Statement covering:<br>a) Final SuDS to be incorporated and final discharge points where relevant<br>b) Reason for changes to any previously submitted drainage scheme<br>c) How the drainage design satisfies SuDS techniques in terms of water quality and attenuation and discharge quantity for the lifetime of the development<br>d) Proposals, where relevant, for integrating the drainage system into the landscape or required publicly accessible open space and providing habitat and social enhancement<br>e) Calculations showing the pre and post-development peak runoff flow rate for the critical rainfall event<br>f) Provision of drainage for large storm events, including protection for SuDS systems<br>g) Indication of overland flow routes and safeguarding of properties from flooding<br>h) Any phasing plan for the development<br>i) Management of health and safety risks<br>j) The process for information delivery and community engagement to relevant stakeholders<br>k) System valuation (including capital costs, operation and maintenance costs, cost contributions) and a demonstration of long term economic viability<br>l) Preferred point of connection.<br>m) Proposed method of flow control | |

| Detailed Drainage Design | | |
|---|---|---|
| **Ref.** | **Information required** | **Supplied Y/N** |
| **4.** | Method Statement detailing how surface water runoff will be managed during construction phase. | |
| **5.** | Confirmation of land ownership of all land required for drainage and relevant permissions. | |
| **6.** | A SuDS Management Plan, which provides:<br>a) Details of which body will be responsible for vesting and maintenance for individual aspects of the drainage proposals<br>b) A management statement to outline the management goals for the site and required maintenance<br>c) Description of maintenance schedule and materials and tools needed<br>d) A maintenance schedule<br>e) A site plan including access points, easements and outfalls. | |
| **7.** | Where required for major developments, a plan showing each development plot or phase (e.g. a development block of houses) which shows the allocation of volume storage and discharge rate given to that plot as part of a wider SuDS strategy. | |

# H LFRMS Programme and Strategic Investment Plan

The Strategy Programme and Funding Plan compiles all actions identified for the Borough over the Strategy period (6 years) and sits behind the LFRMS.

The annual Action Plans are prepared each year to outline the actions identified in the Strategy Programme and Funding Plan that are to be undertaken in that particular year.

## H.1 LFRMS Funding and Programme scoring

There are two stages to the prioritisation of Actions

- Strategy period prioritisation; and
- Annual action prioritisation

**Strategy period prioritisation**

This first stage identifies which year of the Strategy period funding may be available. This will provide the initial Annual Action Plan

**Annual action prioritisation**

Once it has been identified what year of the Strategy period funding may be available, it is useful to prioritise those actions within the given year. To achieve this, the following scoring criteria have been developed:

## H.2 Prioritisation scoring criteria

Q1: Is funding available from external partners?

*If funding is available from external partners to support delivery it will increase the chances of an Action / Scheme receiving Grant in Aid (GiA) funding.*

| Answer | Score |
|---|---|
| Yes | 1 |
| No | 0 |

Q2: Is the area known to have flooded in the past?

*Areas that are known to have flooded in the past have been assigned a higher score to reflect the need to investigate and reduce flooding in areas known to be at risk.*

| Answer | Score |
|---|---|
| Yes | 1 |
| No | 0 |

**Q3: Approximately how many properties will benefit?**

*One way of assessing the benefits an Action / scheme may provide is to look at the number of properties that may benefit.*

*At this stage it is difficult to determine the exact number of properties that may benefit from an Action / scheme. To gain an approximate idea of the number of properties that may benefit, the number of properties at risk from surface water flooding in each Area of Critical Drainage (AoCD) has been used and refined where more information makes this possible. However, it is acknowledged that not all of these properties will no longer be at risk should a scheme be implemented. Where an Action is not limited to a specific AoCD, i.e. a borough-wide Action, it has been assigned the highest score.*

| Answer | Score |
|---|---|
| Less than 10 | 1 |
| 10 – 20 | 2 |
| 21 – 50 | 3 |
| 51 – 100 | 4 |
| 101 – 500 | 5 |
| 501 – 750 | 6 |
| 751 – 1,000 | 7 |
| More than 1,001 | 8 |
| Borough-wide benefit | 9 |

**Q4: Are there additional benefits?**

*Ideally Actions should provide multiple benefits, for example environmental benefits such as Water Framework Directive (WFD) benefits, or social benefits such as providing leisure and amenity or improving an area.*

*The more benefits that an Action / scheme can provide, the greater the likelihood of it receiving additional funding from outside sources.*

| Answer | Score |
|---|---|
| Yes | 1 |
| No | 0 |

**Q5: How many local objectives does the action meet?**

*It is important the Actions meet the objectives set out by the LFRMS. The more objectives that can be achieved through an Action, the higher the priority.*

| Answer | Score |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |
| 7 | 7 |
| 8 | 8 |

**Q6: What was the priority classification for the Action in the Surface Water Management Plan (SWMP)?**

*This allows the priority assigned to Actions carried over from the SWMP to be incorporated into the LFRMS.*

| Answer | Score |
|---|---|
| Low | 1 |
| Medium | 2 |
| High | 3 |

## H.3 Annual action plan prioritisation criteria

The scores from the questions set out in Section 2.2.1 are then compiled to give an overall score. The overall score is then used to assign a priority to the Actions in the Annual Action Plan.

| Annual Action Plan Priority | Score |
|---|---|
| Low | Less than 5 |
| Medium | 6 – 10 |
| High | 11 – 20 |
| Very High | Greater than 21 |

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